

2026 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 new combined utility ("1U") that includes legacy Duke Energy Carolinas ("DEC") and Duke Energy Progress ("DEP") transmission systems of up to three scenarios derived from the six proposed MVST scenarios submitted to the CTPC by TAG members and to develop recommendations for strategic transmission projects for possible inclusion in the 2027 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 Oversight Steering Committee ("OSC").

The TAG stakeholders proposed a total of six MVST scenarios and several sensitivities to those scenarios. The proposed scenarios referenced portfolios from Duke Energy's Carbon Plan Integrated Resource Plan (CPIRP) and then proposed modifications to the resources, load forecasts, and natural gas prices assumed in those portfolios. In addition, the proposed scenarios recommended constraints on the solutions that can 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.
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.
   - Apply MVST Selection Criteria to advance problems/issues to Solution Development
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 Projects Recommended for Inclusion in the Local Transmission Plan**
   - Compare alternatives and select the preferred solution alternatives – balancing cost, benefits, and risks.
     - Discuss any objections to a solution or solution alternative by any TAG stakeholder.
   - 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 projects recommended for inclusion in the Local Transmission Plan.

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

Study Assumptions

The specific assumptions selected for the 2026 Study are:

- The years to be studied (study years) will be 2031 Summer and Summer Shoulder; 2031/2032 Winter; 2036 Summer and Summer Shoulder; 2036/2037 Winter; 2041 Summer and Summer Shoulder; and 2041/2042 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 legacy DEC and legacy 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 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 2025 Carolinas Resource Plan Portfolios through 2040 to be studied with the following modifications and sensitivities:

- Scenario 1: Recommend Portfolio aligned with Near-Term Action Plan (NTAP)
- Scenario 2: High Load Portfolio – Includes adding approximately 1900 MWs of additional large loads beyond those with existing agreements.
  - New large loads will be hypothetical locations and sizes but informed by prior requests
  - Load sensitivity to include even more economic development load aligned with 2026 SC IRP High Load Forecast.
- Scenario 3: High Renewables Scenario – Evaluates an alternative to the Scenario 1 resource portfolio that includes modified renewable resource siting, the addition of Bad Creek II, and delays in gas resource additions.
  - Includes a sensitivity case that increases load, solar generation, and energy storage to Scenario 2 levels while holding all other capacity additions constant
- Sensitivities on each scenario will include:
  - Benefits only sensitivity on the forecasted price of natural gas

- PSS/E, TARA, and EnCompass nodal 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 2026 CTPC Reliability Study Scope list the major generation facility additions and retirements assumed to occur by 2041 Summer and 2041/2042 Winter.
- The retirements and resource additions modeled in the study are generally based on portfolios from the 2025 Carolinas Resource Plan filed with the State Commissions in Fall 2025.

Reference the "2026 CTPC Reliability Study Scope" document for "Major Generation Facility Additions" and "Major Generation Facility Retirements" that are included in the base cases through 2036/7 Winter. 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.



Additional Major Generation[1] Facility Additions in 2026 MVST Study

Future facilities based on IRP or interconnection queue

Company	Generation Facility	2031S	2031/32 W	2036S	2036/37 W	2041S	2041/42 W
DEP	Person County CC #2	Y	Y	Y	Y	Y	Y
DEC	Anderson CC	Y	Y	Y	Y	Y	Y
DEC	Davie County CC #1	N	N	Y	Y	Y	Y
DEC	Davie County CC #2	N	N	Y	Y	Y	Y
DEC	Generic CC (Scenario 1&2)	N	N	N (S1) Y (S2)	N	Y	Y
DEC	Buck CTs 1&2	Y	Y	Y	Y	Y	Y
DEP	Smith CT	Y	Y	Y	Y	Y	Y
DEC	Belews Creek CTs 1&2	N	Y	Y	Y	Y	Y
DEC	DEC Generic CTs 1&2	N	N	N	N	Y	Y
DEC	DEC Generic CT 3 (Scenario 1)	N	N	N	N	Y	Y
DEP	DEP Generic CTs 1&2 (Scenario 3)	N	N	N	N	Y	Y
DEC	Pumped Storage Hydro Bad Creek II (Scenario 3)	N	N	N	N	Y	Y
DEC	Generic Nuclear #1	N	N	N	Y	Y	Y
DEC	Generic Nuclear #2	N	N	N	N	Y	Y
DEP	Generic Nuclear #3	N	N	N	N	Y	Y
DEC/ DEP	Solar, Wind, and Storage (see further details below)	Y	Y	Y	Y	Y	Y

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

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

All values are nameplate capacity (MW-AC)

Scenario 1: Recommended Portfolio

Resources added by January 1, 2031 -> 2031 Summer Cases								
Portfolio	**Solar**	**Battery**	**CC**	**CT**	**Onshore**	**PSH**	**Nuclear**	**Offshore**
CAR	1,650	2,600	4,095	1,967	-	-	-	-
DEC	600	1,300	1,365	1,712	-	-	-	-
DEP	1,050	1,300	2,730	255	-	-	-	-
Resources added by January 1, 2036 -> 2036 Summer Cases								
Portfolio	**Solar**	**Battery**	**CC**	**CT**	**Onshore**	**PSH**	**Nuclear**	**Offshore**
CAR	5,700	6,400	6,825	2,823	-	-	-	-
DEC	2,550	2,500	4,095	2,140	-	-	-	-
DEP	3,150	3,900	2,730	683	-	-	-	-
Resources added through 2040 -> 2041 Summer Cases								
Portfolio	**Solar**	**Battery**	**CC**	**CT**	**Onshore**	**PSH**	**Nuclear**	**Offshore**
CAR	10,350	8,400	8,190	4,107	-	-	3,351	-
DEC	4,350	2,500	5,460	3,424	-	-	2,234	-
DEP	6,000	5,900	2,730	683	-	-	1,117	-

Scenario 2: High Load Portfolio

Resources added by January 1, 2031 -> 2031 Summer Cases								
Portfolio	**Solar**	**Battery**	**CC**	**CT**	**Onshore**	**PSH**	**Nuclear**	**Offshore**
CAR	1,650	3,600	4,095	2,394	-	-	-	-
DEC	600	3,000	1,365	1,712	-	-	-	-
DEP	1,050	600	2,730	683	-	-	-	-
Resources added by January 1, 2036 -> 2036 Summer Cases								
Portfolio	**Solar**	**Battery**	**CC**	**CT**	**Onshore**	**PSH**	**Nuclear**	**Offshore**
CAR	6,525	7,800	8,190	2,823	300	-	-	-
DEC	3,525	3,900	5,460	2,140	-	-	-	-
DEP	3,000	3,900	2,730	683	300	-	-	-
Resources added through 2040 -> 2041 Summer Cases								
Portfolio	**Solar**	**Battery**	**CC**	**CT**	**Onshore**	**PSH**	**Nuclear**	**Offshore**
CAR	13,725	9,400	8,190	4,535	300	-	3,351	-
DEC	6,525	3,900	5,460	2,994	-	-	2,234	-
DEP	7,200	5,500	2,730	1,538	300	-	1,117	-

Scenario 3: High Renewables Portfolio

Resources added by January 1, 2031 -> 2031 Summer Cases								
Portfolio	**Solar**	**Battery**	**CC**	**CT**	**Onshore**	**PSH**	**Nuclear**	**Offshore**
CAR	1,650	2,100	4,095	1,967	-	-	-	-
DEC	600	1,300	1,365	1,712	-	-	-	-
DEP	1,050	800	2,730	255	-	-	-	-
Resources added by January 1, 2036 -> 2036 Summer Cases								
Portfolio	**Solar**	**Battery**	**CC**	**CT**	**Onshore**	**PSH**	**Nuclear**	**Offshore**
CAR	5,475	6,100	6,825	2,823	300	-	-	-
DEC	2,700	2,500	4,095	2,140	-	-	-	-
DEP	2,775	3,600	2,730	683	300	-	-	-
Resources added through 2040 -> 2041 Summer Cases								
Portfolio	**Solar**	**Battery**	**CC**	**CT**	**Onshore**	**PSH**	**Nuclear**	**Offshore**
CAR	10,275	8,400	6,825	3,677	300	1760	3,351	-
DEC	4,500	2,600	4,095	2,994	-	1760	2,234	-
DEP	5,775	5,800	2,730	683	300	-	1,117	-

Additional Major Generation[2] Facility Retirements in 2026 MVST Study

Company	Generation Facility	2036S	2036/37W	2041S	2041/42W
DEC	Cliffside 5 (575 MW)	Retired	Retired	Retired	Retired
DEC	Marshall 3-4 (1424 MW)	Retired	Retired	Retired	Retired
DEC	Belews Creek 1-2 (2220 MW)	-	-	Retired	Retired
DEP	Mayo 1 (713 MW)	Retired	Retired	Retired	Retired
DEP	Roxboro 2&3 (1371 MW)	Retired	Retired	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 or, if available, 1U criteria (voltage, thermal, stability, short circuit and phase angle)

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

Case Development

- The 2026 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 1U 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 2036 for 2036S cases and in-service by the winter for 2036/2037W 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).
- Generation down cases will be developed from the common Base Case and share the relevant cases with each other.
- Legacy DEC and DEP generation will be dispatched together to reflect consolidated 1U system operations.

Study Methodology

DEC and DEP will combine contingency and monitored element files so all monitored elements are checked against all contingencies in the 1U footprint. 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 legacy DEC and DEP specific reliability criteria or, if available, 1U criteria for assessing the scenario impacts on transmission facilities. The transmission needs resulting from the scenario assessments will be documented. The needs report will identify needs with multiple drivers, including, but not limited to, economic

congestion and generator interconnection. These results will be reviewed and discussed with the TAG for feedback.

- MVST Selection Criteria will be applied to MVST needs to identify which projects will advance to Solution Development. The PWG will propose MVST Selection Criteria to the OSC based on the principles of identifying projects that demonstrate a high likelihood of being necessary regardless of modeling assumptions (i.e. Scenarios, resource-siting), address multiple drivers that may increase benefits of a strategic solution, and that require near-term action. The MVST Selection Criteria will be reviewed and discussed with the TAG.

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. In addition, the effectiveness at relieving economic congestion will be evaluated. Potential solutions will be prioritized for detailed analysis based on the results of effectiveness, preliminary economics, and constructability. Specific criteria for prioritizing solutions will be recommended by the PWG to the OSC and presented at a future TAG meeting prior to the MVST Solutions meeting.
- DEC and DEP will develop rough, planning-level cost estimates and construction schedules for the solution alternatives.
- DEC and DEP will apply 1U models to quantify the following benefits over time horizons consistent with the expected life of the asset for the identified transmission portfolio of solutions:
    1. Avoided/Deferred Transmission & Aging Infrastructure Replacements
    2. Reduced Planning Reserve Margins
    3. Production Cost Savings
    4. Reduced transmission losses (energy)
    5. Reduced Congestion Due to Transmission Outages
    6. Mitigation of Extreme Weather Events /Unexpected Events
    7. Capacity Cost Benefits from Reduced Peak Energy Losses
- During the benefits quantification process, DEC and DEP shall provide an estimated breakdown by benefit for any project likely to be recommended or selected for inclusion in

the Local Transmission Plan. Additionally, any TAG stakeholder shall be able to request that DEC or DEP provide an estimated breakdown by benefit for any project to inform recommendations on the final transmission portfolio.

- DEC and DEP will document a methodology for quantifying each benefit and review with TAG stakeholders prior to the Solutions Meeting.

Selection of Recommended Projects for Inclusion in the Local 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 2027 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 2027 Local Transmission 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.