Generator Interconnection Feasibility Study Report

Pitt County, NC
56.0 MW Solar Farm
Queue #401

May 21, 2018
Duke Energy Progress
Transmission Department

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1 PURPOSE

The purpose of this Feasibility Study is to assess the impacts of a generator interconnection request on the reliability of the Duke Energy Progress (DEP) transmission system with respect to power flow and short circuit. Estimates of the cost and time required to interconnect the generation as well as to resolve the impacts as determined in this analysis are also included. The DEP internal system analysis consists of an evaluation of the internal DEP transmission system utilizing documented transmission planning criteria. The requests are described in Table 1 below.

Table 1: Interconnection Requests

DEP Generator Interconnection Queue No.	MW	Requested In-Service Date	County	Interconnection Facility
401	56.0	6/30/2018	Pitt County, NC	Kinston DuPont – New Bern 115 kV Line or Greenville – Kinston DuPont 230 kV Line

2 ASSUMPTIONS

The following Feasibility Study results are from the DEP internal power flow models that reflect specific conditions of the DEP system at points in time consistent with the generator interconnection requests being evaluated. The cases include the most recent information for load, generation, transmission, interchange, and other pertinent data necessary for analysis. Future years may include transmission, generation, and interchange modifications that are not budgeted and for which no firm commitments have been made. Further, DEP retains the right to make modifications to modeling cases as needed if additional information is available or if specific scenarios necessitate changes. For the systems surrounding DEP, data is based on the ERAG MMWG model. The suitability of the model for use by others is the sole responsibility of the user. Prior queued generator interconnection requests were considered in this analysis.

The results of this analysis are based on Interconnection Customer's queue requests including generation equipment data provided. If the facility technical data or interconnection points to the transmission system change, the results of this analysis may need to be reevaluated.

This study was based on the following assumptions:

- CUSTOMER would construct, own and operate the electrical infrastructure that would connect their generation to DEP's facilities, including any step up transformers and lines from the generators, but excluding the circuit breaker in the new breaker station where applicable.

3 RESULTS

3.1 Power-flow Analysis Results

Facilities that may require upgrade within the first three to five years following the in-service date are identified. Based on projected load growth on the DEP transmission system, facilities of concern are those with post-contingency loadings of 95% or greater of their thermal rating and low voltage of 92% and below, for the requested in-service year or the in-service year of a higher queued request. The identification of these facilities is crucial due to the construction lead times necessary for certain system upgrades. This process will ensure that appropriate focus is given to these problem areas to investigate whether construction of upgrade projects is achievable to accommodate the requested interconnection service.

All queue requests, as well as nearby existing and prior-queued generation, were modeled and assumed to be operating at full output.

Contingency analysis study results show that interconnection of these generation facilities **DOES NOT** result in potential thermal overloads on the DEP system for either the primary or alternate point of interconnection.

These results are dependent on assumptions regarding prior-queued interconnection requests. If any prior-queued requests drop out of the queue, these results **may change significantly**.

3.2 Stability Analysis Results

To be performed in the System Impact Study.

3.3 Power Factor Requirements

To be performed in the System Impact Study.

3.4 Short Circuit Analysis Results

A short circuit analysis was performed to assess the impact of the proposed generation addition on transmission system equipment capabilities. The analysis indicates that no short circuit equipment capabilities will be exceeded as result from the proposed generation additions and associated transmission upgrades.

The results of the short circuit study are based on Customer provided generation equipment data and location. Also, the prudent use of engineering assumptions and typical values for some data were used. If the units' technical data or interconnection points to the transmission system changes, the results of this analysis may need to be reevaluated.

3.5 Harmonics Assessment

There is potential interaction of harmonic current injections from the Customer's proposed generation and certain capacitor banks on the DEP system. Testing may be necessary after the actual in-service date of this generation and the Customer will be responsible for mitigation of any detrimental impacts to the system.

3.6 Interconnection of Customer's Generation

The primary point of interconnection for Queue #401 is a new 115 kV breaker station connected to the Kinston DuPont – New Bern 115 kV Line. The breaker station one-line is provided as Figure 1.

The alternate point of interconnection for Queue #401 is a new 230 kV breaker station connected to the Greenville – Kinston DuPont 230 kV Line. The breaker station one-line is provided as Figure 2.

The customer should verify that the MVA ratings of their connecting lines are sufficient to accommodate delivering the total MVA output to the point of interconnection at the required 0.95 power factor.

3.7 Estimate of Interconnection Cost

Q401 – Primary Point of Interconnection

The estimate includes the assumption that DEP will acquire and use a portion of the property that the Customer will secure for the addition of the facility. The costs below are typical values. Specific projects may cost outside this range. A detailed estimate will be developed at project kick-off.

Tap Line

Description: DEP will tap the Kinston DuPont – New Bern 115kV Line and Construct a short tap line to New Breaker Station adjacent to DEP ROW. Manual switches will be installed on each side of the Tap.

Estimated Cost: $1,000,000

New Breaker Station

Description: Construct new 1-115 kV breaker station at generation new connection point. Assumes a control building with cable trench, line trap, CCVTs, surge arrestors, power pot, 115 kV breaker with air break switches, metering PTs and CTs.

Estimated Cost: $2,400,000

Install Transfer Trip Scheme at New Breaker Station and Transmission Substations

Description: It will be necessary to separate this generation facility from the DEP system for faults on the Kinston DuPont – New Bern 115 kV Line. Install protection system and transfer trip for coordination between the above listed transmission line and proposed generation facility.

Estimated Cost: $350,000

Taxes

Description: NC utility tax of 7%

Estimated Cost: $262,500

Total Interconnection Cost Estimate: $4,012,500

Q401 – Alternate Point of Interconnection

The estimate includes the assumption that DEP will acquire and use a portion of the property that the Customer will secure for the addition of the facility. The costs below are typical values. Specific projects may cost outside this range. A detailed estimate will be developed at project kick-off.

Tap Line

Description: DEP will tap the Greenville – Kinston DuPont 230 kV Line and Construct a short tap line to New Breaker Station adjacent to DEP ROW. Manual switches will be installed on each side of the Tap.

Estimated Cost: $1,100,000

New Breaker Station

Description: Construct new 1-230 kV breaker station at generation new connection point. Assumes a control building with cable trench, line trap, CCVTs, surge arrestors, power pot, 230 kV breaker with air break switches, metering PTs and CTs.

Estimated Cost: $2,500,000

Install Transfer Trip Scheme at New Breaker Station and Transmission Substations

Description: It will be necessary to separate this generation facility from the DEP system for faults on the Greenville – Kinston DuPont 230 kV Line. Install protection system and transfer trip for coordination between the above listed transmission line and proposed generation facility.

Estimated Cost: $350,000

Taxes

Description: NC utility tax of 7%

Estimated Cost: $276,500

Total Interconnection Cost Estimate: $4,226,500

4 SUMMARY

This Generator Interconnection Feasibility Study assesses the impact of interconnecting a new generation facility with a requested summer/winter rating of 56.0 MW. Power flow analysis found no overloading issues with the primary or the alternate point of interconnection. Interconnection upgrades to the DEP Transmission System are necessary to accommodate Q401.

DEP will require at least 24 months minimum after a firm written agreement to proceed is obtained from the customer, due partially to required major network upgrades assigned to prior queued projects.

The additional cost for telecommunications and metering can be estimated as a monthly charge of $3,000/month per interconnection.

Primary POI	
Power-flow	$0
Stability	$tbd
Short Circuit	$0
Interconnection	$4,012,500
Total Estimate	$4,012,500

Alternate POI	
Power-flow	$0
Stability	$tbd
Short Circuit	$0
Interconnection	$4,226,500
Total Estimate	$4,226,500

Study Completed by: _____
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Reviewed by: _____
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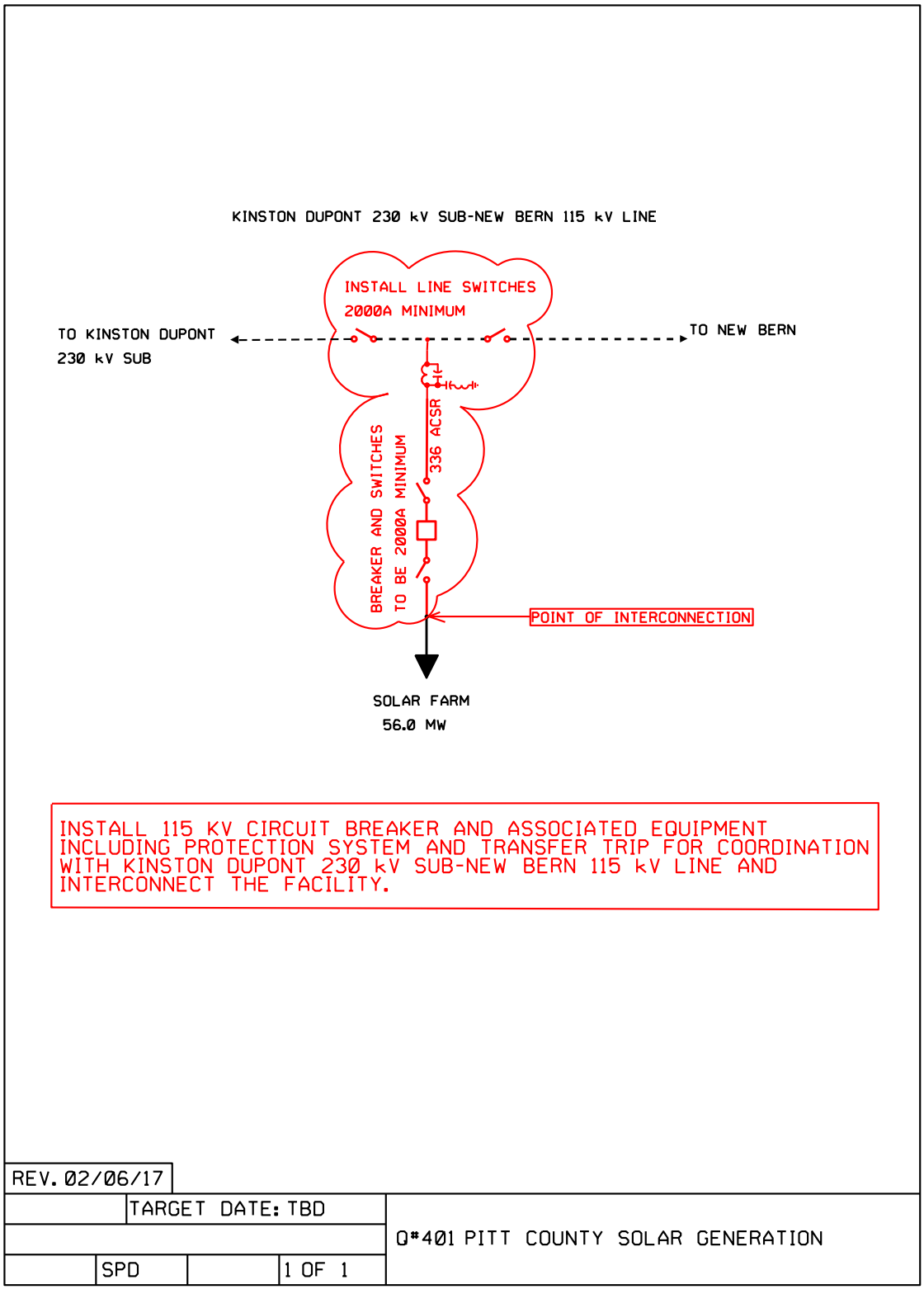
APPENDIX I : FIGURES

-Figure 1- Primary POI



-Figure 2 - Alternate POI