



Carolinas Transmission Planning Collaborative

2024 Multi-Value Strategic Transmission (MVST) Study

Purpose of Study

The purpose of the Multi-Value Strategic Transmission Study is to assess the impact on the Duke Energy Carolinas (“DEC”) and Duke Energy Progress (“DEP”) transmission systems of up to three scenarios derived from the nine proposed MVST scenarios submitted to the CTPC by TAG members and to develop recommendations for strategic transmission projects for possible inclusion in the 2025 collaborative local transmission plan. The Planning Working Group (“PWG”) will perform the technical analysis outlined in this study scope under the guidance and direction of the OSC.

Four Public Policy requests were received from TAG stakeholders by the February 16th deadline for the 2024 study year. At the March 22, 2024, TAG stakeholder meeting, the OSC discussed with the TAG stakeholders the plan for absorbing the Public Policy requests into MVST scenarios and following the MVST study process as outlined in the March 13, 2024, effective revised Attachment N-1 local transmission planning process accepted by FERC. The Public Policy requests were reviewed first and then proposed MVST scenarios for the study scope were shared with the Public Policy requestors during a meeting on April 30, 2024. The Public Policy requestors determined that the conversion of the Public Policy requests would not provide broad enough scenarios for a MVST study. Therefore, a new request for TAG members to submit MVST scenarios utilizing the MVST form was emailed out on May 31st with a June 28th deadline.

The TAG stakeholders proposed a total of nine MVST scenarios and they proposed several sensitivities to those scenarios. The proposed scenarios referenced two portfolios from Duke Energy’s Carbon Plan Integrated Resource Plan (CPIRP) and then proposed modifications to the resources, location of new resources, load, and natural gas prices assumed in those portfolios. In addition, the proposed scenarios contained instructions on what type of solutions should be considered.

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.



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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, benefits, and risks.
- 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 2024 Study are:

- The years to be studied (study years) will be 2034 Summer and 2034/2035 Winter for the MVST scenario 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 Balancing Authority Areas. Generation will be dispatched for each LSE in the cases to meet that LSE’s peak load in accordance with the



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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).

- The three MVST scenarios will use the 2023 Carolinas Resource Plan Supplemental Portfolios for the 2034 Summer and 2034/2035 Winter to be studied with the following modifications and sensitivities:
 - Scenario 1: P1 Fall Supplemental Portfolio. The base study will assume New Bern for the offshore wind POI.
 - Scenario 2: P3 Fall Supplemental Portfolio. The base study will assume New Bern for the offshore wind POI.
 - Scenario 3: P3 Fall Supplemental Portfolio with renewables re-sited.
 - TAG Proposal - 2 GW of solar moved from DEP to DEC.
 - PWG Proposal – Increase solar sited in DEP to 80% of incremental solar and model firm transfer of 60% of all incremental solar and wind to DEC.
 - Sensitivities on each scenario will include:
 - An additional 2400 MW of offshore wind with a POI at Sutton North
 - Load adjustments of +/- 10% in peak cases, re-dispatched with no additional generation
 - Benefits only sensitivity on the forecasted price of natural gas
 - Benefits only sensitivity that does not include alternative solutions and only considers reconductoring and rebuilding transmission lines with high-performance conductors in existing rights-of-way.
- PSS/E and/or TARA will be used for the study.
- Generation, load, interchange, and other assumptions will be coordinated between Participants as needed.
- The tables below combined with the tables from the 2024 CTPC Reliability Study Scope list the major generation facility additions and retirements assumed to occur by 2034 Summer and 2034/2035 Winter.
- The retirements and resource additions modeled in the study are generally based on portfolios from the Supplemental Planning Analysis filed with the State Commissions in January 2024.

Reference the “2024 CTPC Reliability Study Scope” document for “Major Generation Facility Additions” and “Major Generation Facility Retirements” that are included in the base case. The MVST resource changes in the tables below are in addition to the reliability study and will be included as needed to achieve the incremental capacity in each of the scenarios described above.



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Additional Major Generation¹ Facility Additions in 2024 MVST Study

Future facilities based on IRP or interconnection queue

Company	Generation Facility	2034S	2034/35 W
DEC	Marshall Plant CC	Included	Included
DEC	Anderson CC	Included	Included
DEC	TBD CC (Portfolio P3 Only)	Included	Included
DEC	Belews Creek CTs	Included	Included
DEC	Buck CTs	Included	Included
DEC	Pumped Storage Hydro Bad Creek II	Included	Included
DEC	Belews Creek SMR	Not Included	Included
DEP	Person County CC #2 (Portfolio P3 Only)	Included	Included
DEC/DEP	Solar, Wind, and Storage (see further details below)	Included	Included

The table above does not include capacity updates to existing or Generator Replacement Request (GRR) facilities, but they may be included as needed to achieve capacity in tables below.

All values are nameplate capacity (MW-AC)

Scenario 1:

Resources added by January 1, 2034 -> 2034 Summer Cases								
Portfolio	Solar	Battery	CC	CT	Onshore	PSH	SMR	Offshore
P1	19,800	9,540	4,077	2,124	2,250	1,834	-	2,400
DEC	8,100	2,780	2,718	2,124	600	1,834	-	-
DEP	11,700	6,760	1,359	-	1,650	-	-	2,400
Resources added by January 1, 2035 - 2034/35 Winter Cases								
Portfolio	Solar	Battery	CC	CT	Onshore	PSH	SMR	Offshore
P1	20,775	9,540	4,077	2,124	2,250	1,834	600	2,400
DEC	8,850	2,780	2,718	2,124	600	1,834	600	-
DEP	11,925	6,760	1,359	-	1,650	-	-	2,400

¹ Major Generation is 10 MW or greater and connected to the transmission system.



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Scenario 2:

Resources added by January 1, 2034 -> 2034 Summer Cases								
Portfolio	Solar	Battery	CC	CT	Onshore	PSH	SMR	Offshore
P3	10,800	3,060	6,800	2,124	1,650	1,834	-	2,400
DEC	4,500	1,540	4,077	2,124	-	1,834	-	-
DEP	6,300	1,520	2,718	-	1,650	-	-	2,400
Resources added by January 1, 2035 - 2034/35 Winter Cases								
Portfolio	Solar	Battery	CC	CT	Onshore	PSH	SMR	Offshore
P3	12,600	5,100	6,800	2,124	2,100	1,834	600	2,400
DEC	5,250	1,740	4,077	2,124	450	1,834	600	-
DEP	7,350	3,360	2,718	-	1,650	-	-	2,400

Scenario 3 Option - TAG Solar Shift:

Resources added by January 1, 2034 -> 2034 Summer Cases								
Portfolio	Solar	Battery	CC	CT	Onshore	PSH	SMR	Offshore
P3	10,800	3,060	6,800	2,124	1,650	1,834	-	2,400
DEC	6,500	1,540	4,077	2,124	-	1,834	-	-
DEP	4,300	1,520	2,718	-	1,650	--	-	2,400
Resources added by January 1, 2035 - 2034/35 Winter Cases								
Portfolio	Solar	Battery	CC	CT	Onshore	PSH	SMR	Offshore
P3	12,600	5,100	6,800	2,124	2,100	1,834	600	2,400
DEC	7,250	1,740	4,077	2,124	450	1,834	600	-
DEP	5,350	3,360	2,718	-	1,650	-	-	2,400

Scenario 3 Option - PWG Solar Shift:

Resources added by January 1, 2034 -> 2034 Summer Cases								
Portfolio	Solar	Battery	CC	CT	Onshore	PSH	SMR	Offshore
P3	10,800	3,060	6,800	2,124	1,650	1,834	-	2,400
DEC	6,500	1,540	4,077	2,124	-	1,834	-	-
DEP	4,300	1,520	2,718	-	1,650	-	-	2,400
Resources added by January 1, 2035 - 2034/35 Winter Cases								
Portfolio	Solar	Battery	CC	CT	Onshore	PSH	SMR	Offshore
P3	12,600	5,100	6,800	2,124	2,100	1,834	600	2,400
DEC	2,520	1,740	4,077	2,124	450	1,834	600	-
DEP	10,080	3,360	2,718	-	1,650	-	-	2,400
DEP % of Capacity	80%	66%	40%	0%	79%	0%	0%	100%
Transfer DEP to DEC Summer	4,320	-	-	-	990	-	-	1,440
Transfer DEP to DEC Winter	5,040	-	-	-	810	-	-	1,440



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Additional Major Generation² Facility Retirements in 2024 MVST Study

Company	Generation Facility	2034S	2034/35 W
DEC	Allen 1 (167 MW) - GRR Pending	Retired	Retired
DEC	Cliffside 5 (575 MW)	Retired	Retired
DEC	Marshall 3-4 (1424 MW)	Retired	Retired
DEP	Mayo 1 (713 MW)	Retired	Retired
DEP	Roxboro 2&3 (1371 MW)	Retired	Retired

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 consider the following reliability elements:

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

Case Development

- The 2024 CTPC Reliability Study models will be used as a starting point for each Scenario’s Base Case. The Reliability models include detailed internal models for DEC and DEP combined with the most current MMWG system models for external systems.
- The Base Case will include current transmission additions planned to be in-service for the given year (e.g., in-service by summer 2034 for 2034S cases and in-service by the winter for 2034/2034W 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.
- DEC and DEP generation will be dispatched together to reflect consolidated system operations.

² Major Generation is 10 MW or greater and connected to the transmission system.



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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 95%.
- 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

- The MVST study will utilize DEC and DEP specific reliability criteria for assessing the scenario impacts on transmission facilities. The transmission needs resulting from the scenario assessments will be documented. These results will be reviewed and discussed with the TAG for feedback.

Solution Development

- The PWG will develop potential solution alternatives to the identified scenario transmission needs. The alternative solutions that will be considered include greenfield transmission, right-of-way optimization, grid-enhancing technologies (GETs), advanced conductors, Remedial Action Schemes (RAS), and battery storage as a Non-Traditional Solution (NTS).
- The TAG will be able to propose solution alternatives to the identified scenario transmission needs.
- DEC and DEP will evaluate 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.
- DEC and DEP will quantify the following benefits over time horizons consistent with the expected life of the asset for the identified transmission portfolio of solutions:



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1. Avoided capacity costs
 2. Capacity savings from reduced losses
 3. Congestion and fuel savings
 4. Energy savings from reduced losses
 5. Avoided customer outages
 6. Avoided transmission investment
- DEC and DEP will document a methodology for quantifying each benefit and review with TAG stakeholders prior to the Solutions Meeting.

Selection of a Recommended Collaborative Transmission Plan

- The PWG will compare alternatives and select the preferred solution alternatives, balancing costs, benefits, and risks.
- 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 recommendations for strategic transmission project additions to the 2025 collaborative local transmission 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 additions to the 2025 collaborative plan. The final report will include a comprehensive summary of all the study activities as well as the recommended strategic transmission improvements including estimates of costs, portfolio multi-value benefits, and construction schedules.