

Generator Interconnection Feasibility Study Report

**Cumberland County, NC
1235 MW Combined Cycle Plant
Queue #399**



**May 8, 2018
Duke Energy Progress
Transmission Department**

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1 PURPOSE

The purpose of this 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
399	1235	3/1/2023	Cumberland County, NC	Cumberland 500 kV Substation, 500 kV switchyard

2 ASSUMPTIONS

The following 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.

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** result in potential thermal overloads on the DEP system. The following facilities will need to be upgraded to accommodate the proposed generation:

Table 2: Network Upgrades

Facility	Sections	Length (mi)	Upgrade	Cost Estimate (\$M)	Time To Complete (years)
Cumberland 230/500 kV transformer bank	NA	-	Add new 230/500 kV 1000 MVA transformer at Cumberland and buswork	25.0	4
Lee Sub – Mt. Olive 115 kV Line	Mt. Olive Industrial Tap-Structure 76-2	1.81	Uprate line to full 212 deg conductor rating	1.0	3
Lee Sub – Mt. Olive 115 kV Line	Tri-County Mt. Olive Tap-Mt. Olive 115kV Sub	0.09	Reconductor with 1590 MCM ACSR	1.5	2
Clinton-Mt. Olive 115 kV line	Faison Hwy Industrial-Mt. Olive 115 kV Sub	9.37	Uprate line to full 212 deg conductor rating	5.0	3
Erwin-Selma 230 kV Line	Erwin 230 kV Sub-Benson PGI Tap	6.03	Uprate line to full 212 deg conductor rating	3.0	3
Total				35.5	4

The substation terminations for the 2nd 500/230 kV transformer at Cumberland are shown in Figures 1 and 2. These results are dependent on assumptions regarding prior-queued interconnection requests. In particular, approximately **\$112 million of network upgrades that will take 48 months to complete** are assumed to be in service and paid for by prior queued projects. If any prior-queued requests drop out of the queue, these results **may change significantly**.

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

No harmonics issues expected for synchronous generators.

3.6 Estimate of Interconnection Cost

Q399

The power island for Q399 is assumed to be approximately one (1) mile from the Cumberland 500 kV Substation. Three (3) 500 kV tie lines will be constructed from the power island to the Cumberland 500 kV Substation and terminated on new 500 kV buses at Cumberland. The terminations at Cumberland can be seen on Figure 1. The estimates include the assumption that DEP will acquire and use a portion of the property that the Customer will secure for the addition of the facility.

Tie Lines

Description: DEP will construct three (3) 500 kV tie lines from the Q399 power island to the Cumberland 500 kV Substation and terminate them on the 500 kV buses at Cumberland (See Figure 1).

Estimated Cost: \$15,000,000

Total Interconnection Cost Estimate: \$15,000,000

4 SUMMARY

This Generator Interconnection Impact Study assesses the impact of interconnecting a new generation facility with a requested summer/winter ratings of 1130/1235 MW. Power flow analysis found multiple overloading issues requiring long lead time network upgrades. Stability, power factor, and short circuit analyses will be completed at a later date. Interconnection upgrades to the DEP Transmission System are necessary to accommodate Q399.

DEP will require approximately 48 months after a firm written agreement to proceed is obtained from the customer.

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

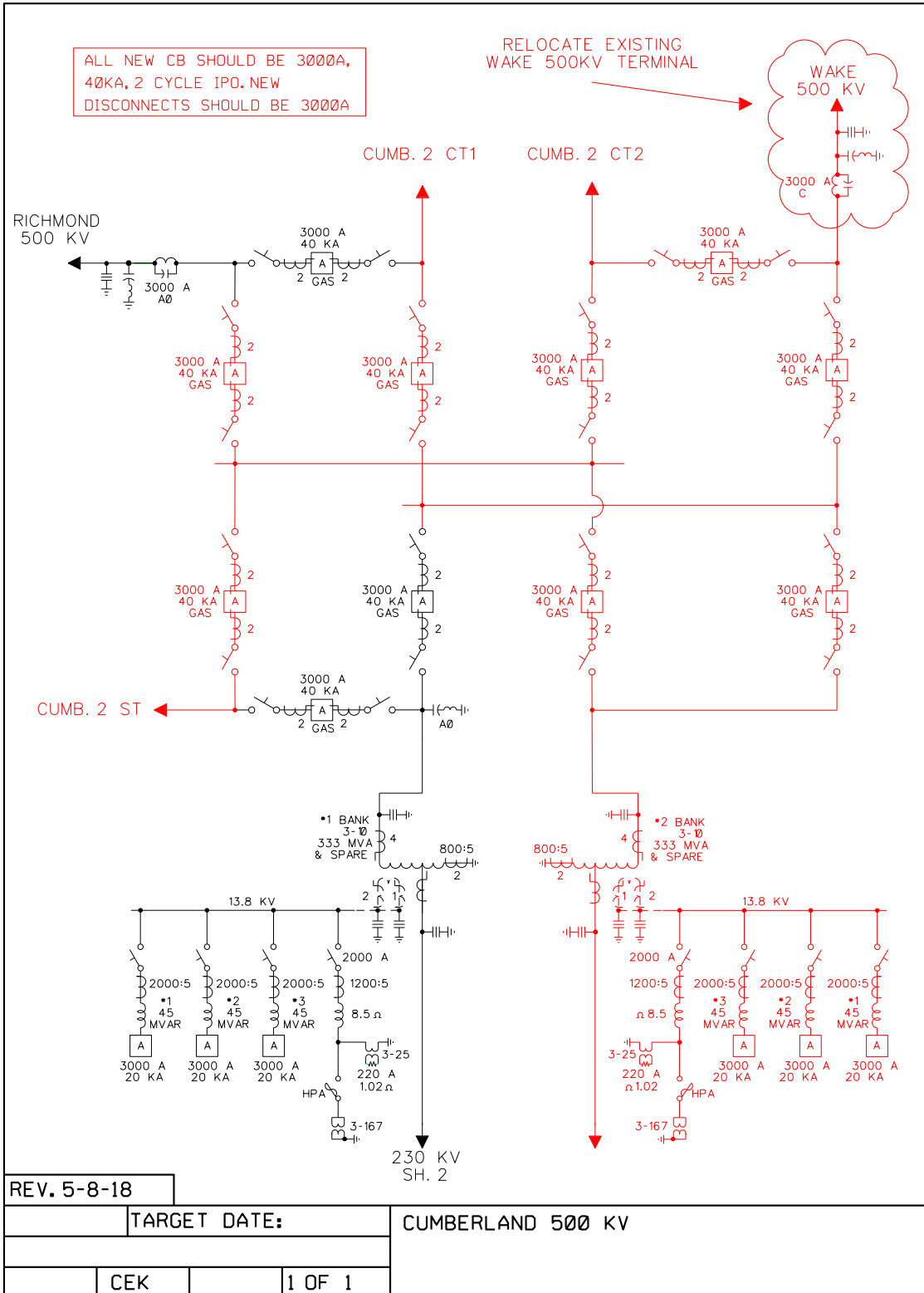
Power-flow	\$35,500,000
Stability	\$tbd
Short Circuit	\$tbd
<u>Interconnection</u>	<u>\$15,000,000</u>
Total Estimate	\$50,500,000

Study Completed by: Bill Quaintance
Bill Quaintance, PE, Duke Energy Progress

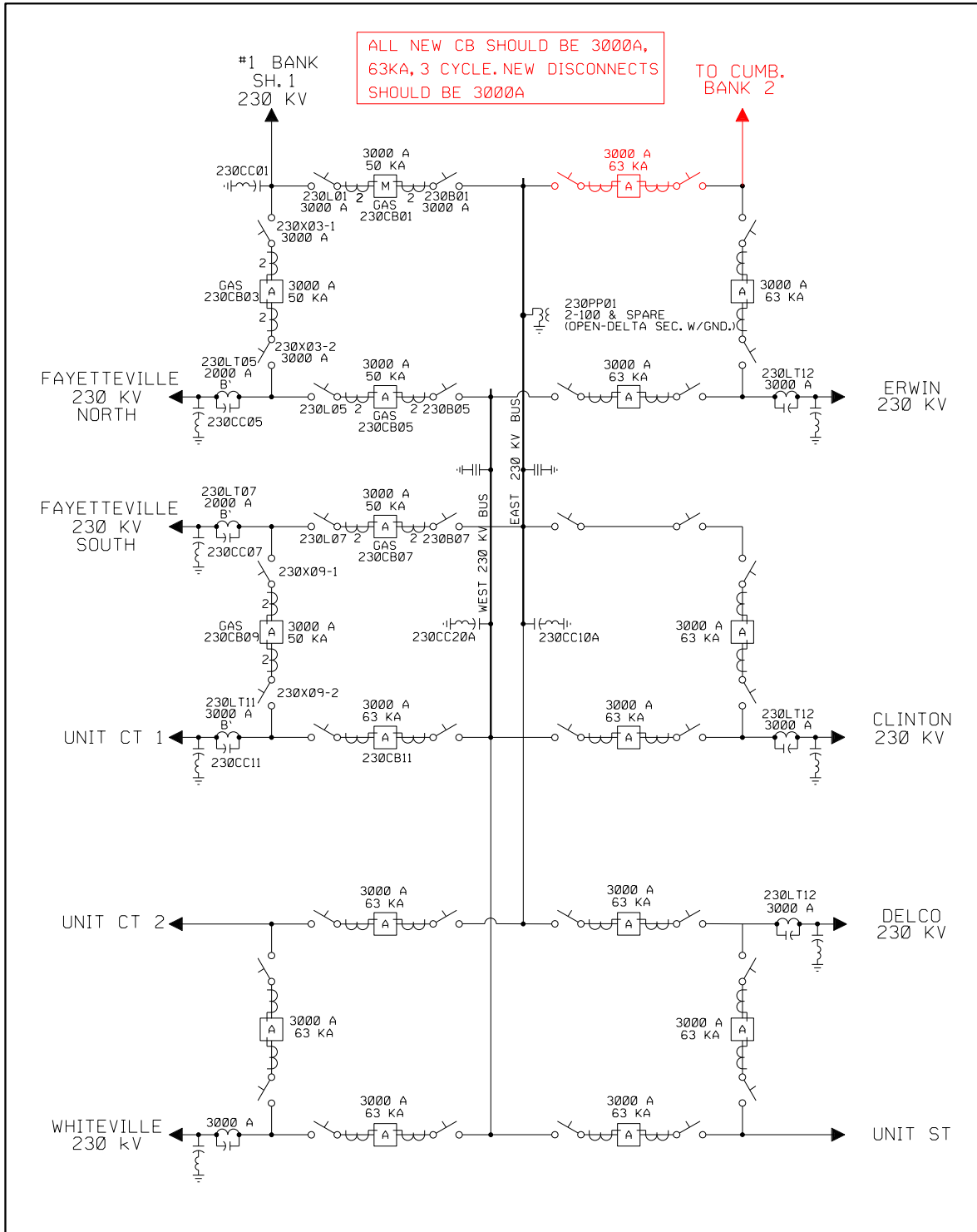
Reviewed by: Mark Byrd
Mark Byrd, PE, Duke Energy Progress

APPENDIX I : FIGURES

-Figure 1-



-Figure 2-



REV. 5-8-18		TARGET DATE:		CUMBERLAND 500 KV SUB. 230 KV SWITCHYARD	
CEK		1 OF 1			