# CAROLINAS TRANSMISSION PLANNING COORDINATION ARRANGEMENT (CTPCA)

# 2014/21 SUMMER PEAK RELIABILITY STUDY

# FINAL

**April 4, 2011**

# STUDY PARTICIPANTS

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

| Representative | Company |
|---|---|
| Joey West | Progress Energy Carolinas |
| Kai Zai | Progress Energy Carolinas |
| Brian D. Moss, Chair | Duke Energy Carolinas |
| Bob Pierce | Duke Energy Carolinas (Alternate) |
| Kale Ford | South Carolina Electric and Gas |
| Vanessa M. Abercrombie | South Carolina Electric and Gas (Alternate) |
| William Gaither | South Carolina Public Service Authority |
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Reviewed by: **CTPCA Steering Committee (SC)**

| Representative | Company |
|---|---|
| Samuel Waters | Progress Energy Carolinas |
| A. Mark Byrd | Progress Energy Carolinas |
| Ed Ernst | Duke Energy Carolinas |
| Bob Pierce | Duke Energy Carolinas |
| Brian D. Moss | Duke Energy Carolinas |
| Clay Young, Chair | 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"), Progress Energy Carolinas ("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 evaluated any potential joint alternatives identified by the Steering Committee ("SC") representatives which might improve the simultaneous feasibility of the Participants' transmission expansion plans. The Power Flow Studies Group ("PFSG") performed 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 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 SC
7. **Potential Alternative Assessment**
   - 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

- The years studied (study year) are 2014 Summer for a near term reliability analysis and 2021 Summer for a longer term reliability analysis.
- Generation is dispatched for each Participant in the study cases to meet that Participant's peak 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 will be replaced, such as by that Participant's dispatch orders).
- PSS/E and/or MUST are used for the study.
- Load growth assumptions are in accordance with each Participant company's practice.
- Generation, interchange, and other assumptions are coordinated between the Participant companies as needed. The 2010 series LTSG cases for 2014 and 2021 Summer are used as the starting points for study case and interchange development.
- The PFSG use the 2014 and 2021 Summer 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 are included in this report.

## STUDY CRITERIA

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

## CASE DEVELOPMENT

- The most current MMWG models are used for the systems external to Duke, Progress, SCEG, and SCPSA as a starting point for the study cases used by the PFSG in their analyses.
- The study cases include the detailed internal models for Duke, Progress, SCEG, and SCPSA and include existing transmission additions planned to be in-service for the given year (i.e. in-service by summer 2014 for 2014S cases as well as in-service by summer 2021 for 2021S cases).
- The Participants coordinated interchange which will include all confirmed long term firm transmission reservations with roll-over rights applicable to the study year(s).

## CASE DEVELOPMENT (continued)

- Duke, Progress, SCEG, and SCPSA each created any requested generation down cases from the common study cases and share the relevant cases with each other.

  Generation Down Cases Shared

  - Duke: Belews Creek 1, Catawba 1, Cliffside 6, Dan River CC, McGuire 1, McGuire 2, Oconee 1, Oconee 3 replaced with internal generation redispatch
  - Progress: Brunswick 1, Brunswick 2, Robinson 2, Harris, Roxboro 4 replaced with TRM import
  - SCE&G\SCPSA: VC Summer 1 (2014), VC Summer 3 (2021) replaced with internal generation redispatch
  - SCPSA: Rainey CC, Cross 3 replaced with internal generation redispatch and import

## STUDY METHODOLOGY

- Initially, power flow analyses were performed based on the assumption that thermal and voltage limits are the controlling limits for the reliability plan. Stability, short circuit and phase angle studies were performed if circumstances warrant.
- Duke, Progress, SCEG, and SCPSA exchanged 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 was performed in accordance with the study methodology. Results from the technical analysis are 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 shared 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 each ran an (N-1) assessment on the base cases and the requested generation down cases using their own internal planning processes. Each Participant's reliability criteria are used for their transmission facilities. Duke, Progress, SCEG, and SCPSA each documented the reliability issues resulting from their assessments. A summary of the potential reliability issues identified in this assessment are found in Tables A-H. These results

were 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.

## POTENTIAL ALTERNATIVE ASSESSMENT

- The SC identified two potential joint alternatives assessed by the PFSG.

  Potential Joint Alternatives Assessed

  - New interconnection between SCPSA's Flat Creek 230 kV station and Duke's Monroe 100 kV station. The studied interconnection is a 30 mile, 230 kV, single-circuit, 1272 ACSR conductor, tied into a new 400 MVA 230/100 kV transformer at Monroe. *ASSESSMENT: This new interconnection does impact power flows on the east side of Charlotte, but only minimal near term benefit was found in the assessment of this potential alternative. A number of Duke's near term projects were found to be accelerated or decelerated 1-2 years, but the more significant benefits were found on projects which are currently projected to be 20-30 years in the future. Duke will continue to assess the benefits of this potential alternative as these future projects move closer to the planning window.*

  - New interconnection between SCPSA's Camden 230/115 kV station and Progress' Camden Junction 115 kV station. The studied interconnection is a 5 mile, 230 kV, single-circuit, 1590 ASCR conductor. *ASSESSMENT: This new interconnection establishes a 230 kV source to Progress's Camden Junction substation which alleviates the overloading issue on the Camden-Camden Junction 115 kV line for the outage of the Camden-Wateree (Duke) 115 kV tie line in the summer of 2021. In addition, the new tie addresses the concern of the ability to adequately service future load growth in the Camden area. Progress will coordinate with SCPSA to assess the feasibility of this project.*

- The PFSG assessed 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 tested the effectiveness of any potential joint alternatives using the same cases, methodologies, assumptions and criteria described above.
- If an alternative is 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 interconnection agreements.

## REPORT ON STUDY RESULTS

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

**TABLE A**
**PROGRESS ENERGY CAROLINAS**
**SUMMARY OF POTENTIAL RELIABILITY ISSUES**
**2014 SUMMER PEAK**

| Element | Contingency | Potential Issue | Potential Solution |
|---|---|---|---|
| Weatherspoon-LOF 115 kV Line | Brunswick 1 Gd (TRM) Weatherspoon-Laurinburg 230 kV Line | Loading (106.2 %) | Operating Guide |
| Laurinburg 230/115 kV Transformers | Brunswick 1 Gd (TRM) Laurinburg 230/115 kV Transformers | Loading (99.3 %) 55 degree rise | 230/115 Bank Replacements [2017] |
| Falls 230/115 kV Transformer | Brunswick 1 Gd (TRM) Common Tower Area 115 kV Lines | Loading (95.5 %) | Install 2nd 230/115 kV Bank [2016] |
| Weatherspoon-Fayetteville 115 kV Line | Brunswick 1 Gd (TRM) Fayetteville Terminal of 115 kV Line | Low Voltage | Fay. Dupont 115kV Capacitor Bank [2014] |

**TABLE B**
**PROGRESS ENERGY CAROLINAS**
**SUMMARY OF POTENTIAL RELIABILITY ISSUES**
**2021 SUMMER PEAK**

| Element | Contingency | Potential Issue | Potential Solution |
|---|---|---|---|
| Weatherspoon-LOF 115 kV Line | Brunswick 1 Gd (TRM) Weatherspoon-Laurinburg 230 kV Line | Loading (114.1 %) | Operating Guide |
| Rockingham-West End 230 kV West Line | Harris Gd (TRM) Rockingham-West End 230 kV East Line | Loading (109.7 %) | Operating Guide |
| Florence-Marion 115 kV Line | Brunswick 2 Gd (TRM) Florence-Latta 230 kV Line | Loading (102.2 %) | Florence-Marion 230 kV Line [2020] |
| Weatherspoon-Marion 115 kV Line | Brunswick 1 Gd (TRM) Weatherspoon-Latta 230 kV Line | Loading (100.1%) | Operating Guide |

**TABLE B (continued)**
**PROGRESS ENERGY CAROLINAS**
**SUMMARY OF POTENTIAL RELIABILITY ISSUES**
**2021 SUMMER PEAK**

| Element | Contingency | Potential Issue | Potential Solution |
|---|---|---|---|
| Camden-Camden Junction 115 kV Line | Robinson 2 Gd (TRM) Camden-Camden Dupont 115 kV Line | Loading (99.4 %) | To Be Followed |
| Durham-RTP 230 kV Line | Harris Gd (TRM) Common Tower Method-Durham 230 kV Lines | Loading (94.3 %) | Reconductor [2020] |

**TABLE C**
**DUKE ENERGY CAROLINAS**
**SUMMARY OF POTENTIAL RELIABILITY ISSUES**
**2014 SUMMER PEAK**

| Element | Contingency | Potential Issue | Potential Solution |
|---|---|---|---|
| McGuire-Riverbend 230 kV Line 2 | Catawba 1 Gm McGuire-Riverbend 230 kV Line 1 | Loading (99.8 %) | Generation ReDispatch [2015] |
| Horseshoe-Nix Rd Tap 100 kV Line | Cliffside 5 Gm Horseshoe-Asheville Hwy 100 kV Line | Loading (92.5 %) | 4.41 miles 477 ACSR Reconductor [2020] |
| McGuire 500/230 kV Transformer A1 | McGuire 1 Gm Woodleaf-Pleasant Garden 500 kV Line | Loading (91.1 %) | New 500/230 kV Substation or 230 kV Switched Reactor [2021] |

**TABLE D**
**DUKE ENERGY CAROLINAS**
**SUMMARY OF POTENTIAL RELIABILITY ISSUES**
**2021 SUMMER PEAK**

| Element | Contingency | Potential Issue | Potential Solution |
|---|---|---|---|
| Peach Valley-Riverview 230 kV Line 2 | Oconee 1 Gm<br>Peach Valley-Riverview 230 kV Line 1 | Loading (111.8 %) | 19.33 miles 795 ACSR Reconductor [2021] |
| Cliffside-Broad River 16 100 kV Line | Oconee 1 Gm<br>Tiger 230/100 kV Transformer 6 | Loading (103.7 %) | 13.92 miles 2/0 Cu Reconductor [2021] |
| Lakewood-Riverbend 100 kV Line | Buck CC Gm<br>Lakewood-Belhaven 100 kV Line | Loading (105.1 %) | 10.64 miles 336 ACSR Reconductor [2021] |
| Great Falls-Wateree 100 kV Line 2 | Harris Gd (TRM)<br>Great Falls-Wateree 100 kV Line 2 | Loading (101.2 %) | Limit Duke's Wateree Generation [2021] |

**TABLE D (continued)**
**DUKE ENERGY CAROLINAS**
**SUMMARY OF POTENTIAL RELIABILITY ISSUES**
**2021 SUMMER PEAK**

| Element | Contingency | Potential Issue | Potential Solution |
|---|---|---|---|
| Shelby-Transco Tap White 100 kV Line | Catawba 1 Gm<br>Shelby-Transco Tap Black 100 kV Line | Loading (107.7 %) | 5.01 miles 2-336 ACSR Reconductor [2021] |
| Lakewood 230/100 kV Transformer | Catawba 1 Gm<br>Lakewood 230/100 kV Transformer | Loading (117.5 %) | Add Transformer Capacity [2021] |
| McAdenville-Rankin Tap 100 kV Line | Belews Creek 1 Gm<br>Riverbend-Lumber Lane Tap 100 kV Line | Loading (106.3 %) | 3.39 miles 795 ACSR Reconductor [2021] |
| Lawsons Fork-Pinewood 100 kV Line | Oconee 1 Gm<br>Lawsons Fork-Pinewood 100 kV Line | Loading (113.5 %) | 1.08 miles 477 ACSR Reconductor [2021] |

**TABLE D (continued)**
**DUKE ENERGY CAROLINAS**
**SUMMARY OF POTENTIAL RELIABILITY ISSUES**
**2021 SUMMER PEAK**

| Element | Contingency | Potential Issue | Potential Solution |
|---|---|---|---|
| Newport-Wylie 100 kV Line | Allen 5 Gm<br>Morning Star 230/100 kV 4<br>Morning Star-Newport 230 kV Line | Loading (100.3 %) | 7.47 miles 795 ACSR Reconductor [2021, 2024] |
| Parkwood 500/230 kV Transformer 5 | Roxboro 4 Gd (TRM)<br>Parkwood 500/230 kV Transformer 6 | Loading (100.6 %) | Operating Guide [2021] |
| Allen 230/100 kV Transformer 6 | Allen 5 Gm<br>Allen 230/100 kV Transformer 2 | Loading (102.4 %) | Add Transformer Capacity [2022] |

**TABLE E**
**SOUTH CAROLINA ELECTRIC AND GAS**
**SUMMARY OF POTENTIAL RELIABILITY ISSUES**
**2014 SUMMER PEAK**

| Element | Contingency | Potential Issue | Potential Solution |
|---|---|---|---|
| McIntosh-Jasper Tap 115 kV Line (Southern/SCE&G) | Cross 3 Gd Jasper-Yemassee 230 kV Line | Loading (100.6 %) | Jasper-Okatie-Yemassee 230 kV Line |
| Lyles-Williams St 115 kV Line | Cross 3 Gd Lyles-Edenwood 230 kV Line | Loading (104.3 %) | Line Upgrade |
| Georgia Pacific Tap | Cliffside 6 Gm Saluda-Georgia Pacific Tap 115 kV Line | High Voltage | SCE&G, SCPSA, and Duke are jointly investigating |

**TABLE F**
**SOUTH CAROLINA ELECTRIC AND GAS**
**SUMMARY OF POTENTIAL RELIABILITY ISSUES**
**2021 SUMMER PEAK**

| Element | Contingency | Potential Issue | Potential Solution |
|---|---|---|---|
| McIntosh-Jasper Tap 115 kV Line (Southern/SCE&G) | Belews Creek 1 Gm McIntosh-Purrysburg 230 kV Line (Southern/SCPSA) | Loading (118.8 %) | SCE&G and Southern Company are jointly investigating |
| Summerville 230/115 kV Transformer 2 | Cross 3 Gd Summerville 230/115 kV Transformer 1 | Loading (100.1 %) | Upgrade Transformer to 336 MVA and leave 224 MVA as in-service spare |
| Parr-Winnsboro 115 kV Line | Pineland-North Point 115 kV Line | Loading (100.4 %) | Winnsboro or Blythewood Substation |
| Georgia Pacific Tap | Cross 3 Gd Saluda-Georgia Pacific Tap 115 kV Line | High Voltage | SCE&G, SCPSA, and Duke are jointly investigating |

**TABLE G**
**SOUTH CAROLINA PUBLIC SERVICE AUTHORITY**
**SUMMARY OF POTENTIAL RELIABILITY ISSUES**
**2014 SUMMER PEAK**

| Element | Contingency | Potential Issue | Potential Solution |
|---|---|---|---|
| Winyah-Campfield 230 kV Line | Brunswick 1 Gd (TRM) Winyah-Hemingway 230 kV Line | Loading (96.9 %) | Bucksville 230-115 kV Sub. [2015] Winyah-Bucksville 230 kV Line [2016] Bucksville-Garden City 115 kV Line [2017] |
| Arcadia-Parkersville 115 kV Line | Brunswick 2 Gd (TRM) Perry Road-Campfield 230 kV Line | Loading (91.8 %) | Bucksville 230-115 kV Sub. [2015] Winyah-Bucksville 230 kV Line [2016] Bucksville-Garden City 115 kV Line [2017] |
| Georgetown-Campfield 3 115 kV Line | McGuire 1 or 2 Gm Winyah-Campfield 230 kV Line | Loading (115.2 %) | Bucksville 230-115 kV Sub. [2015] Winyah-Bucksville 230 kV Line [2016] Bucksville-Garden City 115 kV Line [2017] |

**TABLE G (continued)**
**SOUTH CAROLINA PUBLIC SERVICE AUTHORITY**
**SUMMARY OF POTENTIAL RELIABILITY ISSUES**
**2014 SUMMER PEAK**

| Element | Contingency | Potential Issue | Potential Solution |
|---|---|---|---|
| Georgetown-Winyah 1 115 kV Line | Brunswick 1 or 2 Gd (TRM) Georgetown-Winyah 2 115 kV Line | Loading (93.0 %) | Bucksville 230-115 kV Sub. [2015] Winyah-Bucksville 230 kV Line [2016] Bucksville-Garden City 115 kV Line [2017] |

**TABLE H**
**SOUTH CAROLINA PUBLIC SERVICE AUTHORITY**
**SUMMARY OF POTENTIAL RELIABILITY ISSUES**
**2021 SUMMER PEAK**

| Element | Contingency | Potential Issue | Potential Solution |
|---|---|---|---|
| Winyah-Campfield 230 kV Line | Brunswick 2 Gd (TRM) Georgetown-Campfield 2 115 kV Line | Loading (92.5 %) | Evaluating |