



2021 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.

No Local Economic Study requests were received from TAG stakeholders by the January 18th deadline for the 2021 study year. A Public Policy Study request was received that asked for evaluation of transmission needs involving various assumptions concerning future generator retirements and additions of renewable energy. NCTPC will analyze various aspects of this request and will not perform hypothetical transfers across the NCTPC interface with neighboring systems.

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



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- 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 2021 Study are:

- The years to be studied (study year) will be 2026 Summer and 2026/2027 Winter for a near term reliability analysis and 2031 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



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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 tables below list the major generation facility additions and retirements included in the 2026 Summer, 2026/2027 Winter and 2031 Summer study models.

Major Generation¹ Facility Additions in 2021 Study Models

Company	Generation Facility	2026S	2026/ 2027W	2031S
DEC	Lincoln County CT (525 MW)	Included	Included	Included
DEC	Apex PV (30 MW)	Included	Included	Included
DEC	Blackburn PV (61.7 MW)	Included	Included	Included
DEC	Broad River PV (50 MW)	Included	Included	Included
DEC	Gaston PV (25 MW)	Included	Included	Included
DEC	High Shoals PV (16 MW)	Included	Included	Included
DEC	Lick Creek PV (50 MW)	Included	Included	Included
DEC	Maiden Creek PV (69.3 MW)	Included	Included	Included
DEC	Oakboro PV (40 MW)	Included	Included	Included
DEC	Olin Creek PV (35 MW)	Included	Included	Included
DEC	Partin PV (50 MW)	Included	Included	Included
DEC	Pelham PV (32 MW)	Included	Included	Included

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



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Company	Generation Facility	2026S	2026/ 2027W	2031S
DEC	Pinson PV (20 MW)	Included	Included	Included
DEC	Ruff PV (22 MW)	Included	Included	Included
DEC	Speedway PV (22.6 MW)	Included	Included	Included
DEC	Stanly PV (50 MW)	Included	Included	Included
DEC	Stony Knoll PV (22.6 MW)	Included	Included	Included
DEC	Sugar PV (60 MW)	Included	Included	Included
DEC	Thinking Tree (35 MW)	Included	Included	Included
DEC	Two Hearted PV (22 MW)	Included	Included	Included
DEC	West River PV (40 MW)	Included	Included	Included
DEC	Westminster PV (75 MW)	Included	Included	Included
DEP	Asheville CC (560 MW)	Included	Included	Included
DEP	Highest Power Solar (48.7 MW)	Included	Included	Included
DEP	Trent River Solar (79.9 MW)	Included	Included	Included
DEP	Bay Tree Solar (70.1 MW)	Included	Included	Included
DEP	Roxboro CC Units 1-2 (2700 MW)	Not Included	Not Included	Included
DEP	Mayo Battery Storage (568 MW)	Not Included	Not Included	Included



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Major Generation² Facility Retirements in 2021 Study Models

Company	Generation Facility	2026S	2026/ 2027W	2031S
DEC	Allen 1-5 (1083 MW)	Retired	Retired	Retired
DEC	Cliffside 5 (574 MW)	Retired	Retired	Retired
DEC	Lee 3 (120 MW)	Not Retired	Not Retired	Retired
DEP	Asheville 1-2 (384 MW)	Retired	Retired	Retired
DEP	Darlington Co 1,2,3,4,6,7,8,10 (514 MW)	Retired	Retired	Retired
DEP	Blewett CTs 1-4 and Weatherspoon CTs 1-4 (232 MW)	Retired	Retired	Retired
DEP	Roxboro Units 1-4 (2462 MW)	Not Retired	Not Retired	Retired
DEP	Mayo Unit 1 (746 MW)	Not Retired	Not Retired	Retired

- 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.
- The Public Policy Request study will analyze the transmission impacts of assumptions involving five components:
 - 1) Accelerated retirement of coal generation
 - a. DEC will model the retirement of Allen 1-5, Cliffside 5, and Lee 3 and will model only the dual fuel capability of Marshall 1-4 and Belews Creek 1-2
 - b. DEP will model the retirement of Roxboro 1-4, Mayo 1, Weatherspoon CTs, and Blewett CTs.

² Major Generation Threshold is considered to be 10 MW or greater and connected to the transmission system



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- 2) The increase of renewable generation within the Duke Energy Balancing Authority Areas (numbers below are nameplate output)
 - a. DEC will model an additional 3000 MW of solar generation
 - b. DEP will model an additional 1500 MW of solar generation and 568 MW of battery storage
- 3) Recent increase of solar and wind power plants located in Virginia and North Carolina within Dominion's service territory (PJM) to the extent locations are available
 - a) Model 2460 MW of Dominion offshore wind into Fentress 500 kV Substation
 - b) Dominion solar generation as represented in the current MMWG models
- 4) Addition of Midwest and Offshore wind generation (numbers below are nameplate output)
 - c. DEC will model importing 1000 MW of offshore wind generation and 2500 MW of Midwest onshore wind and will export 1000 MW of that to DEP
 - d. DEP will model an additional 1600 MW of offshore wind generation landing at New Bern 230 kV Substation and will export 1000 MW of that to DEC
- 5) DEP will model the addition of combined cycle gas generation at Roxboro Plant 230 kV Switchyard and will model a transfer of 500 MW from DEP to DEC

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 2026 for 2026S cases and in-service by the winter for 2026/2027W cases as well as in-service by the summer of 2031 for 2031S 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).



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- 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 2031S cases will be developed to evaluate the public policy request as well as additional 2026S and 2026/2027W cases for the other reliability 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.



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- 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.