2016 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 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 several additional sensitivities as discussed by the NCTPC Participants as additional stress tests to the transmission systems of Duke Energy Carolinas and Duke Energy Progress as a part of the Reliability Planning Process. These additional sensitivities are described in the case development section. No Local Economic Study or Public Policy Study requests were received from TAG stakeholders by February 1 for the 2016 study year. Therefore there will be no Local Economic Study Planning Process nor evaluations of Public Policy impacts as a part of the 2016 NCTPC Study.

The TAG members will have the opportunity to provide input on all the study scope elements of both 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 2016 Study are:

- The years to be studied (study year) will be 2021 Summer and 2021/2022 Winter for a near term reliability analysis and 2026 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).

- DEP will assume that Asheville 1 and 2 coal units will be shut down in all three study cases, and the two planned Asheville combined cycle (CC) units (280 MW each, 560 MW total winter rating) will be added to all three study cases. One of the planned Asheville CC units will be connected to the Asheville 230 kV switchyard and the other will be connected to the Asheville 115 kV switchyard. The summer cases will include a CPLW import of 436 MW and the winter case will include a CPLW import of 436 MW. The 436 MW import into CPLW will come from the following: 400 MW from CPLE, 22 MW from SCPSA, and 14 MW from TVA. To meet the remaining CPLW load, CPLW generation will be dispatched in the following order: Walters, Marshall, planned Asheville CC units, and finally the existing Asheville CTs. While the System Impact Study for the planned Asheville CC units is not yet complete, DEP is confident of two required upgrades: replacing the Asheville 230/115 kV and Pisgah 115/100 kV autotransformers with larger units. These transformer upgrades will be modeled in this study.
- PSS/E and/or MUST 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.

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
- 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 to be used by both DEC and DEP in their analyses.
- 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 2021 for 2021S cases and in-service by the winter for 2021/2022W cases as well as in-service by summer 2026 for 2026S 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 cases will be developed to evaluate additional sensitivities to be performed as a part of Reliability Planning Process. These sensitivities will include the following:

    - For a hypothetical event resulting in a long-term outage of an entire nuclear power plant, evaluate the simultaneous outage of both nuclear units at the Brunswick Nuclear Plant in the Wilmington area of the Duke Energy Progress system. Replacement power for the Brunswick Units will be modeled as coming from neighboring systems.
    - Identify permanent transmission upgrades that would eliminate the use of specific operating procedures currently in effect on the DEC and DEP systems for mitigating reliability violations under peak operating conditions. The operating procedures to be considered in this study are listed in the tables below.

Guide	Action	Limiting Facility	Outaged Facilities
DEC / DEP	Open Wateree 115/100 kV	Wateree-Great Falls 100 kV 1/2	Wateree-Great Falls 100 kV 2/1
		Camden – Industry 104 115 kV Line	Camden-Camden Junction 115 kV Line with Harris offline
DEP	Open Rockingham-West End 230kV West line at West End	Rockingham-West End 230kV West line	Rockingham-West End 230kV East line with Harris offline
DEP	Open Marion-Weatherspoon 115 kV	Marion-Dillon Tap 115 kV	Latta-Dillon Maple 230 kV with a Brunswick 1 offline
DEP	Open Weatherspoon-LOF 115 kV line between Pembroke and Maxton	Weatherspoon-LOF 115 kV line	Weatherspoon-Laurinburg 230 kV line with a Brunswick Unit off
DEP	Open Goldsboro Terminal	Goldsboro – E13 Arba 115 kV Line	Wommack – Industry 053 230 kV Line

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.

Progress and Duke 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 party will utilize its own reliability criteria for its own transmission facilities. Each party 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 the 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