

Generator Interconnection System Impact Study Report

Power Flow Only

**Buncombe County, NC
9.5 MW Solar Farm
Queue #400**



**May 10, 2018
Duke Energy Progress
Transmission Department**

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1 PURPOSE

The purpose of this System Impact Study is to assess the impacts of the generator interconnection requests on the reliability of the Duke Energy Progress (DEP) transmission system with respect to power flow, power factor, stability, and short circuit. **This interim report presents only the power flow results.** 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
400	9.5	12/31/2023	Buncombe County, NC	Asheville Plant 230 kV Substation, 115 kV Bus

2 ASSUMPTIONS

The following System Impact 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.

The subject queue request, as well as nearby existing and prior-queued generation and their assigned transmission upgrades, were modeled and assumed to be operating at full output. Based on these assumptions, contingency analysis study results show that interconnection of these generation facilities **DOES** result in a potential thermal overload on the DEP system. The following facility will need to be upgraded to accommodate the proposed generation:

Facility	Sections	Length (mi)	Upgrade	Cost Estimate (\$M)	Time To Complete (years)
Craggy-Enka 115 kV Line	Enka-Enka SE Container	0.06	Raise structures	0.5	2

These results are dependent on assumptions regarding prior-queued interconnection requests. The study results could change if prior queued requests withdraw.

3.2 Stability Analysis Results

To be performed at a later date.

3.3 Power Factor Requirements

To be performed at a later date.

3.4 Short Circuit Analysis Results

To be performed at a later date.

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 point of interconnection for Queue #400 is at Asheville SEP 115 kV between the two existing breakers that are connected between the West 115 kV Bus and the ICT Gen 115 kV Bus. The generator will use the start-up transformer for the existing coal-fired units that are planned to be retired at the end of 2019.

The Asheville Plant substation one-line is provided as Figure 1. The customer should verify that the MVA rating of their connecting transformer is 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

Q400

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.

Protection & Controls

<i>Description:</i>	It will be necessary for P&C to install and/or modify protection systems for coordination between the above listed substation and proposed generation facility.
<i>Estimated Cost:</i>	\$200,000

Total Interconnection Cost Estimate: \$ 200,000

4 SUMMARY

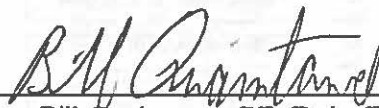
This Generator Interconnection System Impact Study assesses the impact of interconnecting a new generation facility with a requested summer/winter rating of 9.5 MW. Power flow analysis found an overloading issue that must be addressed. These results are dependent upon assumptions regarding prior-queued projects and network upgrades that must be constructed to accommodate them. Interconnection upgrades to the DEP Transmission System are necessary to accommodate Q400.

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.

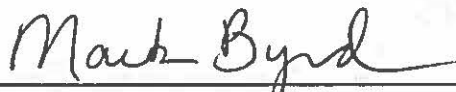
Power-flow	\$500,000
Stability	tbd
Short Circuit	tbd
<u>Interconnection</u>	<u>\$200,000</u>
Total Estimate	\$700,000

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APPENDIX I : FIGURES

-Figure 1-

