



GEN-2016-071

Impact Restudy for Generator Modification (POI Change)

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By Generator Interconnection

REVISION HISTORY

DATE OR VERSION NUMBER	AUTHOR	CHANGE DESCRIPTION	COMMENTS
11/27/2018	Generator Interconnection		Initial Posting

EXECUTIVE SUMMARY

The GEN-2016-071 Interconnection Customer has requested a modification to its Interconnection Request. SPP has performed this system impact restudy to determine the effects of a Point of Interconnection (POI) change from WFEC Chilocco 138kV to OKGE Middleton Tap 138kV (one bus away). The facility remains comprised of eighty-seven (87) GE 2.3MW wind turbine generators (WTG) with total nameplate at 200.1 MW.

Due to the change in POI, the DISIS-2016-001 identified rebuild of Middleton Tap – Chilocco upgrade is no longer necessary. Cost Allocation remains the same for all other upgrades assigned as constraint mitigation. The previously identified OKGE Interconnection costs remain required whereas the WFEC Interconnection costs may no longer be required. Updated Interconnection costs require identification through the Facility Study. No additional upgrades were identified.

To prevent reactive power injection into the transmission system during low/no wind operation, the Interconnection Customer will be required to install approximately 9.5 Mvar of shunt reactors to be located in the Interconnection Customer's collector substation on the 34.5 kV bus(es) or install and utilize an equivalent means of compensating for the injection of reactive power into the transmission system at the Point of Interconnection.

This study shows that the requested change in the Point of Interconnection is not Material.

It should be noted that this study analyzed the requested modification to change generator technology, manufacturer, and layout. This study analyzed many of the most probable contingencies, but it is not an all-inclusive list and cannot account for every operational situation. It is likely that the customer may be required to reduce its generation output to 0 MW, also known as curtailment, under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Nothing in this study should be construed as a guarantee of transmission service or delivery rights. If the customer wishes to obtain deliverability to final customers, a separate request for transmission service must be requested on Southwest Power Pool's OASIS by the customer.

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SECTION 1: INTRODUCTION

This System Impact Study was performed to evaluate the impacts of a generation interconnection request, GEN-2016-071, moving their Point of Interconnection (POI) from WFEC Chilocco to OKGE Middleton Tap (one bus away). The requested generating facility summary is detailed in Table 1-1 below.

TABLE 1-1: INTERCONNECTION REQUEST

Request	Capacity (MW)	Generator Model	Point of Interconnection
GEN-2016-071	200.1	87 X GE 2.3 MW WTG	Middleton Tap (514804)

The prior-queued, equally-queued, and lower queued requests dispatched and monitored in the evaluation are shown in Table 1-2.

TABLE 1-2: GROUP 8 PRIOR, EQUALLY AND LATER QUEUED INTERCONNECTION REQUESTS

Request	Capacity (MW)	Generator Model	Point of Interconnection
GEN-2016-009	29	GENROU	Osage 69kV (514742)
GEN-2016-022	151.8	Vestas V126 3.45MW	Ranch Road 345kV (515576)
GEN-2016-031	1.5MW uprate of GEN-2015-001(total = 201.3MW)	Vestas V126 3.3MW	Ranch Road 345kV (515576)
GEN-2016-032	200	Vestas V110 2MW	Tap Marshall (514733)- Cottonwood Creek (514827) 138kV, (G16-032-TAP, 560077)
GEN -2016-048	82.3	Sunny Central 2940 2.94MW	Sooner 138kV (514802)
GEN-2016-061	250.7	GE 2.3 MW	Tap Woodring (514715) – Sooner (514803) 345kV (G16-061-TAP, 560084)
GEN-2016-068	250	GE 2.0MW	Woodring 345kV (514715)
GEN-2016-073	220	GE 2.0MW	Tap on Thistle (539801) to Wichita (532796) 345kV, ckt1&2 (Buffalo Flats 345kV; 560033)
GEN-2002-004	199.5	GE.1.5MW	Latham 345kV (532800)
GEN-2005-013	199.8	Vestas V90 1.8MW	Caney River 345kV (532780)
GEN-2007-025	299.2	GE 1.6MW	Viola 345kV (532798)
GEN-2008-013	300	G.E. 1.68MW	Hunter 345kV (515476)
GEN-2008-021	1261 Summer 1283 Winter	GENROU	Wolf Creek 345kV (532797)
GEN-2008-098	100.8	Vestas V100 1.8MW	Tap on the Wolf Creek – LaCygne 345kV line (560004)

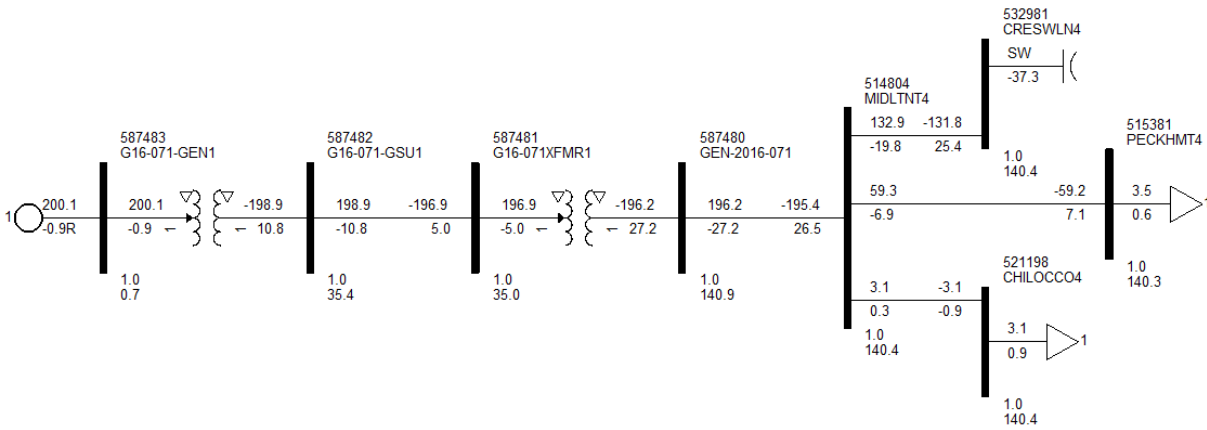
Request	Capacity (MW)	Generator Model	Point of Interconnection
GEN-2009-025	59.8	Siemens 2.3MW	Tap on the Deerck – Sinck 69kV line (515528)
GEN-2010-003	100.8	Vestas V100 1.8MW	Tap on the Wolf Creek – LaCygne 345kV line (560004)
GEN-2010-005	299.2	GE 1.6MW	Viola 345kV (532798)
ASGI-2010-006	150	GE1.5MW	Remington 138kV (301369)
GEN-2010-055	4.8	GENROU	Wekiwa 138kV (509757)
GEN-2011-057	150.4	GE 1.6MW	Creswell 138kV (532981)
KCPL Distributed: Osawatomie	76.0	GENROU (543078)	Paola 161kV
GEN-2012-032	300	Vestas V112 3.0MW	Tap Rose Hill-Sooner 345kV (562318)
GEN-2012-033	98.8	GE 1.62MW	Tap Bunch Creek-South 4th 138kV(562303)
GEN-2012-041	85 Summer 121.5 Winter	GENROU	Tap Rose Hill-Sooner 345kV (562318)
GEN-2013-012	4 x 168.0MW Summer 4 x 215MW Winter	GENROU (514910) (514911) (514912) (514942)	Redbud 345kV (514909)
GEN-2013-028	516.4 Summer 559.5 Winter	GENROU (583743, 583746)	Tap on Tulsa N to GRDA1 345kV (562423)
GEN-2013-029	300	Vestas V100 VCSS 2MW (583753, 583756)	Renfrow 345kV(515543)
GEN-2014-001	200.6	GE 1.7MW 100m (583853,583856)	Tap Wichita to Emporia Energy Center 345kV (562476)
GEN-2014-028	35 (Uprate) (Pgen=259W/256 S)	GENROU	Riverton 161kV (547469)
GEN-2014-064	248.4	GE 2.3MW	Otter 138kV (514708)
ASGI-2014-014	56.4W/54.3S	GENROU	Ferguson 69kV (512664)
GEN-2015-001	200.0	Vestas V110 2.0MW	Ranch Road 345kV
GEN-2015-015	154.6	Siemens 2.3MW with Power Boost (115kW => 2.415MW)	Tap Medford Tap – Coyote 138kV
GEN-2015-016	200.0	Vestas V110 2.0MW	Tap Centerville – Marmaton 161kV
GEN-2015-024	220.0	GE 2.0MW	Tap on Thistle to Wichita 345kV, ckt1&2 (560033)
GEN-2015-025	220.0	GE 2.0MW	Tap on Thistle to Wichita 345kV, ckt1&2 (560033)
GEN-2015-030	200.1	GE 2.3MW	Sooner 345kV
GEN-2015-034	200	Vestas V112- 2MW	Ranch Road 345kV (515576)
ASGI-2015-004	54.300 Summer 56.364 Winter	GENSAL	Coffeyville Municipal Light & Power Northern Industrial Park Substation 69kV (512735)
GEN-2015-047	300	Vestas V110-2MW	Sooner 345kV Tap (514803)
GEN-2015-052	300	Vestas V110-2MW	Tap on Opensky (515621) to RoseHill (532794) 345 kV (560053)

Request	Capacity (MW)	Generator Model	Point of Interconnection
GEN-2015-062	4.5	G.E. 1.79MW	Breckenridge 138kV (514815)
GEN-2015-063	300	Vestas V110-2MW	Tap on Woodring (514715) to Matthewson (515497) 345 kV (560055)
GEN-2015-069	300	Vestas V110-2MW	Union Ridge 230kV (532874)
GEN-2015-073	200.1	Siemens 2.3MW	Emporia/Lang 345kV (532768)
GEN-2015-066	248	G.E. 2.3MW	Tap on Cleveland (512694) to Sooner (514803) 345 kV (560056)
GEN-2015-090	220	G.E. 2MW	Wichita (532796)-Thistle (539801) 345kV Tap

SECTION 2: FACILITIES

A one-line drawing for the GEN-2016-071 generation interconnection request is shown in Figure 2-1. The POI is at the OKGE Middleton Tap 138kV requiring construction of a substation.

FIGURE 2-1: GEN-2016-071 ONE-LINE DIAGRAM



SECTION 3: POWER FLOW ANALYSIS

The current POI at WFEC Chilocco 138kV and the new POI at OKGE Middleton Tap 138kV (one bus away) are nearly electrically equivalent beyond the OKGE Middleton Tap 138kV. Additionally with exception to the 138kV generator transmission lead, which is electrically comparable to the Middleton Tap – Chilocco 138kV circuit, the generating facility design remains unchanged. Therefore a power flow analysis was determined to be unnecessary as the facility and system response are anticipated to be unchanged thus, with exception to the Middleton Tap – Chilocco 138kV circuit, the results from DISIS-2016-001-1 remain applicable and a power flow analysis was not performed again.

Due to the change in POI, the DISIS-2016-001 identified rebuild of Middleton Tap – Chilocco upgrade is no longer necessary. Cost Allocation remains the same for all other upgrades assigned as constraint mitigation. The previously identified OKGE Interconnection costs remain required whereas the WFEC Interconnection costs may no longer be required. Updated Interconnection costs require identification through the Facility Study. No additional upgrades were identified.

TABLE 3-1: GEN-2016-071 NETWORK UPGRADES

Network Upgrade	Current POI at WFEC Chilocco 138kV	New POI at OKGE Middleton Tap 138kV
Rebuild Farber – Belle Plains 138 kV CKT 1 (Current Study)	✓	✓
GEN-2016-071 Interconnection Costs (Current Study)	✓	✓
Rebuild Kildare - White Eagle 138kV CKT 1 (Current Study)	✓	✓
Rebuild Middleton Tap - Chilocco 138kV CKT 1 (Current Study)	✓	
Rebuild Osage - Webb Tap 138kV CKT 1 (Current Study)	✓	✓
Rebuild Osage - White Eagle 138kV CKT 1 (Current Study)	✓	✓
GEN-2015-063 Tap_Matthewson 345 kV CKT 1 (Previously Allocated)	✓	✓

SECTION 3: STABILITY ANALYSIS

The current POI at WFEC Chilocco 138kV and the new POI at OKGE Middleton Tap 138kV (one bus away) are nearly electrically equivalent beyond the OKGE Middleton Tap 138kV. Additionally with exception to the 138kV generator transmission lead, which is electrically comparable to the Middleton Tap – Chilocco 138kV circuit, the generating facility design remains unchanged. Therefore a stability analysis was determined to be unnecessary as the facility and system response are anticipated to be unchanged thus the results from DISIS-2016-001-1 remain applicable and a stability analysis was not performed again.

SECTION 4: REDUCED GENERATION ANALYSIS

Interconnection requests for wind generation projects that interconnect on the SPP system are analyzed for the capacitive charging effects during reduced generation conditions (unsuitable wind speeds, curtailment, etc.) at the generation site.

MODEL PREPARATION

The project generators and capacitors (if any), and all other wind projects that share the same POI, were turned off in the base case. The resulting reactive power injection into the transmission network comes from the capacitance of the project's transmission lines and collector cables. This reactive power injection is measured at the POI. Shunt reactors were added at the study project substation low voltage bus to bring the MVar flow into the POI down to approximately zero.

RESULTS

A final shunt reactor requirement for each of the studied interconnection requests is shown in Table 4-1. One line drawings used in the analysis are shown in Appendix A: Low Wind Analysis.

TABLE 4-1: SUMMARY OF SHUNT REACTOR REQUIREMENTS

Request	POI	Approximate Shunt Reactor Required
GEN-2016-071	Middleton Tap (514804)	9.5 MVar

The results shown are for the 2025 summer case. The other two cases (2016 winter and 2017 summer) were almost identical since the generation plant design is the same in all cases.

SECTION 5: CONCLUSION

The SPP evaluation of the GEN-2016-071 modification of a POI change from WFEC Chilocco 138kV to OKGE Middleton Tap 138kV is determined to not be a Material modification.

Due to the change in POI, the DISIS-2016-001 identified rebuild of Middleton Tap – Chilocco upgrade is no longer necessary. Cost Allocation remains the same for all other upgrades assigned as constraint mitigation. The previously identified OKGE Interconnection costs remain required whereas the WFEC Interconnection costs may no longer be required. Updated Interconnection costs require identification through the Facility Study. No additional upgrades were identified.

To prevent reactive power injection into the transmission system during low/no wind operation, the Interconnection Customer will be required to install approximately 9.5 Mvar of shunt reactors to be located in the Interconnection Customer's collector substation on the 34.5 kV bus(es) or install and utilize an equivalent means of compensating for the injection of reactive power into the transmission system at the Point of Interconnection.

Any changes to the assumptions made in this study, for example, one or more of the previously queued requests withdraw, may require a re-study at the expense of the Customer.

Nothing in this study should be construed as a guarantee of transmission service or delivery rights. If the customer wishes to obtain deliverability to final customers, a separate request for transmission service must be requested on Southwest Power Pool's OASIS by the customer.

APPENDIX A: LOW WIND ANALYSIS

FIGURE A-1: GEN-2016-071 WITH GENERATION OFF AND NO SHUNT REACTOR

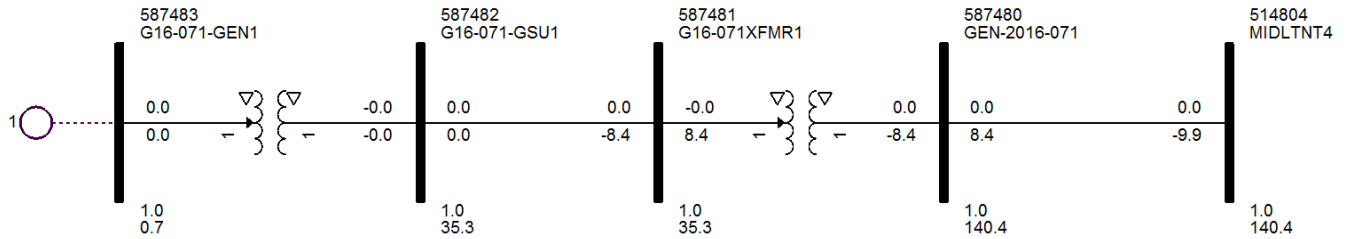


FIGURE A-1: GEN-2016-071 WITH GENERATION OFF AND SHUNT REACTOR

