ERCOT Independent Review of the CenterPoint Jones Creek Project

Version 1.0

Document Revisions

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Table of Contents

1. Introduction

The Freeport area is an industrialized area with several large chemical facilities as well as a major seaport on the Gulf of Mexico. CenterPoint Energy has received inquiries involving significant load growth in this area, among which Freeport LNG has publicly announced a natural gas Liquefaction and Export Project with an associated new 690 MW load. This new load will be served through the ERCOT Region transmission system by the third quarter of 2018.

With the above load addition and using the 2019 summer peak load case, under the X-1+N-1 contingencies when both of Dow–Velasco 345/138 kV autotransformers are out of service the case does not solve, which indicates a system voltage collapse. Additionally, several thermal violations around the Freeport area can be observed under certain N-1 or X-1+N-1 contingencies. Figure 1 shows the area of concern.

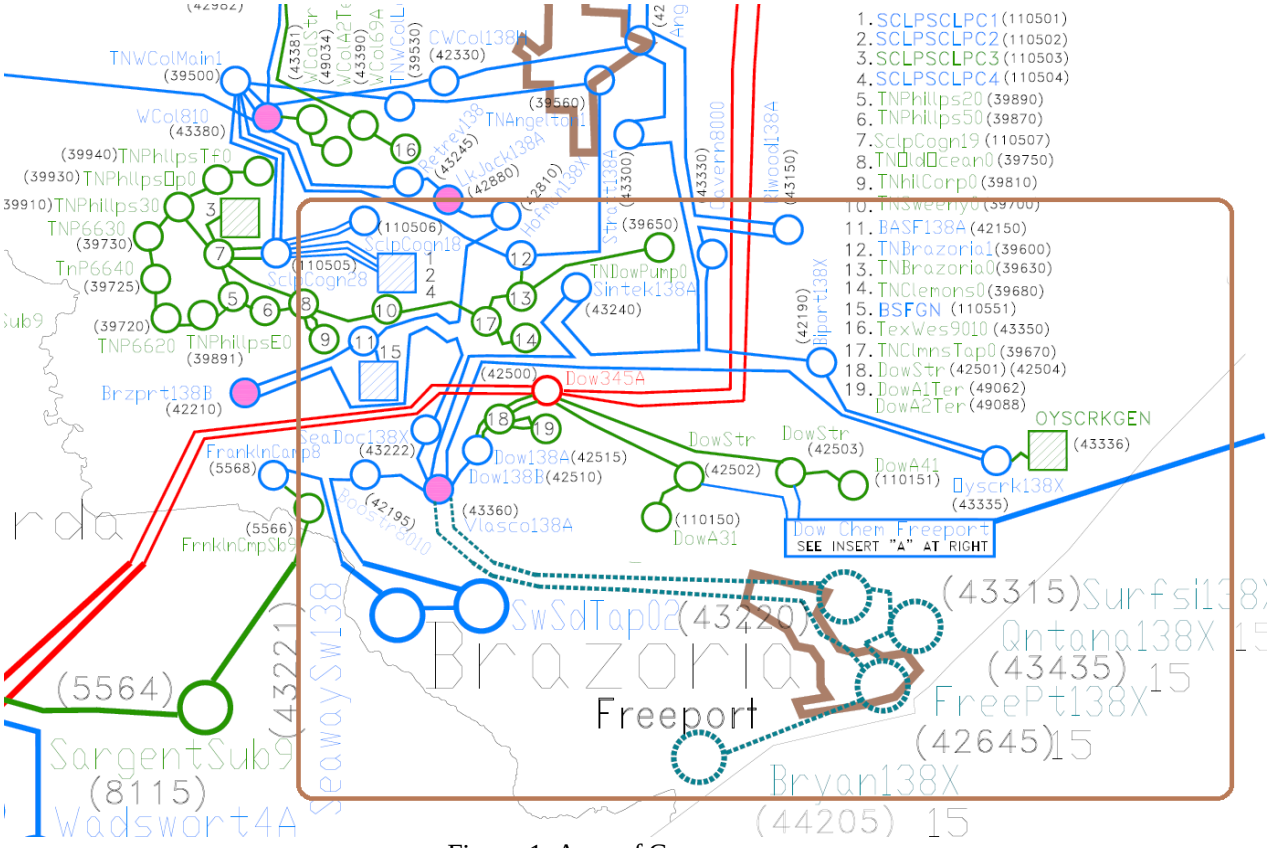

Figure 1: Area of Concern

In order to provide transmission infrastructure that meets ERCOT reliability criteria and serves future load growth in the Freeport area, CenterPoint Energy proposed the following improvements in the area of concern:

- Construct a new 345/138 kV "Jones Creek" Substation;
- Install two new 800 MVA normal rating / 1000 MVA emergency rating (800/1000 MVA) 345/138 kV autotransformers at the Jones Creek Substation;
- Loop the 345 kV Dow - STP circuit 18 into the Jones Creek Substation;

- Loop the 138 kV Freeport - Velasco circuit 59 into the Jones Creek Substation;
- Upgrade the Velasco 138 kV Substation to a fault duty rating of 63 kA;
- Split and reconfigure circuits in the Freeport area creating: 138 kV Velasco - Surfside - Freeport - Jones Creek circuit 59, 138 kV Velasco - Quintana - Jones Creek circuit 48, and 138 kV Velasco - Jones Creek circuit 59;
- Reconfigure 138 kV Velasco - Franklins Camp circuit 02 to create 138 kV Jones Creek - Franklins Camp circuit 02;
- Upgrade the 138 kV Jones Creek - Quintana circuit 48 and 138 kV Quintana - Velasco circuit 48 with 838 MVA normal rating / 894 MVA emergency rating (838/894 MVA);
- Install a new 138 kV 120 MVAR capacitor bank at the Jones Creek Substation.

The total cost for this project is estimated to be $79.8 million and it is anticipated that the project can be completed by the second quarter of 2017.

2. Study Approach

The analysis of the system primarily focused on the steady-state thermal and voltage reliability of the ERCOT transmission system in the Freeport area to meet the projected load growth. The latest 2013 Regional Transmission Plan (RTP) model for the year 2018 served as the starting case of this analysis.

From the starting case, the following changes are applied to form the base case for this study.

Base case Transmission system changes:

- Adjust load level to reflect the latest load forecast for the year of 2019, e.g. the total load in CenterPoint Energy TSP area is 23078 MW.
- Install a second 800 MVA normal rating / 1000 MVA emergency rating 345/138 kV autotransformer at the Dow-Velasco Substation, and build a second autotransformer 138 kV lead from Dow-Velasco to Velasco Substation at a minimum 800/1000 MVA rating.
- Add 138 kV Oyster Creek Substation with 146 MW load, 82 MW generator, and 40 MVAR capacitor bank.
- Add 690 MW load at Quintana substation.

As part of the ERCOT independent review, several transmission improvement options were studied and compared in order to identify a reliable while economical solution. The evaluation of these options mainly consisted of N-1 contingency analysis. In addition, selected G-1+N-1 (single generator unavailable followed by N-1) contingency analysis, X-1+N-1 (single 345/138 kV transformer unavailable followed by N-1) contingency analyses, and N-1-1 contingency analysis were performed in accordance with NERC and ERCOT reliability criteria.

3. Reliability Analysis of the Base Case

AC N-1 contingency analysis of the base case was performed using PowerWorld Simulator. Table 1 lists the thermal violations revealed by this study.

Contingency (N-1)	Monitored Facility	Rate B (MVA)	Worst % Loading
Freeport – Velasco 138 kV Circuit 48	Quintana – Surfside Beach 138 kV Circuit 59	562	143%
Surfside – Velasco 138 kV Circuit 59	Freeport – Quintana 138 kV Circuit 47	562	141%

Table 1 Thermal Violations in N-1 Contingency Analysis

The X-1+N-1 analysis reveals a few unsolved or limiting conditions for the study area. Table 2 shows the results of the reliability analysis for these conditions.

First Contingency (X-1)	Second Contingency (N-1)	Monitored Facility	Rate B (MVA)	Worst % Loading
345/138 kV autotransformer A1 in Dow-Velasco	345/138 kV autotransformer A2 in Dow-Velasco	NA	NA	Unsolved
345/138 kV autotransformer A1 in Dow-Velasco	Dow – Velasco 138 kV Circuit 83	NA	NA	Unsolved
345/138 kV autotransformer A1 in Dow-Velasco	Freeport – Velasco 138 kV Circuit 48	Quintana – Surfside Beach 138 kV Circuit 59	562	146%
345/138 kV autotransformer A1 in Dow-Velasco	Surfside – Velasco 138 kV Circuit 59	Freeport – Quintana 138 kV Circuit 47	562	143%
345/138 kV autotransformer A1 in Dow-Velasco	Retrieve – West Columbia 138 kV Circuit 02	Dow – Velasco 138 kV Circuit 83	1000	109%

Table 2 Reliability Analysis Results for Selected X-1+N-1

It should be noted that the above contingency analyses also revealed other post-contingency overloaded elements that were regional problems. These elements were discarded from this analysis since these were either not related to the new load addition, were very far from the area of concern, or will be addressed by subsequent projects. More details of the contingency analysis results for the base case can be found in Appendix A.

4. Reliability Analysis of Project Options

The existing substations feeding the Freeport area are the 345 kV / 138 kV Dow-Velasco Substation and the 138 kV Velasco Substation. Since neither of these two substations has space to accommodate more transmission devices, a new substation is needed to support the projected load growth in this area. Based on the existing electric network topology around the Freeport area, two types of projects are proposed: 1) upgrade 138 kV circuits to support the load addition; or 2) add more 345 kV / 138 kV autotransformers to support the load addition. Since all the three 138 kV circuits serving the Freeport area are long lines and need to be upgraded, the estimated installation

cost of this option is much higher than adding more 345 kV / 138 kV autotransformers; hence only the second type is thoroughly studied using simulations.

Two transmission improvement options were analyzed using PowerWorld Simulator to identify a reliable and economical solution to serve new load addition in Freeport area. These two options and the reliability analysis results are listed below:

Option A (Option 2 in CenterPoint Energy's RPG Submittal)

- Construct a new 345/138 kV "Jones Creek" Substation;
- Install two new 800 MVA normal rating / 1000 MVA emergency rating (800/1000 MVA) 345/138 kV autotransformers at the Jones Creek Substation;
- Loop the 345 kV Dow - STP circuit 18 into the Jones Creek Substation;
- Loop the 138 kV Freeport - Velasco circuit 59 into the Jones Creek Substation;
- Upgrade the Velasco 138 kV Substation to a fault duty rating of 63 kA;
- Split and reconfigure circuits in the Freeport area creating: 138 kV Velasco - Surfside - Freeport - Jones Creek circuit 59, 138 kV Velasco - Quintana - Jones Creek circuit 48, and 138 kV Velasco - Jones Creek circuit 59;
- Reconfigure 138 kV Velasco - Franklins Camp circuit 02 to create 138 kV Jones Creek - Franklins Camp circuit 02;
- Upgrade the 138 kV Jones Creek - Quintana circuit 48 and 138 kV Quintana - Velasco circuit 48 with 838 MVA normal rating / 894 MVA emergency rating (838/894 MVA);
- Install a new 138 kV 120 MVAR capacitor bank at the Jones Creek Substation.

The total cost estimate for Option A is approximately $79.8 million.

N-1 AC contingency analysis showed no overloads with Option A.

G-1+N-1 AC contingency analysis (the first outage is the loss of a single unit at STP substation, 1375 MW, or the loss of a single unit at WAP substation, 658MW, or the loss of all steam turbines at AMOCO substation, 350 MW) showed no overloads in the study area.

X-1+N-1 AC contingency analysis (loss of the 345/138 kV autotransformer A1 in Dow-Velasco as the first outage) showed no overloads in the study area.

N-1-1 AC contingency analysis (loss of the STP – Dow 345 kV circuit 27 as the first outage) showed no overloads in the study area.

Option B

- Construct a new 345/138 kV "Jones Creek" Substation;
- Install two new 800 MVA normal rating / 1000 MVA emergency rating (800/1000 MVA) 345/138 kV autotransformers at the Jones Creek Substation;
- Loop the 345 kV Dow - STP circuit 18 into the Jones Creek Substation;
- Loop the 138 kV Freeport - Velasco circuit 59 into the Jones Creek Substation;
- Upgrade the Velasco 138 kV Substation to a fault duty rating of 63 kA;
- Split and reconfigure circuits in the Freeport area creating: 138 kV Velasco - Surfside - Freeport - Jones Creek circuit 59, 138 kV Velasco - Quintana - Jones Creek circuit 48, and 138 kV Velasco - Jones Creek circuit 59;

- Reconfigure 138 kV Velasco - Franklins Camp circuit 02 to create 138 kV Jones Creek - Franklins Camp circuit 02;
- Upgrade the 138 kV Jones Creek - Quintana circuit 48 and 138 kV Quintana - Velasco circuit 48 with 838 MVA normal rating / 894 MVA emergency rating (838/894 MVA).

The total cost estimate for Option B is approximately $77.8 million.

N-1 AC contingency analysis showed no overloads with Option B.

G-1+N-1 AC contingency analysis (the first outage is the loss of a single unit at STP substation 1375 MW, or the loss of a single unit at WAP substation 658MW, or the loss of all steam turbines at AMOCO substation 350 MW) showed no overloads in the study area.

X-1+N-1 AC contingency analysis (loss of the 345/138 kV autotransformer A1 in Dow-Velasco as the first outage) showed no overloads in the study area.

N-1-1 AC contingency analysis (loss of the STP – Dow 345 kV circuit 27 as the first outage) showed no overloads in the study area.

More details of the contingency analysis results for Option B can be found in Appendix B.

As a minor variation of Option A, Option B does not include adding the 120 MVAR capacitor bank in Jones Creek substation. ERCOT did not find any NERC or ERCOT planning criteria violations due to the absence of this capacitor bank.

5. Economic Analysis of the Preferred Project

For Option B, to reveal potential congestion under economical operation conditions with different flow patterns, security-constrained production cost analysis was performed using UPLAN. To see the impacts of the load addition in Freeport area and the selected project, the monthly congestion results in the Coast weather zone were compared with those in the 2018 economic case obtained from the 2013 RTP studies. No new significant congestion was identified.

6. Conclusion

In conclusion, ERCOT recommends the following transmission upgrades studied as Option B, which constitute the most effective solution to serve the projected load growth in the Freeport area:

- Construct a new 345/138 kV “Jones Creek” Substation;
- Install two new 800 MVA normal rating / 1000 MVA emergency rating (800/1000 MVA) 345/138 kV autotransformers at the Jones Creek Substation;
- Loop the 345 kV Dow - STP circuit 18 into the Jones Creek Substation;
- Loop the 138 kV Freeport - Velasco circuit 59 into the Jones Creek Substation;
- Upgrade the Velasco 138 kV Substation to a fault duty rating of 63 kA;
- Split and reconfigure circuits in the Freeport area creating: 138 kV Velasco - Surfside - Freeport - Jones Creek circuit 59, 138 kV Velasco - Quintana - Jones Creek circuit 48, and 138 kV Velasco - Jones Creek circuit 59;
- Reconfigure 138 kV Velasco - Franklins Camp circuit 02 to create 138 kV Jones Creek - Franklins Camp circuit 02;

- Upgrade the 138 kV Jones Creek - Quintana circuit 48 and 138 kV Quintana - Velasco circuit 48 with 838 MVA normal rating / 894 MVA emergency rating (838/894 MVA).

7. Designated Providers of Transmission Facilities

In accordance with ERCOT Protocol Section 3.11.4.8, ERCOT staff is to designate transmission providers for projects reviewed in the RPG. These providers can agree to provide or delegate the new facilities or inform ERCOT if they do not elect to provide them. For the project scope recommended in this report CenterPoint Energy is the sole designated provider of all transmission facilities.

8. Appendix

Appendix A: Contingency Analysis Results of Base Case	Appendix A.xlsx
Appendix B: Contingency Analysis Results of Option B	Appendix B.xlsx