GEN-2024-GR6

Generator Replacement Study

By SPP Generator Interconnection

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EXECUTIVE SUMMARY

Pursuant to the Southwest Power Pool (SPP) Open Access Transmission Tariff (SPP tariff) Attachment V section 3.9 and SPP Business Practice 7800, Interconnection Customers can submit replacement requests for their Existing Generating Facilities. The Interconnection Customer of an Existing Generating Facility (EGF) with a Point of Interconnection (POI) at the Open Sky 345 kV Substation requested to be studied in the SPP Generator Replacement process.

GEN-2024-GR6, the Replacement Generating Facility (RGF), will connect to, the existing POI, the Open Sky 345 kV Substation in the Southwest Power Service (SPS) area.

The EGF has 300 MW of available replacement capacity, based on the EGF Generation Interconnection Agreement (GIA). This Study has been requested to evaluate the replacement configuration of 130 x 2.66 MW Siemens SG 3.1-129 VS Wind turbines with a proportionally reduced dispatch of 300 MW as specified in the Generator Interconnection Agreement. This generating capacity for the RGF (301.06 MW), exceeds its requested Interconnection Service amount of 300 MW at the generators bus. As a result, the customer must install monitoring and control equipment as needed to ensure that the amount of power injected at the POI does not exceed the Interconnection Service amount.

The Generator Replacement Process consists of two parts: a Reliability Assessment Study and a Replacement Impact Study. The Reliability Assessment Study identifies any system impacts between the removal of the EGF from service and the commission date of the RGF and system adjustments to mitigate those issues. The Replacement Impact Study identifies whether the RGF is a Material Modification.

Reliability Assessment Study

SPP Planning and Operations conducted screening to determine whether a Reliability Assessment Study was necessary. Since the cessation date of the EGF aligns with the in-service date of the replacement generation facility, there is no reliability "gap" to evaluate. SPP Planning therefore concluded that system performance without the EGF reflects the current planning baseline. Additionally, SPP Operations noted that while the EGF has been committed by the TOP within the past two years, it has not been committed by SPP for reliability, is not designated as a blackstart resource, and is not located near a major flowgate to provide system relief. Based on these findings, SPP determined that no further reliability analysis is required, and no mitigation measures are necessary.

Replacement Impact Study

1898 & Co, a part of Burns & McDonnell, was retained by SPP to perform the Replacement Impact Study (Impact Study) for GEN-2024-GR6.

SPP determined that steady-state analysis was not required because the requested capacity of the RGF does not exceed the previously studied EGF output of 300 MW. In addition, the EGF was previously studied at maximum Interconnection Service under all necessary reliability conditions. However, SPP determined that short circuit and dynamic stability analyses were required as the dynamic model parameters of the REGCA1 model for the EGF and RGF are different. The scope of this Impact Study included reactive power analysis, short circuit analysis, and dynamic stability analysis.

The results of the Impact Study showed that the requested replacement did not have a material adverse impact on the SPP transmission system. The requested generator replacement of the EGF with GEN-2024-GR6 was determined **not a Material Modification**.

As the requested replacement generating capacity is higher than its Interconnection Service, the customer must install monitoring and control equipment as needed to ensure that the amount of power injected at the POI does not exceed the requested Interconnection Service amount. The monitoring and control scheme may be reviewed by the Transmission Owner (TO) and documented in Appendix C of the RGF GIA.

In accordance with FERC Order No. 827, the generating facility will be required to provide dynamic reactive power within the range of 0.95 leading to 0.95 lagging at the high-side of the generator substation.

It is likely that the customer may be required to reduce its generation output in real-time, 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. Transfer of an existing resource designation from the EGF to the RGF can be achieved by submitting a transfer of designation request pursuant to Section 30.2.1 of the SPP tariff. If the customer would like to obtain new deliverability to final customers, a separate request for transmission service must be requested on Southwest Power Pool's OASIS by the customer.

SCOPE OF STUDY

Pursuant to SPP tariff Attachment V section 3.9 and SPP Business Practice 7800, Interconnection Customers can submit replacement requests for its Existing Generating Facilities. A Generator Replacement Impact Study is an interconnection study performed to evaluate the impacts of replacing existing generation with new generation. Two analyses covering different time frames are evaluated:

- Reliability Assessment Study – study performed to evaluate the performance of the Transmission System for the time period between the date that the Existing Generating Facility (EGF) ceases commercial operations and the Commercial Operation Date (COD) of the Replacement Generating Facility (RGF).
- Replacement Impact Study – study performed to evaluate if the RGF has a material adverse impact on the SPP Transmission System.

For any impacts to the system identified in the Reliability Assessment Study, non-transmission solutions such as redispatch, remedial action schemes, or reactive setting adjustments will be identified to mitigate issues originating after the removal of the EGF from service and before the commission of the RGF.

If the Replacement Impact Study identifies any materially adverse impact from operating the RGF when compared to the EGF, such impacts shall be deemed a Material Modification.

RELIABILITY ASSESSMENT STUDY

SPP Planning and Operations conducted screening to determine whether a Reliability Assessment Study was necessary. Since the cessation date of the EGF aligns with the in-service date of the replacement generation facility, there is no reliability "gap" to evaluate. SPP Planning therefore concluded that system performance without the EGF reflects the current planning baseline. Additionally, SPP Operations noted that while the EGF has been committed by the TOP within the past two years, it has not been committed by SPP for reliability, is not designated as a blackstart resource, and is not located near a major flowgate to provide system relief. Based on these findings, SPP determined that no further reliability analysis is required, and no mitigation measures are necessary.

REPLACEMENT IMPACT STUDY

1898 & Co, a part of Burns & McDonnell, was retained by SPP to perform the Replacement Impact Study (Impact Study) for GEN-2024-GR6. All analyses were performed using Siemens PTI PSS/E version 34 software.

STEADY STATE ANALYSIS

To determine whether steady state analysis is required, SPP evaluates if all required reliability conditions were previously studied. This is done by comparing the current DISIS steady-state requirements versus the steady-state analysis previously performed on the EGF. SPP determined that since the EGF was previously studied at maximum Interconnection Service under all necessary reliability conditions, no steady-state analysis for the RGF is required.

STABILITY AND SHORT CIRCUIT ANALYSES

To determine whether stability and short circuit analyses are required, SPP evaluates the difference between the stability models and corresponding parameters and, if needed, the collector system impedance between the existing configuration and the requested replacement. Dynamic stability analysis and short circuit analysis would be required if the differences listed above may result in a significant impact on the most recently performed DISIS stability analysis.

REACTIVE POWER ANALYSIS

A reactive power analysis was performed on the requested replacement configuration as it is a non-synchronous resource. The reactive power analysis determines the capacitive effect at the POI caused by the project’s collector system and transmission line’s capacitance. A shunt reactor size is determined in order to offset the capacitive effect and maintain zero (0) MVAr flow at the POI while the project’s generators and capacitors (if any) are offline.

STUDY LIMITATIONS

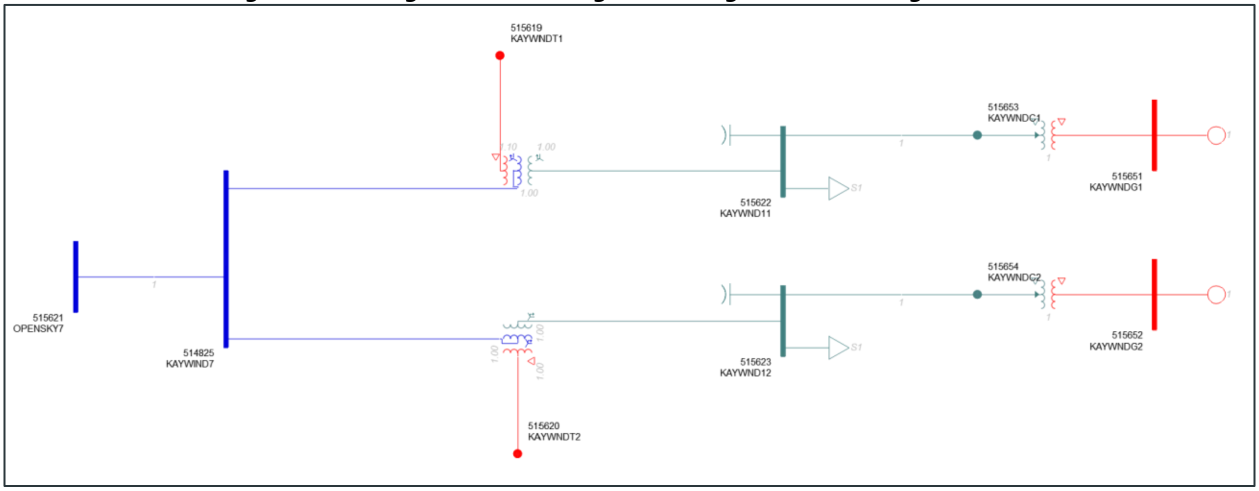
The assessments and conclusions provided in this report are based on assumptions and information provided to SPP/1898 & Co. by others. While the assumptions and information provided may be appropriate for the purposes of this report, SPP/1898 & Co. does not guarantee that those conditions assumed will occur. In addition, SPP/1898 & Co. did not independently verify the accuracy or completeness of the information provided. As such, the conclusions and results presented in this report may vary depending on the extent to which actual future conditions differ from the assumptions made or information used herein.

PROJECT AND REPLACEMENT REQUEST

The GEN-2024-GR6 Interconnection Customer has requested a replacement to its EGF, a Wind generating facility with a POI at the Open Sky 345 kV Substation and a requested retirement date of December 1, 2026. The Interconnection Service available for replacement is 300 MW, based on the EGF Generation Interconnection Agreement (GIA). Of the Interconnection Service available, the RGF Interconnection Customer has requested 300 MW of Energy Resource Interconnection Service (ERIS). The requested RGF is a Wind farm consisting of 130 x 2.66 MW Siemens SG 3.1-129 VS wind turbines with a proportionally reduced dispatch of 300 MW as specified by the Interconnection Customer. This generating capacity for the RGF (301.06 MW), exceeds its requested Interconnection Service amount of 300 MW. As a result, the customer must install monitoring and control equipment as needed to ensure that the amount of power injected at the POI does not exceed the Interconnection Service amount. The RGF has a planned commercial operation date of May 1, 2027.

The POI of the EGF and RGF is at the Open Sky 345 kV Substation in the Southwest Power Service (SPS) area, and the EGF and RGF are not expected to be operational simultaneously. Figure 1 and Figure 2 show the steady state model single-line diagram for the EGF and RGF configurations, respectively. Table 1 details the existing and replacement configurations for GEN-2024-GR6.

Figure 1: Existing Generation Single Line Diagram (EGF Configuration)*



*based on the DISIS-2021-01 25SP stability models

Figure 2: GEN-2024-GR6 Single Line Diagram (RGF Configuration)

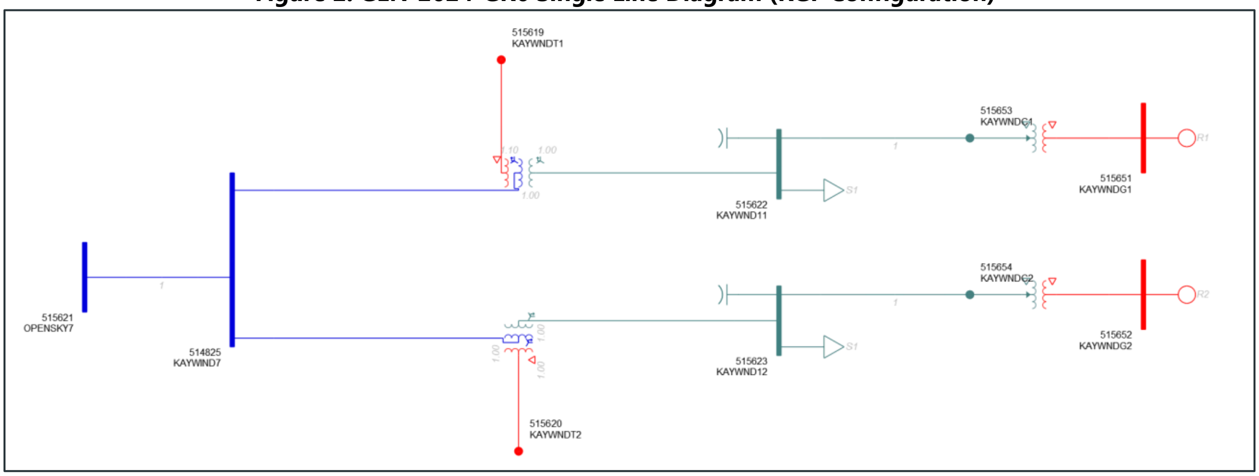


Table 1: EGF and RGF Configuration Details

Facility	Existing Generator Facility Configuration		Replacement Generator Facility Configuration	
Point of Interconnection	Open Sky 345 kV Substation (515621)		Open Sky 345 kV Substation (515621)	
Configuration/Capacity	Wind Turbine 299 MW (REGCAU1[1])		108 x 2.66 MW Siemens SG 3.1-129 VS (wind turbines) = MW [300 MW dispatch] PPC to limit GEN-2024-GR6 to 300 MW at the Generator bus	
Generation Interconnection Line	Length = 0.8 miles R = 0.000010 pu X = 0.000040 pu B = 0.000660 pu Rating A/B MVA 1434/1434 MVA		Length = 0.8 miles R = 0.000010 pu X = 0.000040 pu B = 0.000660 pu Rating A/B MVA 1434/1434 MVA	
Main Substation Transformer[1]	**GEN 1** X12 = 9.7434% R12 = 0.2535%, X23 = 4.0995% R23 = 0.3487%, X13 = 15.052% R13 = 0.3912%, Voltage = 345/34.5/12.5 kV (Wye Grounded/Wye Grounded/Delta), Taps Available = N/A Winding MVA = 100/35.0/35.0 MVA, Rating MVA = 166/166/53.3 MVA	**GEN 2** X12 = 9.7768% R12 = 0.2489%, X23 = 11.413% R23 = 2.811%, X13 = 43.0634% R13 = 3.2213%, Voltage = 345/34.5/12.5 kV (Wye Grounded/Wye Grounded/Delta), Taps Available = N/A Winding MVA = 100/35.0/35.0 MVA, Rating MVA = 166/166/53.3 MVA	**Gen R1: (57 Inverters)** X12 = 9.7434% R12 = 0.2535%, X23 = 4.0995% R23 = 0.3487%, X13 = 15.052% R13 = 0.3912%, Voltage = 345/34.5/12.5 kV (Wye Grounded/Wye Grounded/Delta), Taps Available = N/A Winding MVA = 100/35.0/35.0 MVA, Rating MVA = 100/100/53.3 MVA	**Gen R2: (57 Inverters)** X12 = 9.7768% R12 = 0.2489%, X23 = 14.8506% R23 = 2.811%, X13 = 2.5594% R13 = 3.2213%, Voltage = 345/34.5/12.5 kV (Wye Grounded/Wye Grounded/Delta), Taps Available = N/A Winding MVA = 100/35.0/35.0 MVA, Rating MVA = 100/166/53.3 MVA
Generator Step Up Transformer	X2 = 6.00%, R2 = 0.750%, Voltage = 34.5/0.69 kV, Winding MVA = 178.8 MVA, Rating MVA = 179 MVA	X2 = 6.00%, R2 = 0.750%, Voltage = 34.5/0.69 kV, Winding MVA = 178.8 MVA, Rating MVA = 179 MVA	X2 = 5.966%, R2 = 0.632%, Voltage = 34.5/0.69 kV, Winding MVA = 178.8 MVA, Rating MVA = 179 MVA	X2 = 5.970%, R2 = 0.632%, Voltage = 34.5/0.69 kV, Winding MVA = 178.8 MVA, Rating MVA = 179 MVA
Equivalent Collector Line[3]	R = 0.007790 pu X = 0.011190 pu B = 0.009070 pu	R = 0.007790 pu X = 0.011190 pu B = 0.009070 pu	R = 0.007790 pu X = 0.011190 pu B = 0.009070 pu	R = 0.007790 pu X = 0.011190 pu B = 0.009070 pu
Generator Dynamic Model[4]	REGCAU1[1] user model	REGCAU1[1] user model	REGCA1[1]	REGCA1[1]
Power Factor	Leading: 0.95[2] Lagging: 0.95[2]	Leading: 0.95[2] Lagging: 0.95[2]	Leading: 0.95[3] Lagging: 0.95[3]	Leading: 0.95[3] Lagging: 0.95[3]

1) DYR stability model name, **2)** From GEN-2021-032 (Kay Wind) Executed GIA, **3)** From Kay Wind Repowering - SG 3.1-129 (Mode 12, 2.66MW) - WTG LGIA Model_rev00.pdf.

RELIABILITY ASSESSMENT STUDY

SPP Planning and Operations reviewed whether a Reliability Assessment Study was needed. Since the EGF is scheduled to go offline the same day the replacement unit begins service, there is no gap in reliability to study. The EGF is also not committed by SPP for reliability, is not a blackstart resource, and is not near a major flowgate. Based on this, SPP determined the study was not needed and therefore was not performed, and no mitigation is required.

REPLACEMENT IMPACT STUDY

1898 & Co, a part of Burns & McDonnell, was retained by SPP to perform the Replacement Impact Study (Impact Study) for GEN-2024-GR6.

EXISTING VS. REPLACEMENT COMPARISON

To determine which analyses are required for the Impact Study, the differences between the existing configuration and the requested replacement were evaluated. SPP performed this comparison and the resulting analyses using a set of modified study models developed based on the replacement request data and the DISIS-2021-01 study models.

STABILITY MODEL PARAMETERS COMPARISION

Because the dynamic model parameters of the REGCA1 model for the EGF and RGF are different, SPP determined short-circuit and dynamic stability analyses were required. This is because the short-circuit contribution and stability responses of the existing configuration and the requested replacement's configuration may differ. The generator dynamic model for the RGF can be found in Appendix A.

As short-circuit and dynamic stability analyses were required, a stability model parameters comparison was not needed for the determination of the scope of the study.

EQUIVALENT IMPEDANCE COMPARISON CALCULATION

As the stability model change determined that short circuit and dynamic stability analyses were required, an equivalent impedance comparison was not needed for the determination of the scope of the study.

REACTIVE POWER ANALYSIS

1898 & Co, a part of Burns & McDonnell, performed a reactive power analysis for GEN-2024-GR6 to determine the capacitive charging effects under reduced generation conditions (unsuitable wind speeds, unsuitable solar irradiance, insufficient state of charge, idle conditions, curtailment, etc.) at the generation site and to size shunt reactors that would reduce the project reactive power contribution to the POI to approximately zero.

METHODOLOGY AND CRITERIA

For this analysis, the nearby projects that share the gen-tie line were disconnected. The GEN-2024-GR6 generators were switched out of service while other system elements remained in-service. A shunt reactor was tested at the project's collection substation 34.5 kV bus to set the MVAr flow into the POI to approximately zero. The size of the shunt reactor is equivalent to the charging current value at unity voltage and the compensation provided is proportional to the voltage effects on the charging current (i.e., for voltages above unity, reactive compensation is greater than the size of the reactor).

The reactive power analysis was performed using the replacement request data based on the DISIS-2021-01 stability study 2025 Summer Peak (25SP) model.

RESULTS

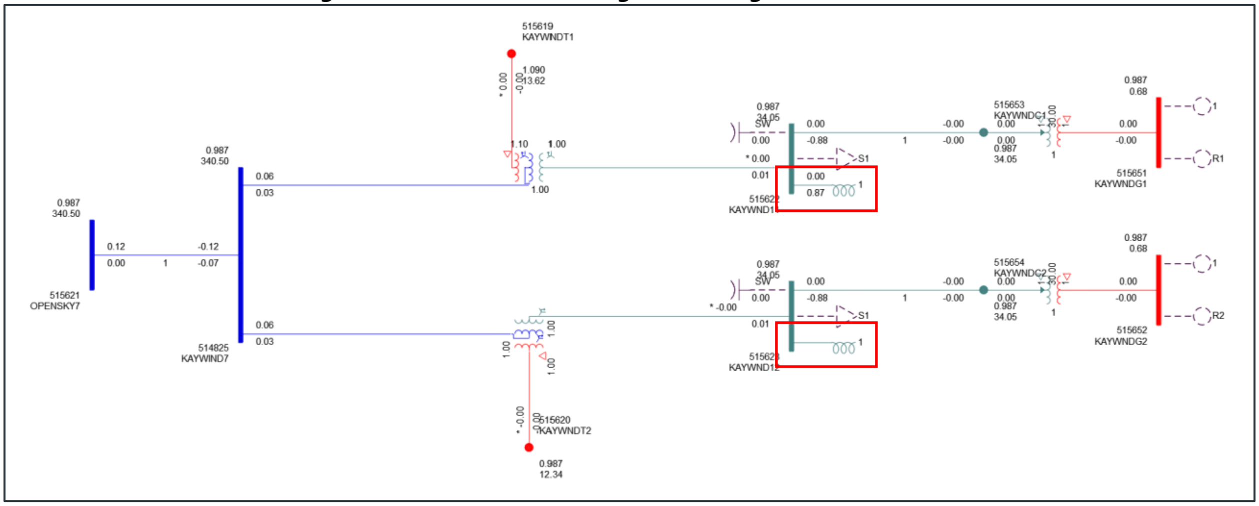
The results from the analysis showed that the GEN-2024-GR6 project needed approximately 1.792 MVAr of compensation at its collector substations, to reduce the POI MVAr to zero. Figure 3 illustrates the shunt reactor size needed to reduce the POI MVAr to approximately zero with the updated configuration. The final shunt reactor requirements for GEN-2024-GR6 are shown in Table 2.

The information gathered from the reactive power analysis is provided as information to the Interconnection Customer and Transmission Owner (TO) and/or Transmission Operator (TOP). The applicable reactive power requirements will be further reviewed by the TO and/or TOP.

Table 2: Shunt Reactor Size for Reactive Power Analysis

Machine	POI Bus Number	POI Bus Name	Reactor Size (MVAr)
			25SP
GEN-2024-GR6 R1	515621	Open Sky 345 kV	-0.896
GEN-2024-GR6 R2	515621	Open Sky 345 kV	-0.896

Figure 3: GEN-2024-GR6 Single Line Diagram (Shunt Size)



SHORT-CIRCUIT ANALYSIS

1898 & Co, a part of Burns & McDonnell, performed a short circuit study using the 25SP model to determine the maximum fault current requiring interruption by protective equipment with the RGF online for each bus in the relevant subsystem, and the amount of increase in maximum fault current due to the addition of the RGF. The detailed results of the short circuit analysis are provided in Appendix B.

METHODOLOGY

The short-circuit analysis included applying a three-phase fault on buses up to five levels away from the 345 kV POI bus. The PSS/E "Automatic Sequence Fault Calculation (ASCC)" fault analysis module was used to calculate the fault current levels in the transmission system with and without the GEN-2024-GR6 RGF online.

SPP created a short circuit model using the 25SP stability study model by adjusting the GEN-2024-GR6 short-circuit parameters consistent with the replacement data. The adjusted parameters are shown in Table 3 below.

Table 3: GEN-2024-GR6 Short-Circuit Parameters*

Parameter	Value by Generator Bus#	Value by Generator Bus#
	515651	515652
R (pu)	0.000	0.000
X'' (pu)	0.410	0.410

*pu values based on Machine MVA Base

RESULTS

The results of the short circuit analysis for the 25SP model are summarized in
Table **4** and Table 5. The GEN-2024-GR6 POI bus (Open Sky 345 kV) fault current magnitude is provided in
Table **4** showing a fault current of 14.113 kA with the RGF online. The addition of the RGF increased the POI bus fault current by 0.229 kA. Table 5 shows the maximum fault current magnitudes and fault current increases with the RGF project online.

The maximum fault current calculated within 5 buses of the POI was 37.181 kA for the 25SP model. There were no buses with a maximum three-phase fault current over 40 kA. The maximum contribution to three-phase fault currents due to the addition of the RGF was about 1.66% and 0.229 kA. These buses are highlighted in Appendix B.

Table 4: POI Short-Circuit Results

Case	GEN-OFF Current (kA)	GEN-ON Current (kA)	kA Change	%Change
25SP	13.883	14.113	0.229	1.651%

Table 5: 25SP Short-Circuit Results

Voltage (kV)	Max. Current (EGF & SGF) (kA)	Max kA Change	Max %Change
69	12.144	0.013	0.106%
115	N/A	N/A	N/A
138	37.181	0.257	0.901%
161	29.936	0.000	0.000%
230	N/A	N/A	N/A
345	34.665	0.229	1.656%
Max	**37.181**	**0.257**	**1.656%**

9.940

DYNAMIC STABILITY ANALYSIS

1898 & Co, a part of Burns & McDonnell, performed a dynamic stability analysis to identify the impact of the GEN-2024-GR6 project. The analysis was performed according to SPP's Disturbance Performance Requirements[1]. The replacement details are described in the Project and Replacement Request section and the dynamic modeling data is provided in Appendix A. The simulation plots can be found in Appendix C.

METHODOLOGY AND CRITERIA

The dynamic stability analysis was performed using models developed with the requested RGF configuration of 130 x 2.66 MW Siemens SG 3.1-129 VS with a reduced dispatch of 300 MW (REGCA1). This stability analysis was performed using PTI's PSS/E version 34.9.6 software.

The RGF project details were used to create modified stability models for this impact study based on the DISIS-2021-001 stability study models:

- 2025 Summer Peak (25SP)
- 2025 Winter Peak (25WP)

The dynamic model data for the GEN-2024-GR6 project is provided in Appendix A. The modified power flow models and associated dynamics database were initialized (no-fault test) to confirm that there were no errors in the initial conditions of the system and the dynamic data.

The following system adjustments were made to address simulation issues:

- The PSSE dynamic simulation iterations and acceleration factor were adjusted as needed to resolve PSSE dynamic simulation crashes.

During the fault simulations, the active power (PELEC), reactive power (QELEC), and terminal voltage (ETERM) were monitored for the EGF and RGF and other current and prior queued projects in Group 4[2]. In addition, voltages of five (5) buses away from the POI of the RGF were monitored and plotted. The machine rotor angle for synchronous machines and speed for asynchronous machines within the study areas including AEPW, OKGE, SPS, and WAPA were monitored. The voltages of all 100 kV and above buses within the study area were monitored as well.

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[1] SPP Disturbance Performance Requirements:
https://www.spp.org/documents/28859/spp%20disturbance%20performance%20requirements%20(twg%20approved).pdf

[2] Based on the DISIS-2018-002/2019-001-1 Cluster Groups

FAULT DEFINITIONS

1898 & Co. developed fault events as required in order to study the RGF. The new set of faults were simulated using the modified study models. The fault events included three-phase faults and single-line-to-ground stuck breaker faults. Single-line-to-ground faults are approximated by applying a fault impedance to bring the faulted bus positive sequence voltage to 0.6 pu. The simulated faults are listed and described in Appendix D. These contingencies were applied to the modified 25SP and 25WP models.

RESULTS

Table 6 shows the relevant results of the fault events simulated for each of the modified cases. The associated stability plots are also provided in Appendix C.

Table 6: Stability Analysis Results

Fault ID	25SP			25WP		
	Voltage Violation	Voltage Recovery	Stable	Voltage Violation	Voltage Recovery	Stable
P1_509755_WEKIWA-7-509757_WEKIWA-4_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_509755_WEKIWA-7-509852_TNO--7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_509755_WEKIWA-7-509870_SAPLPRD7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_509757_WEKIWA-4-505610_KEYSTON4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_509757_WEKIWA-4-509755_WEKIWA-7_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_509757_WEKIWA-4-509812_SHEFFD-4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_509757_WEKIWA-4-509823_WED-TAP4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_509757_WEKIWA-4-509851_P&P_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_509757_WEKIWA-4-512726_SILVCTYGR4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_509852_TNO--7-509895_TNO2-4_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_509852_TNO--7-510406_NES-7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_509852_TNO--7-512694_CLEVLND7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_509852_TNO--7-765721_G21-047-TAP_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_509870_SAPLPRD7-509782_RSS-7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_509870_SAPLPRD7-509871_SAPLPRD4_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_512694_CLEVLND7-512729_CLEVLND_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514704_MILLERT4-515412_DMNCRKT4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514715_WOODRNG7-514714_WOODRNG4_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514715_WOODRNG7-515476_HUNTERS7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514715_WOODRNG7-515875_REDNGTN7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514798_SNRPMPT4-514743_OSAGE_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514802_SOONER-514704_MILLERT4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass

Fault ID	25SP			25WP		
	Voltage Violation	Voltage Recovery	Stable	Voltage Violation	Voltage Recovery	Stable
P1_514802_SOONER-514706_COWCRK_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514802_SOONER-514798_SNRPMPT4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514802_SOONER-514803_SOONER_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514802_SOONER-515447_MORISNT4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514803_SOONER-509755_WEKIWA-7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514803_SOONER-560056_G15-066T_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514880_NORTWST7-514879_NORTWST4_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514880_NORTWST7-514901_CIMARON7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514880_NORTWST7-514908_ARCADIA7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514880_NORTWST7-515497_MATHWSN7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_514881_SPRNGCK7-514880_NORTWST7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_515447_MORISNT4-514706_COWCRK_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_515447_MORISNT4-515011_STILWTR4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_515576_RANCHRD7-514803_SOONER_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_515621_OPENSKY7-515576_RANCHRD7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_515621_OPENSKY7-560053_G15052_T_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_515688_FRNTWND7-515689_FRNTWD11_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_516010_PINTAIL7-514715_WOODRNG7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_516010_PINTAIL7-514803_SOONER_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532777_G17-009-TAP-532793_NEOSHO_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532780_CANEYRV7-532777_G17-009-TAP_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532780_CANEYRV7-532800_LATHAMS7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532791_BENTON-532796_WICHITA7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532791_BENTON-532986_BENTON_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532794_ROSEHIL7-532791_BENTON_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532796_WICHITA7-532771_RENO_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532796_WICHITA7-532782_BUFFALO7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532796_WICHITA7-532782_BUFFALO7_Ckt2.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532796_WICHITA7-532798_VIOLA_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532796_WICHITA7-533040_EVANS_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532796_WICHITA7-562476_G14-001-TAP_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532797_WOLFCRK7-532794_ROSEHIL7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532797_WOLFCRK7-532799_WAVERLY7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532797_WOLFCRK7-533653_WOLFCRK2_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532797_WOLFCRK7-542965_WGRDNR7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532797_WOLFCRK7-765200_G20-090-TAP_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass

Fault ID	25SP			25WP		
	Voltage Violation	Voltage Recovery	Stable	Voltage Violation	Voltage Recovery	Stable
P1_532799_WAVERLY7-766261_G20-007-TAP_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532800_LATHAMS7-532794_ROSEHIL7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532986_BENTON-532791_BENTON_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532986_BENTON-532988_BELAIRE4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532986_BENTON-532990_MIDIAN_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532986_BENTON-533024_29TH_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532986_BENTON-533052_PARKCTY4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532991_WEAVER-532993_TALLGRS4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532991_WEAVER-533026_ANDOVER4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532991_WEAVER-533059_ELPASOE4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532991_WEAVER-533067_SPRNGDL4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_532991_WEAVER-533604_WEAVER_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_533039_ELPASO-533046_GILL_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_533039_ELPASO-533059_ELPASOE4_CktZ1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_533039_ELPASO-533068_STEARMN4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_533059_ELPASOE4-532984_SUMNER_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_533059_ELPASOE4-532991_WEAVER_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_533059_ELPASOE4-533066_64TH_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_533059_ELPASOE4-533793_ELPASO_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_533062_ROSEHIL4-532794_ROSEHIL7_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_533062_ROSEHIL4-532991_WEAVER_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_533062_ROSEHIL4-533039_ELPASO_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_533062_ROSEHIL4-533068_STEARMN4_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_533068_STEARMN4-533033_CANAL_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_533653_WOLFCRK2-532797_WOLFCRK7_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_533653_WOLFCRK2-533626_BURLJCT2_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_542965_WGRDNR7-532774_SWISVAL7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_542965_WGRDNR7-542940_ATLNTIC7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_542965_WGRDNR7-542966_WGARDNR5_3Winding.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_542965_WGRDNR7-542968_STILWEL7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_542965_WGRDNR7-542981_LACYGNE7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_560053_G15052_T-532794_ROSEHIL7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_560056_G15-066T-512694_CLEVLND7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_562900_G15052_1-562901_G15052_2_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_562900_G15052_1-562901_G15052_2_Ckt2.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_587804_G16-119-TAP-514803_SOONER_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass

Fault ID	25SP			25WP		
	Voltage Violation	Voltage Recovery	Stable	Voltage Violation	Voltage Recovery	Stable
P1_587804_G16-119-TAP-514881_SPRNGCK7_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P1_765200_G20-090-TAP-300739_7BLACKBERRY_Ckt1.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-512694_CLEVLND7-ConID-136489.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-512694_CLEVLND7-ConID-136508.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-514803_SOONER-ConID-138949.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-514803_SOONER-ConID-138950.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_HOL-509755_WEKIWA-7.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_HOL-514802_SOONER.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_HOL-514803_SOONER.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_HOL-532791_BENTON.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_HOL-532794_ROSEHIL7.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_HOL-532797_WOLFCRK7.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_HOL-533062_ROSEHIL4.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_HOL-560056_G15-066T.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_TO-512694_CLEVLND7-ConID-GRDA-55_BMcD.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_TO-512694_CLEVLND7-ConID-GRDA-57_BMcD.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_TO-514803_SOONER-ConID-OKGE-29_BMcD.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_TO-515576_RANCHRD7-ConID-OKGE-25.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_TO-532791_BENTON-ConID-Evergy-104.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_TO-532794_ROSEHIL7-ConID-Evergy-116.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_TO-532794_ROSEHIL7-ConID-Evergy-152.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_TO-532797_WOLFCRK7-ConID-Evergy-122.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_TO-532797_WOLFCRK7-ConID-Evergy-123.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-514803_SOONER-ConID-138951.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-514881_SPRNGCK7-ConID-138957.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-515576_RANCHRD7-ConID-138898.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-515576_RANCHRD7-ConID-138899.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-515576_RANCHRD7-ConID-138900.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-515576_RANCHRD7-ConID-138901.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-515576_RANCHRD7-ConID-138902.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-515621_OPENSKY7-ConID-138869.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-515621_OPENSKY7-ConID-138870.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-515621_OPENSKY7-ConID-138871.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-516010_PINTAIL7-ConID-138889.idv	Pass	Pass	Pass	Pass	Pass	Pass
P4_CON-516010_PINTAIL7-ConID-138890.idv	Pass	Pass	Pass	Pass	Pass	Pass

There were no voltage recovery or out of step violations attributed to the GEN-2024-GR6 replacement request observed during the simulated faults. There were some power and VARS damping constraints observed for 3 generators (GEN-2016-119 Unit 1 & 2, and GEN-2017-141), which were also observed in the Base simulations. For faults that showed new damping issues, tuning the replacement request's dynamic model parameters resulted in a damped response. However, the damping issues seen do not meet SPP's stability requirement criteria, and therefore do not classify the replacement request as a material modification. These results can be seen in Appendix C. Additionally, the project was found to stay connected during the contingencies that were studied and, therefore, will meet the Low Voltage Ride Through (LVRT) requirements of FERC Order #661A.

INSTALLED CAPACITY EXCEEDS GIA CAPACITY

Under FERC Order 845, Interconnection Customers are allowed to request Interconnection Service that is lower than the full generating capacity of their planned generating facilities. The Interconnection Customers must install acceptable control and protection devices that prevent the injection above their requested Interconnection Service amount measured at the POI.

NECESSARY INTERCONNECTION FACILITIES

This study identified necessary Interconnection Facilities to accommodate GEN-2024-GR6 as shown in Table 7.

Table 7: Necessary Interconnection Facilities

Upgrade Name	Upgrade Description
Open Sky 345 kV GEN-2024-GR6 Interconnection (TOIF) (AEP)	Interconnection upgrades and cost estimates needed to interconnect the following Interconnection Customer facility, GEN-2024-GR6, into the POI at Open Sky 345 kV.
Open Sky 345 kV GEN-2024-GR6 Interconnection (Non-Shared NU) (AEP)	Interconnection upgrades and cost estimates needed to interconnect the following Interconnection Customer facility, GEN-2024-GR6, into the POI at Open Sky 345 kV.

Should the Interconnection Customer choose to move forward with this request, an Interconnection Facilities Study will be necessary to determine the full scope, cost, and time required to interconnect these upgrades. SPP will work with the TO(s) indicated for the Interconnection Facilities Study.

RESULTS

RELIABILITY ASSESSMENT STUDY

SPP Planning and Operations reviewed whether a Reliability Assessment Study was needed. Since the EGF is scheduled to go offline the same day the replacement unit begins service, there is no gap in reliability to study. The EGF is also not committed by SPP for reliability, is not a blackstart resource, and is not near a major flowgate. Based on this, SPP determined the study was not needed and therefore was not performed, and no mitigation is required.

REPLACEMENT IMPACT STUDY

In accordance with SPP tariff Attachment V, any material adverse impact from operating the RGF when compared to the EGF would be identified as a Material Modification. In the case that the Interconnection Customer chooses to move forward with the RGF, it must submit the RGF as a new Interconnection Request.

Because no material adverse impacts to the SPP Transmission System were identified, SPP determined the requested replacement is **not a Material Modification**. SPP determined that the requested replacement did not cause a materially adverse impact to the dynamic stability and short-circuit characteristics of the SPP system.

This determination implies that no new upgrades beyond those required for interconnection of the RGF are required, thus not resulting in a material adverse impact on the cost or timing of any other Interconnection Request with a later Queue priority date.

NEXT STEPS

As the requested replacement is determined to not be a Material Modification, pursuant to SPP tariff Attachment V section 3.9.3, the Interconnection Customer shall inform SPP within 30 Calendar Days after having received these study results of its election to proceed.

If the Interconnection Customer chooses to proceed with the studied replacement, SPP will initiate an Interconnection Facilities Study and subsequently tender a draft GIA. The Interconnection Customer shall withdraw any associated Attachment AB retirement requests of the EGF, if applicable, and complete the Attachment AE requirements for de-registration of the EGF and registration of the RGF, including transfer or termination of applicable existing transmission service. If the Interconnection Customer would like to obtain new deliverability to final customers, a separate request for transmission service must be requested on Southwest Power Pool's OASIS.

Failure by the Interconnection Customer to provide an election to proceed within 30 Calendar Days will result in withdrawal of the Interconnection Request pursuant to section 3.7 of SPP tariff Attachment V.