

May 16, 2014

2014 NCTPC – MISO - PJM Joint Inter-regional Economic Study Scope

The Economic Scope Document has been developed in recognition of the need to perform production costing studies to respond to the questions posed by the North Carolina Utilities Commission regarding the potential impact of certain resources cleared in the PJM 2016/2017 base residual capacity auction (BRA.) Because this analysis will utilize proprietary generating unit production cost data from multiple confidential sources this economic scope was necessarily developed as a separate document to complement the Reliability Scope Document. The portion of the scope that relies upon Duke Energy confidential information will be performed by Duke Energy, outside the NCTPC Planning Working Group (PWG) process. Since the joint study participants do not have access to the Duke Energy production cost data, the scope will include a parallel analysis using publically available (subject to applicable data access provisions of the data licensor) data sources. These production costing studies will utilize the results of the parallel PWG effort and the results will be shared through the respective regional processes with stakeholders.

Purpose and Limitations of Study

For a detailed discussion of the purpose of this study, see “**2014 NCTPC – MISO - PJM Joint Inter-regional Reliability Study Scope**”, dated April 10, 2014.

The economic study is to be conducted in parallel to the reliability study, based, in part, on the results of the power flow analysis conducted as part of that reliability study. This economic study scope document should be considered as an addendum to the reliability scope document identified above.

CEII and Confidential Data

The production costing databases (PROSYM) used to determine economic impacts of certain incremental flows through the Duke Energy Carolinas/Duke Energy Progress (DEC/DEP) systems are considered confidential information to Duke Energy. The production costing databases and software (PowerBase and PROMOD) used by PJM to determine the economic impacts of certain incremental flows through the DEC/DEP systems are confidential information to Ventyx Inc. and licensed to PJM. The power flow and related study files are Critical Energy Infrastructure Information (CEII). Some specific information from PJM’s base residual capacity auction (BRA) is confidential information. All CEII and confidential information that become study materials will be subject to the applicable procedures including those of PJM, DEC, DEP and MISO.

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Overview of the Study Process Scope

The economic studies will be performed by the Resource Planning group of Duke Energy and the Interregional Planning Department of PJM using the current production costing models (PROSYM and PROMOD) and current assumptions for load forecast, resource plan, generating unit data, fuel price forecasts and other assumptions necessary for the modeling, consistent with standard practices. The Duke Energy model will be used with the same assumptions, and in the same manner, as currently used in the Duke Energy integrated resource planning process. The respective Regional Stakeholder bodies will be apprised of the study methodology, assumptions and results according to each Region's established process, recognizing that some data used in production costing analysis is considered confidential/proprietary to Duke Energy, and will not be shared in detail. Duke Energy will provide data necessary for the parallel PROMOD modeling to be accomplished by PJM. This modeling will accomplish comparative modeling to provide complementary and enhanced nodal views of the Duke Energy work. Information, consistent with the Duke Energy production cost analysis, to be provided will include:

- Hourly balancing area load profiles, monthly peaks and energies
- DR and EE modeling
- The DEC/DEP generating unit list used in the Duke Energy production cost analysis
- Installed unit capacities and fuel types and seasonal variations as applicable
- Installed unit technologies
- Installed unit nodal locations consistent with the reliability power flow
- Assumed unit maintenance dates as modeled
- Assumed unit commitment and dispatch restrictions such as
 - Must run minimum generation levels
 - Minimum run durations
 - Minimum down-time parameters
 - Startup/ramp parameters

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The scope of the proposed economic study process will include the following steps:

1. Study Assumptions

- As stated above, the production costing data and assumptions will be developed consistent with the assumptions used in the 2014 Duke Energy Carolinas/Duke Energy Progress Integrated Resource Planning processes.

2. Study Objectives

- Identify the study objective to be used to evaluate system performance.

3. Methodology

- Determine the methodologies that will be used to carry out the study.

4. Technical Analysis and Study Results

- Perform the study analysis and produce the results.

5. Assessment and Impacts Identification

- Utilizing the impacts caused by the transfer of the resources identified in the **NCTPC – MISO - PJM Joint Inter-regional Reliability Study**, assess possible effects on the annual production costs of the Duke Energy Carolinas and Duke Energy Progress systems.

6. Report on the Study Results and identification of next steps

- Prepare a study report.

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

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Study Assumptions

The specific assumptions selected for the 2014 Joint NCTPC – MISO - PJM Inter-regional scenarios are:

- The study period for the economic studies will be 2016.
- Generation will be dispatched for each control area (DEC and DEP) in the cases to meet load. Economic exchange between DEC and DEP will be modeled as an exchange at the marginal, i.e., incremental/decremental unit dispatch in each system, subject to a transfer limit constraint between the two systems. PROSYM will be used for the study. Since PROSYM does not have a detailed transmission system modeling capability, the limit between the DEC and DEP systems will be represented as a single “pipe” or tie between the two systems, with a capacity equivalent to expected Available Transmission Capacity, defined as the first contingency incremental transfer capability (FCITC) between the two systems. This FCITC will be determined by identifying the maximum transfer above firm transfer commitments from DEC to DEP-East that can be maintained under single contingency conditions without resulting in overload of any remaining facility. PJM will perform a PROMOD analysis similar to the Duke Energy method outlined. In addition, PJM will perform a more detailed nodal PROMOD modeling for comparison.
- Load growth / DR-EE assumptions will be in accordance with each study party’s practice, and consistent with the assumptions used in the reliability study.
- Generation (additions & retirements), interchange and other assumptions for DEC and DEP will be consistent with the 2014 DEC and DEP Integrated Resource Plan assumptions.

Study Objectives

The study objective is to quantify the production cost impacts of any changes in the available transmission capacity from DEC to DEP-East resulting from the impacts caused by the transfer of the resources identified in the reliability scope of work. Any quantified impacts on production costing will be compared, to the extent possible, with actual operating experience of DEC and DEP under the current Joint Dispatch Agreement (JDA).

Study Methodology

A set of two annual production costing simulations will be performed in each of three study scenarios. A reference case, representing the expected operation of the JDA under conditions prior to the transfer of the BRA resources identified in the reliability scope, and an alternate case that models the conditions with the transfer of the identified resources.

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Three scenarios will be tested using three different modeling techniques for comparative purposes. Each scenario will include the previously described reference and alternate cases. The three scenarios will be (1) a DEC/DEP PROSYM scenario, (2) a DEC/DEP PROMOD scenario, and (3) a DEC/DEP, TVA, PJM, and MISO PROMOD scenario.

This alternate case in the DEC/DEP PROSYM/PROMOD scenarios will model the impact of the transfer of resources into PJM by changing the value of the ATC link between DEC and DEP for west to east flows by the amount identified in the reliability study. The annual production costs and number of hours that flows from DEC to DEP are constrained by the transmission limit will be compared between the two cases. A comparison to actual historical hours where flows from DEC to DEP are constrained will be added to assist in benchmarking the results. This comparison will also quantify the DEC and DEP historical monthly on peak and off peak average hourly schedules and actual tie flows with adjacent BA's to document the magnitude of current inadvertent flow issues on the study system.

In addition to the above cases using reference fuel price forecasts, additional pairs of production costing runs, i.e., with and without the impact of the transfer of resources, will be performed using a low and high fuel price forecast.

It should be understood that due to various limitations of the modeling in PROSYM and PROMOD, the economic results obtained in this way can only be viewed as an “order of magnitude” estimate at best. Actual transmission constraints between the DEC and DEP systems, and even internal transmission conditions within the systems, may vary hourly according to contingencies, seasonal variation in fuel prices that impact dispatch, etc. The economic results are, therefore, best viewed as the changes between the reference and alternate cases.

Technical Analysis and Study Results

The technical analysis will be performed in accordance with the study methodology. Results reported from the economic analysis will include, as appropriate, a summary of changes in annual production costs, energy production, binding constraints, hours of constraint, and external transactions. Since the purpose of the study is to quantify impacts, a discussion of next steps will be dependent on that quantification.

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Report on the Study Results

- Results of the economic study will be included in the overall study report described in the reliability study scope.