GEN-2013-027
Impact Restudy for Generator Modification
(Turbine Change)

May 2015
Generator Interconnection

SPP Southwest Power Pool

Executive Summary

The GEN-2013-027 interconnection customer has requested a modification to its Interconnection Request to change wind generator manufacturer from Alstom to Siemens. SPP has performed this system impact restudy to determine the effects of changing wind turbine generators from the previously studied[1] Alstom ECO122 3.0 MW wind turbine generators (50 machines total for aggregate power of 150.0 MW) to Siemens 108m VS 2.3 MW wind turbine generators (65 machines total for aggregate power of 149.5 MW). The point of interconnection (POI) remains a new tap on the existing Southwestern Public Service Company (SPS) Yoakum – Tolk 230kV transmission line.

The analysis for this modification study was incorporated into the Definitive Interconnection System Impact Re-Study performed in May of 2015 and posted to the SPP Generation Interconnection website at the following link:
http://sppoasis.spp.org/documents/swpp/transmission/GENInterPAGE.cfm >> 2014 Impact Studies >> DISIS-2014-002-1
The analysis can be found within the main report as well as within Appendix J and the Group 6 Addendum of the posted study. Both power flow and dynamic analysis was performed for this modification and details of the analysis can be found at the above hyperlink. Prior queued interconnection requests through DISIS-2014-002 were included in the analysis. The restudy showed that no stability problems were found during the summer and the winter peak conditions as a result of changing to the Siemens 2.3 MW wind turbine generators. Additionally, the project wind farm 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.

A low-wind/no-wind condition analysis was performed for this modification request. The project will be required to install approximately 6.7 Mvar of shunt reactors on its substation 34.5kV bus(es), or install and utilize an equivalent method of compensating for the reactive power into the transmission system at the POI. This is necessary to offset the capacitive effect on the transmission network caused by the project's transmission line and collector system during low-wind/no-wind conditions.

The power factor analysis was performed again for this study. The results show that GEN-2013-027, using the Siemens 108m VS 2.3 MW WTGs, will not be able to meet the required to meet 0.95 power factor lagging (providing vars) to 0.95 power factor leading (absorbing vars) for the tested scenarios and throughout all seasons at the POI, without the installation of additional reactive support.

With the assumptions outlined in this report, the DISIS-2014-02-1 restudy report, and with all the required network upgrades from the DISIS-2014-002 in place, GEN-2013-027, utilizing the Siemens

[1] DISIS-2014-002 posted July 2014, see Appendix K: Group 6 Dynamic Stability Analysis Report performed by MEPPI.

108m VS 2.3MW wind turbine generators, should be able to interconnect reliably to the SPP transmission grid.

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.

I. Introduction

GEN-2013-027 Impact Restudy is a generation interconnection study performed to study the impacts of interconnecting the project shown in Table I-1. This restudy is for a change from fifty (50) Alstom ECO122 3.0MW to sixty-five (65) Siemens 108m VS 2.3MW wind turbine generators.

Table I-1: Interconnection Request

Request	Capacity (MW)	Generator Model	Point of Interconnection
GEN-2013-027	149.5	Siemens 108m VS 2.3MW [sixty-five (65) wind turbine generators]	New 230kV substation tapping the Yoakum - Tolk 230kV line

The prior-queued, equally-queued and lower queued requests shown in Table I-2 were included in this study and the wind farms were dispatched to 100% of rated capacity.

Table I-2: Prior and Later Queued Interconnection Requests

Request	Capacity (MW)	Generator Model	Point of Interconnection
All prior queued requests are listed within the DISIS-2014-002-1 restudy report			

The study included both power flow and a stability analysis of the interconnection request. Contingencies that resulted in a prior-queued project tripping off-line, if any, were re-run with the prior-queued project's voltage and frequency tripping relays disabled. Also a low-wind/no-wind analysis was performed on this project since it is a wind farm.

The power flow analysis determines the impacts of the interconnecting new Generating Facilities to the transmission system by identifying any thermal overloads or voltage issues. The stability analysis determines the impacts of the new interconnecting project on the stability and voltage recovery of the nearby systems and the ability of the interconnecting project to meet FERC Order 661A. If problems with power flow, stability or voltage recovery are identified, the need for reactive compensation or system upgrades is investigated.

The power factor analysis was re-run and the results may be found within the DISIS 2014-002-1 restudy. GEN-2013-027 will be required to meet 0.95 power factor lagging (providing vars) to 0.95 power factor leading (absorbing vars) at the POI.

The low-wind/no-wind analysis determines the capacitive effect at the POI caused by the project's collector system and transmission line capacitance. A shunt reactor size was determined to offset the capacitive effect and to maintain zero Mvar flow at the POI when the plant generators and capacitors are off-line such as might be seen in low-wind or no-wind conditions.

II. Facilities

A one-line drawing for the GEN-2013-027 generation interconnection request is shown in Figure II-1. The POI is a new substation tapping the Yoakum - Tolk 230kV substation.

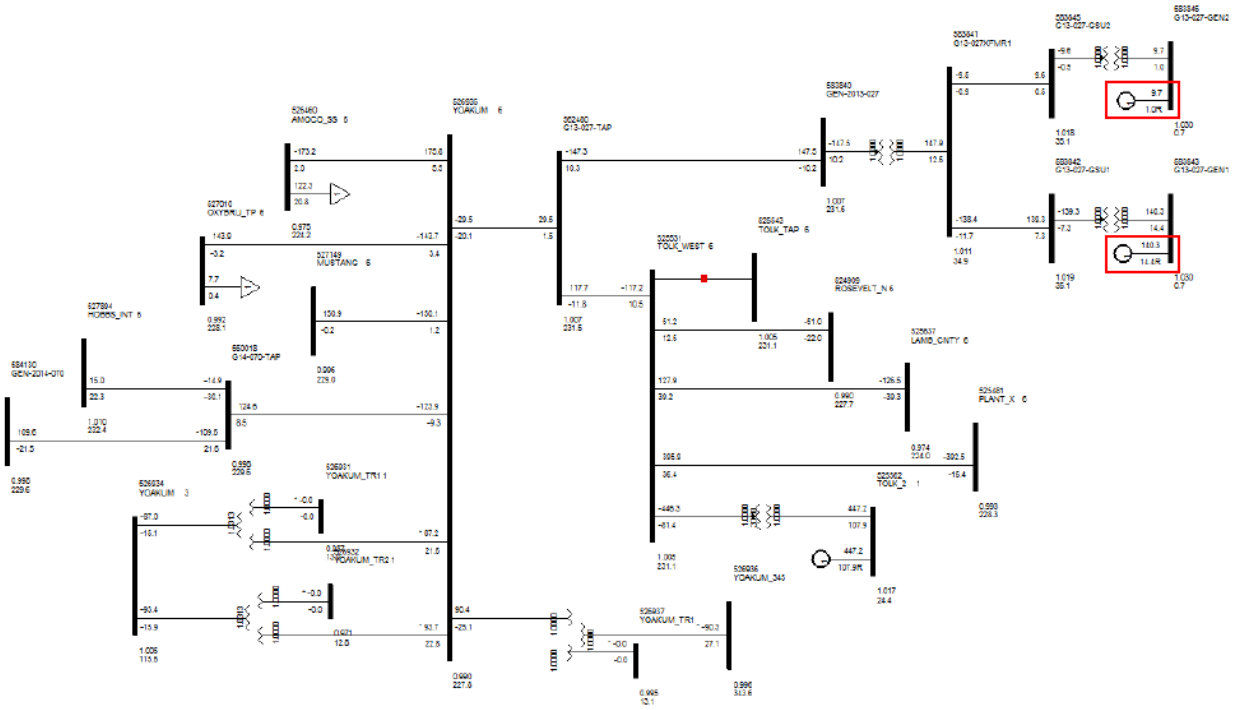

Figure II-1: GEN-2013-027 One-line Diagram

III. Power Flow and Stability Analysis

Please review the DISIS-2014-002-1 restudy report for the details of the power flow and stability analysis.

Results

All results have been summarized in the Executive Summary section of this report and may also be found within the DISIS-2014-002-1 restudy report.

IV. Power Factor Analysis

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Results

All results have been summarized in the Executive Summary section of this report and may also be found within the DISIS-2014-002-1 restudy report.

V. Reduced Generation Analysis

Please review the DISIS-2014-002-1 restudy report for the details of the power flow and stability analysis.

Results

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VI. Short Circuit Analysis

Please review the DISIS-2014-002-1 restudy report for the details of the power flow and stability analysis.

Results

All results have been summarized in the Executive Summary section of this report and may also be found within the DISIS-2014-002-1 restudy report.

VII. Conclusion

The GEN-2013-027 interconnection customer has requested a modification to its Interconnection Request to change wind generator manufacturer from Alstom to Siemens.

The analysis for this modification study was incorporated into the Definitive Interconnection System Impact Re-Study performed in May of 2015 and posted to the SPP Generation Interconnection website.

The restudy showed that no stability problems were found during the summer and the winter peak conditions as a result of changing to the Siemens 2.3 MW wind turbine generators. Additionally, the project wind farm 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. The project will be required to install approximately 6.7 Mvar of shunt reactors on its substation 34.5kV bus(es), or install and utilize an equivalent method of compensating for the reactive power into the transmission system at the POI. GEN-2013-027, using the Siemens 108m VS 2.3 MW WTGs, will not be able to meet the required to meet 0.95 power factor lagging (providing vars) to 0.95 power factor leading (absorbing vars) for the tested scenarios and throughout all seasons at the POI, without the installation of additional reactive support.

With the assumptions outlined in this report, the DISIS-2014-02-1 restudy report, and with all the required network upgrades from the DISIS-2014-002 in place, GEN-2013-027, utilizing the Siemens 108m VS 2.3MW wind turbine generators, should be able to interconnect reliably to the SPP transmission grid.

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.

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