2019 NCTPC Study Scope Document

Purpose of Study

The purpose of this study is to assess the Duke Energy Carolinas ("DEC") and Duke Energy Progress ("DEP") transmission systems' reliability and develop a single collaborative transmission plan for the DEC and DEP transmission systems that ensures reliability of service in accordance with NERC, SERC, DEC, and DEP requirements. In addition, the study will also assess Local Economic Study option scenarios and / or Public Policy Study requests provided by the Transmission Advisory Group ("TAG") and approved for study by the Oversight Steering Committee ("OSC"). The Planning Working Group ("PWG") will perform the technical analysis outlined in this study scope under the guidance and direction of the OSC.

This year the NCTPC will also perform analysis to evaluate resource supply scenarios that model hypothetical transfers across the NCTPC interface with neighboring systems as well as two other hypothetical resource supply scenarios identified in the Study Assumptions below. No Local Economic Study or Public Policy Study requests were received from TAG stakeholders by the February 5th deadline for the 2019 study year but the participants developed the hypothetical resource supply scenarios identified below to be included in the 2019 NCTPC Study.

The TAG members will have the opportunity to provide input on all the study scope elements of the Reliability Planning Process as the study activities progress. This will include input on the following: study assumptions; study criteria; study methodology; case development and technical analysis; problem identification; assessment and development of solutions (including proposing alternative solutions for evaluation); comparison and selection of the preferred transmission plan; and the transmission plan study results report.

Overview of the Study Process Scope

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
   - Determine the different resource supply scenarios to evaluate

4. **Methodology**
   - Determine the methodologies that will be used to carry out the study
5. **Technical Analysis and Study Results**
   - Perform the study analysis and produce the results. Initially, power flow analyses will be performed based on the assumption that thermal limits will be the controlling limit for the reliability plan. Voltage, stability, short circuit and phase angle studies may be performed if circumstances warrant.
6. **Assessment and Problem Identification**
   - Evaluate the results to identify problems / issues
7. **Solution Development**
   - Identify potential solutions to the problems / issues
   - Test the effectiveness of the potential solutions through additional studies and modify the solutions as necessary such that all reliability criteria are met.
   - Perform a financial analysis and rough scheduling estimate for each of the proposed solutions (e.g., cost, cash flow, present value)
8. **Selection of a Recommended Collaborative Transmission Plan**
   - Compare alternatives and select the preferred solution alternatives – balancing cost / benefit / risk
   - Select a preferred set of transmission improvements that provide a reliable transmission system to customers most cost effectively while prudently managing the associated risks
9. **Report on the Study Results**
   - Prepare a report on the recommended Collaborative Transmission Plan

Each of these study steps is described in more specific detail below.

Study Assumptions

The specific assumptions selected for the 2019 Study are:

- The years to be studied (study year) will be 2024 Summer and 2024/2025 Winter for a near term reliability analysis and 2029 Summer for a longer-term reliability analysis. Each Load Serving Entity ("LSE") will provide a list of resource supply assumptions and include the resource dispatch order for each of its Designated Network Resources in the DEC and DEP control areas. Generation will be dispatched for each LSE in the cases to

meet that LSE's peak load in accordance with the designated dispatch order. LSEs will also include generation down scenarios for their resources, if applicable (e.g., generation outage with description of how generation will be replaced, such as by that LSE's dispatch orders).

- PSS/E and/or TARA will be used for the study.
- Load growth assumptions will be in accordance with each LSE's practice.
- Generation, interchange and other assumptions will be coordinated between Participants as needed.
- The table below lists the major generation facility changes included in the 2024 Summer, 2024/2025 Winter and 2029 Summer study models.

Major Generation[1] Facility Changes in 2019 Study Models

Company	Generation Facility	2024S	2024/ 2025W	2029S
DEC	Lincoln County CT (402 MW)	Yes	Yes	Yes
DEC	Reidsville Energy Center (477 MW)	Yes	Yes	Yes
DEC	Retired Allen 1-3 (617 MW)	No	Yes	Yes
DEC	Retired Allen 4-5 (564 MW)	No	No	Yes
DEC	High Shoals PV (16 MW)	Yes	Yes	Yes
DEC	Ruff PV (22 MW)	Yes	Yes	Yes
DEC	Gaston PV (25 MW)	Yes	Yes	Yes
DEC	Simmental PV (69.3 MW)	Yes	Yes	Yes
DEC	Lancaster PV (10 MW)	Yes	Yes	Yes
DEP	Retired Asheville 1-2 (384 MW)	Yes	Yes	Yes
DEP	Asheville CC (560 MW)	Yes	Yes	Yes
DEP	Retired Darlington Co 1,2,3,4,6,7,8,10 (514 MW)	Yes	Yes	Yes

[1] Major Generation Threshold is considered to be 10 MW or greater and connected to the transmission system

DEP	Crooked Run Solar (70.1 MW)	Yes	Yes	Yes
DEP	Bay Tree Solar (70.1 MW)	Yes	Yes	Yes
DEP	Retired Blewett CTs 1-4 and Weatherspoon CTs 1-4 (232 MW)	No	Yes	Yes
DEP	Retired Roxboro Units 1-2 (1053 MW)	No	No	Yes

- For a variety of reasons (such as load growth, generation retirements, or power purchase agreements expiring), some LSEs may wish to evaluate other resource supply options to meet future load demand. These resource supply options can be either in the form of transactions or some "hypothetical" generators which are added to meet the resource adequacy requirements for this study.
- In 2019, the PWG will analyze, among its resource supply options, cases that examine the impacts of fourteen different hypothetical transfers into and out of the DEC and DEP systems. These fourteen hypothetical transfer scenarios are identified in the table below:

Resource Supply Options
2029 Hypothetical Transfer Scenarios

ID	Resource From	Sink	Test Level (MW)
1	PJM	DUK[1]	1,000
2	SOCO	DUK	1,000
3	CPLE[2]	DUK	1,000
4	TVA[3]	DUK	1,000
5	PJM	CPLE	1,000
6	DUK	CPLE	1,000
7	DUK	SOCO	1,000
8	PJM	DUK / CPLE	1,000 / 1,000
9	DUK / CPLE	PJM	1,000 / 1,000
10	CPLE	PJM	1,000
11	DUK	PJM	1,000
12	SOCO[4]	CPLE	1,000
13	DUK[5]	TVA	1,000
14	PJM[6]	SCEG	1,000

[1] DUK is the Balancing Authority for DEC

[2] CPLE is the eastern Balancing Authority for DEP

[3]This hypothetical transfer is intended to evaluate the impact of a 1,000 MW TVA transaction through the SOCO transmission system into DUK.

[4] This hypothetical transfer is intended to evaluate the impact of a 1,000 MW Southern Co transaction through the DEC transmission system into CPLE.

[5] This hypothetical transfer is intended to evaluate the impact of a 1,000 MW DUK transaction through the SOCO transmission system into TVA.

[6] This hypothetical transfer is intended to evaluate the impact of a 1,000 MW PJM transaction through the CPLE transmission system into SCEG.

- An additional resource supply option scenario, using a 2029 Summer study case, will evaluate a hypothetical 2,200 MW Combined Cycle 2x1 (H/J-class) resource supply option located in Davidson County connected to DEC's 230 kV Buck to Beckerdite line
- Another resource supply option scenario, using both a 2024 Summer and 2024/2025 Winter study cases, will evaluate a hypothetical 10 MW solar + 20 MWh / 10 MW battery storage system in Davidson County connected to DEC's 100 kV Buck to Beckerdite line.
- The PWG will analyze these hypothetical resource options to determine if any reliability criteria violations are created. Based on this analysis, the PWG will provide feedback to the Participants on the viability of these options for meeting future load requirements. The results of this analysis will be included in the 2019 Collaborative Transmission Plan Report.

Study Criteria

The study criteria used will promote 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
- SERC requirements
- Individual company criteria (voltage, thermal, stability, short circuit and phase angle)

Case Development

- The most current MMWG system models will be used for the systems external to DEC and DEP as a starting point for the Base Case.
- The Base Case will include the detailed internal models for DEC and DEP and will include current transmission additions planned to be in-service for the given year (i.e. in-service

by summer 2024 for 2024S cases and in-service by the winter for 2024/2025W cases as well as in-service by the summer of 2029 for 2029S cases).

- An "All Firm Transmission" Case(s) will be developed which will include all confirmed long term firm transmission reservations with roll-over rights applicable to the study year(s).
- DEC and DEP will each create their respective generation down cases from the common Base Case and share the relevant cases with each other.
- Additional 2029S cases will be developed to evaluate the resource supply scenarios of fourteen hypothetical transfers as well as additional 2024S and 2025/2025W cases for the other hypothetical resource supply scenarios previously identified under the Study Assumptions section.

Study Methodology

DEC and DEP will exchange contingency and monitored element files so that each can test the impact of the other company's contingencies on its transmission system. Initially, power flow analyses will be performed based on the assumption that thermal limits will be the controlling limit for the reliability plan. Voltage, stability, short circuit and phase angle studies may be performed if circumstances warrant.

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.

DEC and DEP will report results throughout the study area based on:

- Thermal loadings greater than 90%.
- Voltages less than 100% for 500 kV and less than 95% for 230 kV, 161 kV, 115 kV, and 100 kV buses; pre- to post-contingency voltage drops of 5% or more.

Assessment and Problem Identification

- Each utility will utilize its own reliability criteria for its own transmission facilities. Each utility will document the reliability problems resulting from its assessments. These results will be reviewed and discussed with the TAG for feedback.

Solution Development

- The PWG will develop potential solution alternatives to the identified reliability problems.
- The TAG will have the opportunity to propose solution alternatives to the identified reliability problems.
- DEC and DEP will test the effectiveness of the potential solution alternatives using the same cases, methodologies, assumptions and criteria described above.
- DEC and DEP will develop rough, planning-level cost estimates and construction schedules for the solution alternatives.

Selection of a Recommended Collaborative Transmission Plan

- The PWG will compare alternatives and select the preferred solution alternatives, balancing cost / benefit / risk.
- The PWG will select a preferred set of transmission improvements that provides a reliable and cost effective transmission solution to meet customers' needs while prudently managing the associated risks.
- The preferred set of transmission improvements developed by the PWG will be reviewed and discussed with the TAG for feedback.

Report on the Study Results

The PWG will compile all the study results and prepare a recommended collaborative plan for OSC review and approval. Prior to the OSC's final review and approval, the final draft of the study report will be reviewed and discussed with the TAG members to solicit their input on the recommended collaborative plan. The final report will include a comprehensive summary of all the study activities as well as the recommended transmission improvements including estimates of costs and construction schedules.