North Carolina Transmission Planning Collaborative

2011 NCTPC Study Scope Document

Purpose of Study

The purpose of this study is to assess the Progress Energy Carolinas ("Progress") and Duke Energy Carolinas ("Duke") transmission systems' reliability and develop a single collaborative transmission plan for the Duke and Progress transmission systems that ensures reliability of service in accordance with NERC, SERC, Progress and Duke requirements. In addition, the study will also assess Enhanced Access 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.

The TAG members will have the opportunity to provide input on all the study scope elements of both the Reliability Planning Process as well as the Enhanced Transmission Access 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. The TAG members may also propose Enhanced Access scenarios for the year 2021 for evaluation in the study.

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 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
   - Include study results for the Enhanced Access scenarios, if applicable

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

Study Assumptions

The specific assumptions selected for this study are:

- The years to be studied (study year) will be 2016 Summer and 2016/2017 Winter for a near term reliability analysis and 2021 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 Progress and Duke 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 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.
- 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 2011, the PWG will analyze, among its resource supply options, 1) cases that locate renewable wind generation off of the North Carolina coast; 2) cases that examine the impacts of fourteen different hypothetical transfers into and out of the Duke and Progress systems; and 3) cases that locate a 1000 MW generating plant in Davidson County near the Duke Energy Buck Plant. 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 2011 Collaborative Plan Report.

- Enhanced Access scenarios provided by the TAG and approved by the OSC will be incorporated into the study process in a manner similar to the Participants' proposed resource supply option scenarios. The results of this analysis will be included in the 2011 Collaborative Plan Report for use by all stakeholders in developing resource supply plans for the future.

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 models will be used for the systems external to Duke and Progress as a starting point for the Base Case to be used by both Progress and Duke in their analyses.
- The Base Case will include the detailed internal models for Progress and Duke and will include current transmission additions planned to be in-service for the given year (i.e. in-service by summer 2016 for 2016S cases and in-service by the winter for 2016/2017W cases as well as in-service by summer 2021 for 2021S 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).
- Duke and Progress will each create their respective generation down cases from the common Base Case and share the relevant cases with each other.
- Additional 2021 cases will be developed for different off-shore wind scenarios to complement the 2010 off-shore wind study analysis. In 2010, studies were done on the impacts of receiving up to 3000 MW of wind generation off the coast of NC into PEC's and Duke's transmission service territories. The 2010 results showed how the transmission system could accommodate up to 3000 MW's of wind generation via new transmission infrastructure upgrades. In an effort to understand and quantify how the transmission system could accommodate higher levels of wind generation, additional 2021 cases will be developed to study up to 5000 MW of off-shore wind. These scenarios will evaluate the following options to meet load demand forecasts in the study, including evaluating any beneficial impact of the off-shore wind scenarios on reliability projects identified in the PWG base reliability plan:

  Coastal NC wind sensitivity with wind injections in the following locations,

  - 2021 case, <u>on peak</u>:
    - Morehead City (~40% capacity factor): 1,175 MW
    - Bayboro (~35% capacity factor): 875 MW
  - 2021 case, <u>off-peak</u>:
    - Morehead City (90% capacity factor): 2,700 MW
    - Bayboro (90% capacity factor): 2,300 MW

These off shore wind energy scenarios will be modeled to reflect the following sink allocations:

Wind Generation Injection in PEC to Duke and SOCO – Sink Allocation

Participating Transmission Owners	Participation Factor (%)	MW Allocation On Peak	MW Allocation Off Peak
Progress Energy Carolinas	24%	**492**	**1200 MW**
Duke Energy	36%	**738**	**1800 MW**
Southern Company	40%	**820**	**2000 MW**
Total	**100.00%**	**2,050 MW**	**5,000 MW**

- Additional 2021 cases will be developed to re-evaluate resource supply scenarios of fourteen hypothetical transfers that were originally performed in the 2009 Study to meet load demand forecasts in the study. These resource supply scenarios will include the following:

Resource Supply Options
2021 Hypothetical Transfer Scenarios

Resource From	Sink	Test Level (MW)
NORTH – PJM (AEP)	Duke	600
SOUTH - SOCO	Duke	600
SOUTH – SCEG	Duke	600
SOUTH – SCPSA	Duke	600
EAST – Progress	Duke	600
WEST – TVA	Duke	600
NORTH – PJM (AEP)	Progress (CPLE)	600
NORTH – PJM (DVP)	Progress (CPLE)	600
SOUTH – SCEG	Progress (CPLE)	600
SOUTH – SCPSA	Progress (CPLE)	600
WEST – Duke	Progress (CPLE)	600
NORTH – PJM (AEP/AEP)	Duke / Progress (CPLE)	600 / 600
NORTH – PJM (AEP/DVP)	Duke / Progress (CPLE)	600 / 600
Duke / EAST - Progress	PJM (Dominion)	600 / 600

- Additional 2021 cases will be developed to evaluate a hypothetical 1000 MW resource supply option located in Davidson County sinking on the Duke system.
- Other additional cases will be developed as required and approved by the OSC to evaluate the Enhanced Access scenarios submitted by the TAG.

Study Methodology

- 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.
- Progress and Duke will exchange contingency and monitored element files so that each can test the impact of the other company's contingencies on its transmission system.

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

- Duke and Progress will each run their own assessments. Duke reliability criteria will be used for Duke's transmission facilities, and Progress reliability criteria will be used for Progress's transmission facilities. Duke and Progress will each document the reliability problems resulting from their assessments. These results will be reviewed and discussed with the TAG for their 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.
- Duke and Progress will test the effectiveness of the potential solution alternatives using the same cases, methodologies, assumptions and criteria described above.
- Duke and Progress 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 their 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 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. The report will also include study results and information related to any sensitivity analysis, resource supply options scenarios, and Enhanced Access scenarios that were included as part of the 2011 study analysis.