ASSESSMENT OF VALLEY REGION CONSIDERING THE AVAILABILITY OF THE FRONTERA FACILITY BEGINNING 2015.

FRONTERA_CC1

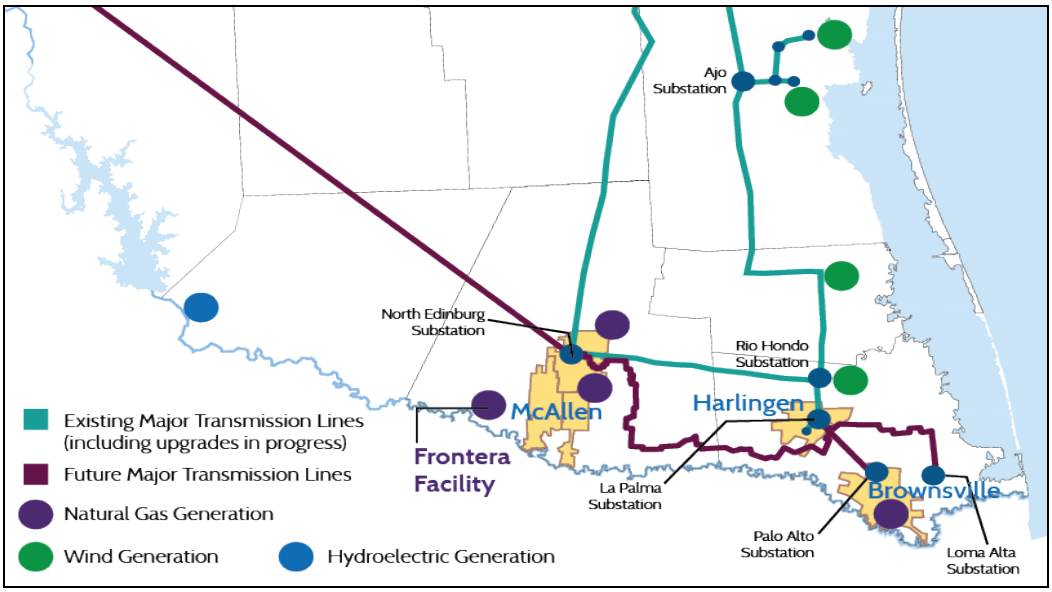
FRONTERA_FRONTEG1
FRONTERA_FRONTEG2
FRONTERA_FRONTEG3

OCTOBER 20, 2014

Contents

INTRODUCTION

In accordance with ERCOT Protocol Section 16.5.4(2), Frontera Generation Limited Partnership (Frontera) has reported to ERCOT that all or part of the Frontera Facility will not be available to the ERCOT System beginning January 1, 2015 through December 31, 2023. Frontera has reported that 170 MW of the overall capacity at the Frontera Facility will not be available to the ERCOT System beginning January 1, 2015, and that 524 MW of capacity (the entire Frontera Facility) will not be available to the ERCOT System after the new transmission projects, Lobo--North Edinburg and North Edinburg--Loma Alta 345 kV lines, are energized in 2016[1].



BACKGROUND

The Frontera Facility is registered as a combined cycle plant (FRONTERA_CC1) and includes three Switchable Generation Resources: FRONTERA_FRONTEG1 (planning model ID – 160171/C1), FRONTERA_FRONTEG2 (planning model ID – 160172/C2), and FRONTERA_FRONTEG3 (planning model ID – 160173/C0). The maximum sustainable rating of each these Resources is 170 MW, 170 MW, and 184 MW, respectively.

STUDY SCOPE

The purpose of this analysis is to determine whether the absence of the Frontera Facility (FRONTERA_FRONTEG2 in 2015 or FRONTERA_CC1 in 2016) will cause violations of ERCOT and NERC reliability requirements that would not occur if the facility were available. This study analyzes whether all or a portion of the Frontera Facility is needed until these reliability criteria can be met through the construction of new facilities or through implementation of acceptable Remedial Action Plans (RAPs) or Special Protection Systems (SPSs).

[1] On September 25, 2014, Frontera submitted an updated Notice of System Planning Data Request for Switchable Resources that clarified that the unavailability of the entire Frontera Facility in 2016 would not occur until the new 345 kV transmission lines are completed.

ANALYSIS AND STUDY CASES

The analyses conducted in this study and the associated study cases are listed below.

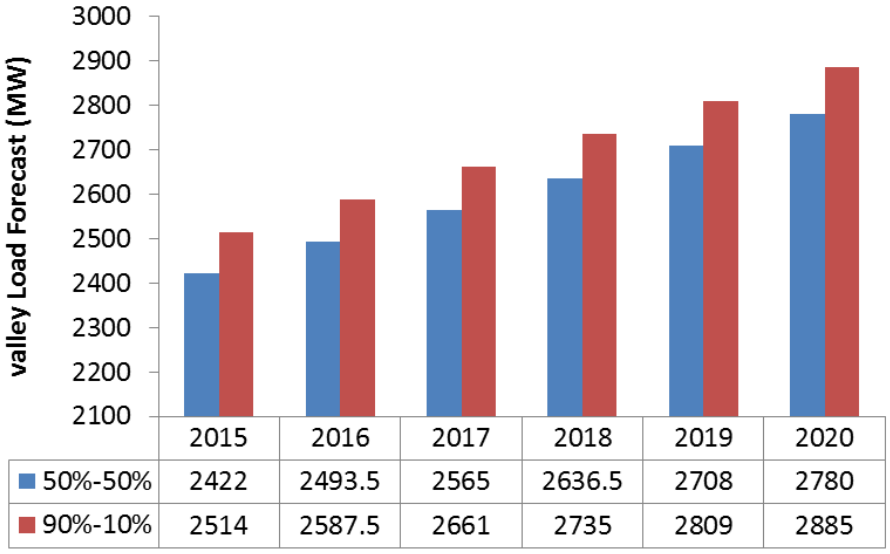
Analysis	Base Case	Monitoring
Steady State Contingency Analysis	SSWG 2015 SUM-Peak SSWG 2016 SUM-Peak	Thermal and Voltage Criteria Violations
Voltage Stability Analysis	SSWG 2015 SUM-Peak SSWG 2016 SUM-Peak	Voltage Collapse
Dynamic Stability Analysis	DWG 2018 Summer Peak Flat Start (Transmission topology is updated for 2015 and 2016 conditions)	Angular and Transient Voltage Instability

Silas Ray unit 5 was turned off in the base case because it is a Mothballed Generation Resource and therefore not available; all other synchronous generation in the Valley region was dispatched at maximum output. Wind units in the Valley region were dispatched at 10 percent of maximum capacity. The Railroad DC Tie was modeled with no import/export. In addition, available reactive devices in the Valley region were adjusted to achieve a high pre-disturbance voltage profile (close to 1.03 p.u. or higher) at most Valley buses after discussion with and concurrence of area Transmission Service Providers (TSPs) that this was an acceptable practice. Topology updates provided by TSPs for the Valley region were incorporated into the study cases. The following notable new generation and transmission projects based on the latest Generation Interconnection or Change Request (GINR) and Transmission Project Information Tracking (TPIT) were also included to reflect 2015 and 2016 Valley conditions.

- 2015:
  - One new wind generation project (200 MW): Los Vientos III
- 2016:
  - One new wind generation project (165 MW): Cameron County Wind
  - Lobo – North Edinburg 345 kV line in service (with series capacitor; TPIT Project - 11TPIT0002)
  - North Edinburg – Loma Alta (Cross Valley) 345 kV line in service (TPIT Project - 16TPIT0030)

FORECASTED LOAD

The chart below provides an overview of the ERCOT forecasted load in the Valley region for years 2015 through 2020. The Valley region includes Starr, Willacy, Cameron, and Hidalgo counties. A 90th-percentile load forecast was utilized in these studies; as such, there is a 10 percent probability that actual Valley load may be higher than the load analyzed for that year. As a comparison, Appendix A includes the historical Valley load from September 2013 to September 2014.



	2015	2016	2017	2018	2019	2020
50%-50%	2422	2493.5	2565	2636.5	2708	2780
90%-10%	2514	2587.5	2661	2735	2809	2885

STUDY SCENARIOS AND CRITERIA

The load in the Valley region was determined as noted above. To assess the reliability impact of change of status of the Frontera Facility on the Valley region, both steady-state and dynamic stability analyses were performed. All transmission buses and transmission branches 60-kV and above in the Valley region were monitored for thermal and voltage conditions in the steady-state analysis. Selected ERCOT transmission buses were monitored for frequency and voltage deviations in the dynamic stability analysis. All generating units in the Valley region were monitored for angular separation. Dynamic load models provided by TSPs were applied for the simulation of contingencies. The dynamic model data also included under-voltage load shedding (UVLS) models for the Valley region. Table 1 lists an overview of the study scenarios.

The contingencies and the associated reliability criteria are based on current applicable ERCOT and NERC reliability requirements (Table 2). Base cases were developed with the stipulated initial outage followed by system adjustment(s) as necessary to provide an acceptable initial condition. The listed contingency event was then simulated to test the system response during and after the disturbance. In this study, N-1 outages include the loss of a single transmission element (60 kV and above) in the Valley region and G-1 outages include the loss of a generation unit or an entire combined-cycle train in the Valley region.

Table 1. Study Scenarios

Study Case	Valley Load Study Case (MW)	Valley Load 90-10 Load Forecast (MW)	FRONTERA Plant Status	Analysis
2015 Summer Peak	2580	2514	All In	Thermal/Voltage
				Voltage Stability
				Dynamic Stability
2015 Summer Peak	2580	2514	1 CT Out	Thermal/Voltage
				Voltage Stability
				Dynamic Stability
2016 Summer Peak	2650	2587	All In	Thermal/Voltage
				Voltage Stability
				Dynamic Stability
2016 Summer Peak	2650	2587	1 CT Out	Thermal/Voltage
				Voltage Stability
				Dynamic Stability
2016 Summer Peak	2650	2587	All Out	Thermal/Voltage
				Voltage Stability
				Dynamic Stability

Table 2. Study Criteria for the Tested Contingencies

Base Case Outage	Contingency	Thermal	Voltage	No Angular Instability	Load Shed Allowed
N/A	N-1	100% Rate B (Emergency Rating)	0.9~1.05 p.u.	√	No
G-1	N-1	100% Rate B (Emergency Rating)	0.9~1.05 p.u.	√	No
G-1	G-1	100% Rate B (Emergency Rating)	0.9~1.05 p.u.	√	Yes
N-1	N-1	100% Rate B (Emergency Rating)	0.9~1.05 p.u.	√	Yes

RESULTS

The study results are summarized in Table 3. It should be noted that the results in Table 3 were obtained under the high voltage profile condition in the Valley region and with no exports on the Railroad DC Tie. When only one unit at the Frontera Facility is unavailable to ERCOT in 2015 and the entire Frontera Facility is unavailable to ERCOT in 2016, the outage of one combined-cycle train together with the contingency loss of another combined-cycle train in the Valley (G-1+G-1) raises concerns about Valley region supply sufficiency and the ability to serve load in the exporting region, as it can cause under-voltage load shed under a high-demand period but without resulting in system collapse.

The instability observed for 2015 in simulations of the outage of one 345 kV line together with the contingency loss of another 345 kV line (N-1+N-1) is an identified existing system constraint for which a Mitigation Plan has been implemented to manage in the System Operations time horizon. However, the absence of the Frontera Facility does exacerbate the transmission instability operating problem and would require a revision to this established operating procedure. Based on the study results, the instability challenge under N-1+N-1 is expected to be resolved with the new 345 kV lines expected to be completed in 2016.

Table 3. Study Results Summary

Case	Valley Load Study Case (MW)	Valley Load 90-10 Forecast (MW)	FRONTERA Plant Status	Analysis	N-1	G-1+N-1	G-1+G-1	N-1+N-1
2015 Summer Peak	2580	2514	All In	Thermal/Voltage	Acceptable	Acceptable	Acceptable	Acceptable
				Voltage Stability	Acceptable	Acceptable	Acceptable	**Instability**
				Dynamic Stability	Acceptable	Acceptable	Acceptable	**Instability**
2015 Summer Peak	2580	2514	1 CT Out	Thermal/Voltage	Acceptable	Acceptable	Acceptable	Acceptable
				Voltage Stability	Acceptable	Acceptable	Acceptable	**Instability**
				Dynamic Stability	Acceptable	Acceptable	**UVLS<200MW**	**Instability**
2016 Summer Peak	2650	2587	All In	Thermal/Voltage	Acceptable	Acceptable	Acceptable	Acceptable
				Voltage Stability	Acceptable	Acceptable	Acceptable	Acceptable
				Dynamic Stability	Acceptable	Acceptable	Acceptable	Acceptable
2016 Summer Peak	2650	2587	1 CT Out	Thermal/Voltage	Acceptable	Acceptable	Acceptable	Acceptable
				Voltage Stability	Acceptable	Acceptable	Acceptable	Acceptable
				Dynamic Stability	Acceptable	Acceptable	Acceptable	Acceptable
2016 Summer Peak	2650	2587	All Out	Thermal/Voltage	Acceptable	Acceptable	Acceptable	Acceptable
				Voltage Stability	Acceptable	Acceptable	Acceptable	Acceptable[2]
				Dynamic Stability	Acceptable	Acceptable	**UVLS<200MW**	**UVLS<200MW**

[2] Acceptable with < 200 MW UVLS, as demonstrated by the dynamic stability analysis.

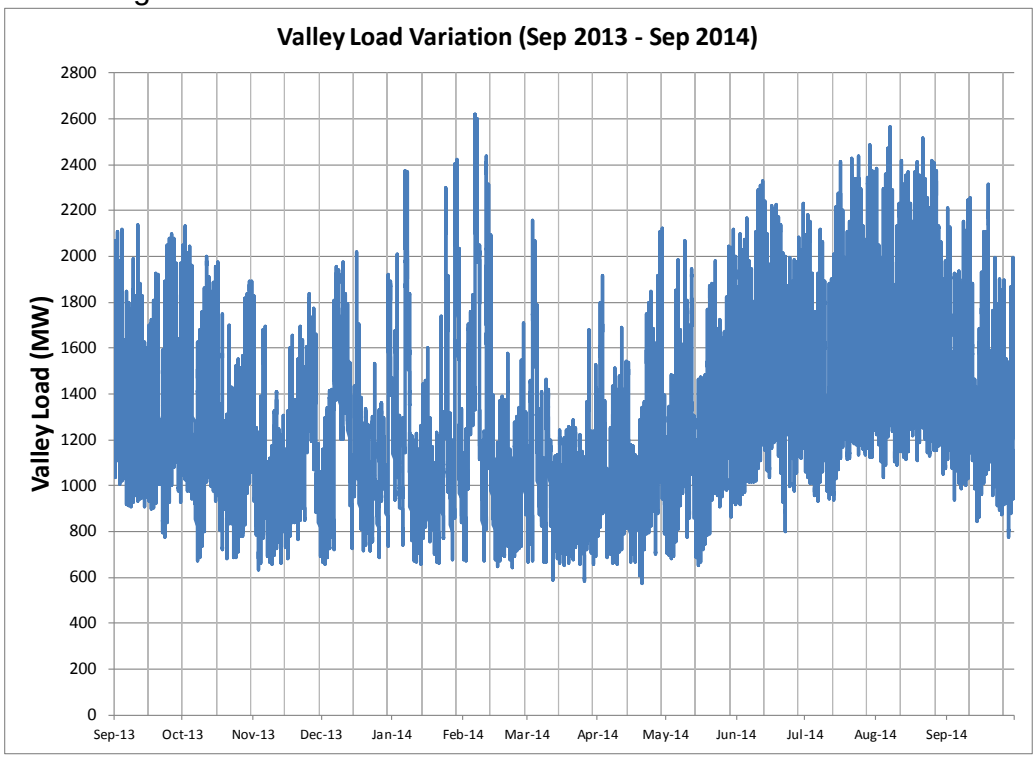
CONCLUSIONS

This study goal was to determine whether the absence of the Frontera Facility (FRONTERA_FRONTEG2 in 2015 or FRONTERA_CC1 in 2016) would cause supply sufficiency issues in the Valley region or violations of ERCOT and NERC reliability requirements. Based on the study results:

- The system maintains acceptable performance under steady-state conditions. No thermal or voltage violations for all tested contingencies.
- Transmission Operators will need to maintain a high voltage profile (~1.03 p.u.) in the Valley region during high-demand periods.
- Stability issues will require ERCOT to limit transfers into the Valley (using load shed, if required) during the outage of one of the existing 345 kV lines under high-demand conditions. With the Frontera Facility unavailable, this issue becomes a problem at lower demand levels, and the unavailability exacerbates the transmission instability operating problem. Moreover, the transfer limitation and load shedding, by their very nature, raise supply sufficiency concerns.
  - The instability issue is relieved with the additional 345 kV lines in 2016, even without the Frontera Facility.
- If the Frontera Facility is not available, planned outages for major 345 kV lines and generation in the Valley region will be further limited and will require greater coordination by ERCOT.
- These stability/supply issues could be mitigated if the Frontera Facility were available in ERCOT during high-demand periods that coincide with the outage of either of the 345 kV transmission lines into the Valley (Lon Hill – North Edinburg or Lon Hill – Rio Hondo, including sub-segments of these lines) or with the outage of either of of the combined-cycle trains in the Valley (DUKE, NEDIN).
- Additional system upgrades (transmission and/or generation) will likely be required to reliably serve Valley load after 2016 if the Frontera Facility is not available after 2016 summer.

APPENDIX A – HISTORICAL LOAD IN THE VALLEY

Chronological:



Load Duration (higher load intervals only):