



ERCOT Independent Review of the TNMP Line 69H Rebuild and Conversion Project

Document Revisions

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1. Introduction

Development in the oil and gas industry has introduced steady load growth in the TNMP West Texas North (WTN) system, and the forecasted coincident peak load is projected to reach 254 MW by 2022 with a significant amount of the forecasted load will be tapped from TNMP's Line 69H. The forecasted load growth is projected to result in transmission planning criteria violations in the TNMP WTN system, and the majority of the criteria violations are located on Line 69H.

TNMP submitted a Regional Planning Group (RPG) project in March 2016 to address the reliability issues in the TNMP WTN system.

Based on the independent review, ERCOT concludes that new transmission reinforcement is needed to meet the reliability criteria. ERCOT evaluated project alternatives to address the reliability needs and concluded the transmission project defined as Option 1 as the best solution. The detailed description of Option 1 is as follows.

- Rebuild Line 69H from IH-20 to Wickett to 138 kV standards with Cumberland 1926 ACSR conductor (~39 miles)
- Rebuild three existing substations (Pyote, Worsham and Collie Field tap) along Line 69H to 138 kV standards.
- Connect Line 69H to IH-20 138 kV substation.
- Build a new Wickett 138 kV ring substation.
- Install a new Wickett 138/69 kV autotransformer.
- Build Wickett to Oncor Wolf 138 kV transmission line with 1926 ACSR conductor (~6.0 miles; ~1.0 miles on new Right of Way)

The estimated cost of the preferred project is approximately \$50.6 million. The estimate may vary as the designated providers of the new transmission reinforcement perform more detailed cost analysis.

The TNMP WTN system was served by the following three main TNMP transmission lines:

- Wickett – Pyote – Worsham – Quito Draw – Birds of Prey – Collie – IH20 69 kV line (Line 69H)
- Wink – All American – Lone Star – Mi Vida – Barstow – Pecos 69 kV line (Line 69E)
- Wink – Bone Springs – Cochise – Pecos 69 kV (Line 69D).

The load increase together with the low thermal rating of Line 69H caused reliability criteria violations in the area. Transmission reinforcement is needed to address the reliability criteria violations. Figure 1.1 shows the system map of the study area.

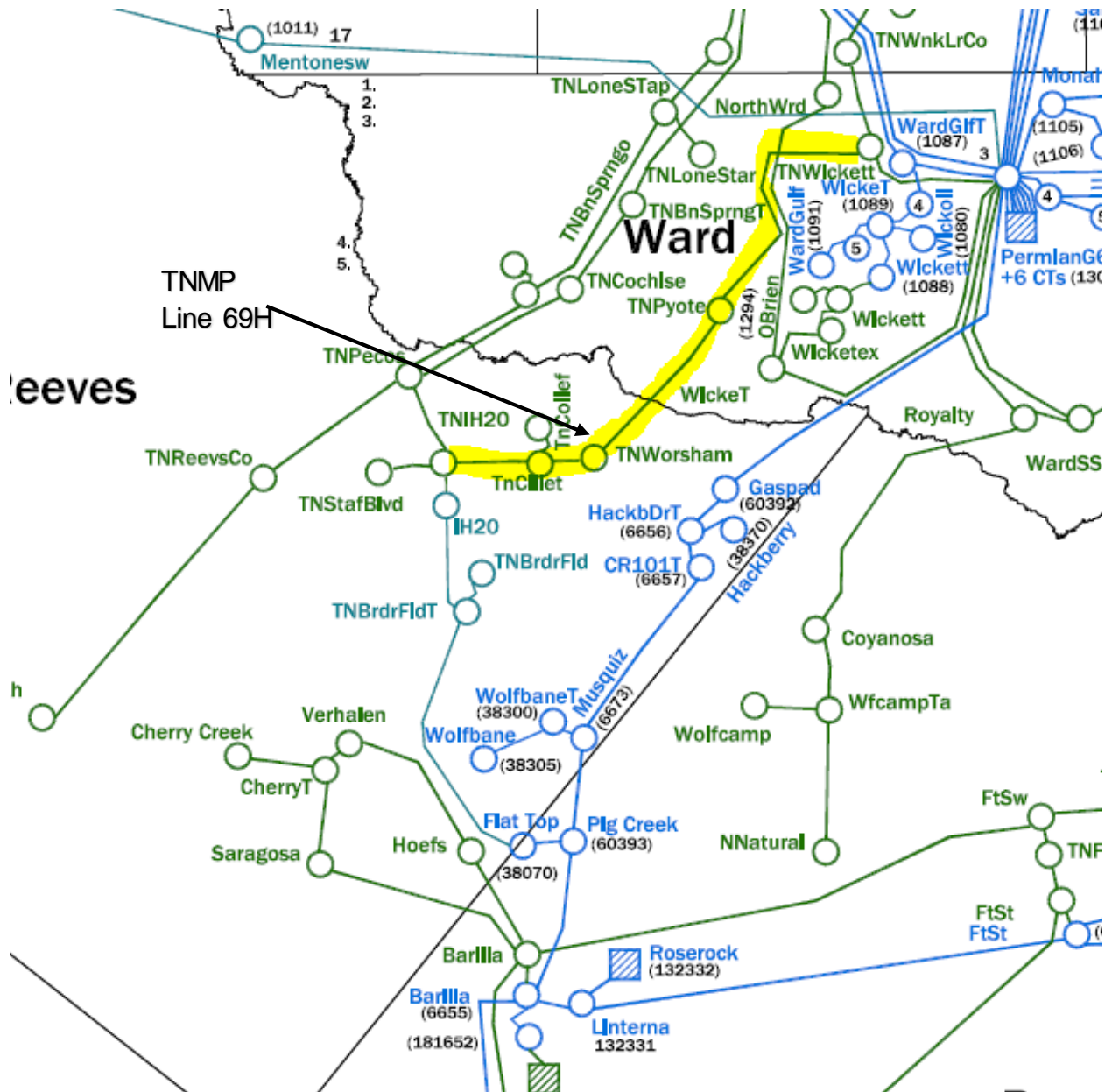


Figure 1.1: Transmission System Map of Study Area

2. Criteria, Study Assumption and Methodology

ERCOT performed studies to evaluate the reliability needs and to find a robust and cost-effective solution from both near-term and long-term transmission planning perspectives. The study criteria, assumptions and methodology for the ERCOT independent review are described in this section.

2.1. Study Region and Criteria

The primary focus of the study is the TNMP WTN transmission system.

The analysis of the system focused on the steady state thermal and voltage reliability of the ERCOT transmission system in the area of concern.

The criteria applied for the power flow analyses are consistent with the ERCOT Planning Guide 4.1.1.2 and the ERCOT 2016 Regional Transmission Plan (RTP).

NERC TPL-001-4 contingency events (P0, P1, P2-1, P3, P6-2 and P7) were analyzed.

2.2. Study Assumption and Methodology

2.2.1. Study Base Cases

The following base cases were used in the study:

- The 2018 and 2022 West/Far West (WFW) summer peak cases from the 2016 RTP (based on the 2015 Steady State Working Group (SSWG) cases).
- The 2019 Min case from the 2016 RTP (based on the 2015 SSWG cases).

The AEP/Oncor Barrilla Junction area improvement project, and the Oncor Riverton-Sand Lake 138 kV upgrade project (currently under RPG review) were included in the study cases. The place holder project to address the TNMP WTN system reliability issues was removed from the RTP base cases to create the study base cases.

The following model updates and corrections were incorporated based on the inputs from TNMP, AEP, and Oncor:

- TNMP WTN transmission system updates.
- Line limits and parameters correction for the Fort Stockton Switch to TNMP Fort Stockton Plant 69 kV line and the AEP Fort Stockton Plant to TNMP Fort Stockton plant 69 kV line.
- Rose Rock Solar and Hovey solar connection update (The Point of Interconnection was moved to Solstice instead of Barrilla Junction).
- Yucca Drive/Wink to Culberson transmission system updates.

Load updates from TNMP, AEP and Oncor in the area were also incorporated.

Generators in the Far West Weather Zone that met Planning Guide Section 6.9 conditions at the time of study, which were not included in the RTP cases, were added to the corresponding cases based on their Commercial Operation Date. The added generators are listed in Table 2.1.

Table 2.1: Generators Met Planning Guide Section 6.9 Requirements as of June 10, 2016

GINR Number	Project Name	MW	Fuel	County	Weather Zone
16INR0065	Castle Gap Solar	117	Solar	Upton	Far West
16INR0065a	Castle Gap Solar 2	63	Solar	Upton	Far West
17INR0020a	RE Maplew ood 2a Solar	100	Solar	Pecos	Far West
17INR0020b	RE Maplew ood 2b Solar	200	Solar	Pecos	Far West
17INR0020c	RE Maplew ood 2c Solar	100	Solar	Pecos	Far West
17INR0020d	RE Maplew ood 2d Solar	100	Solar	Pecos	Far West

2.2.2 Study Methodology

To evaluate the reliability needs, NERC TPL-001-4 contingency events P0, P1, P2-1, and P7 were analyzed for the 2018 and 2022 WFW summer peak cases in this study. ERCOT studies confirmed the reliability needs in the study region. More details of the reliability needs analysis can be found in Section 4.

ERCOT then studied three options based on analyzing the identified reliability issues and reviewing the RPG project submittal. More details of the three options can be found in Section 5. In the option evaluation, NERC TPL-001-4 contingency events P0, P1, P2-1, P3, P6-2 and P7 were analyzed for the 2022 summer peak case.

For the project option evaluation, ERCOT also performed sensitivity analysis using the 2019 Min case.

In addition to comparing the system performance of each option, ERCOT also compared the cost estimates of the three options.

3. Project Need

ERCOT conducted a power flow analysis using the 2018 and 2022 WFW study base cases. The study results indicated transmission line overloading and bus voltage violations in the area under N-1 contingency conditions. In addition, the power flow cannot be solved with the outage of the Flat Top to Pig Creek 138 kV line. The need analysis results are summarized in Table 4.1 and Table 4.2.

Table 4.1 Thermal Overload in the Study Region under N-1 Conditions

Branch	Length (miles)	N-1	
		2018	2022
IH-20 to Pecos 69 kV Ckt 1	2.3	109%	142%
Wickett to Pyote 69 kV Ckt 1	3.1	120%	132%
Pyote to Worsham 69 kV Ckt 1	15.4	110%	122%
IH-20 to Collie Field Tap 69 kV Ckt 1	3.0	109%	121%
Worsham to Quito Draw 69 kV Ckt 1	0.1	<100%	111%

Table 4.2 Voltage Violations Identified in the Study Region under N-1 Conditions

Bus	kV	Limit (p.u.)	N-1	
			2018	2022
Collie Field	69	0.861	0.59	0.57
Collie Field Tap	69	0.861	0.61	0.58
Birds of Prey Customer	69	0.861	0.62	0.59
Birds of Prey	69	0.861	0.62	0.59
Quito Draw Tap	69	0.861	0.65	0.63
Worsham	69	0.861	0.65	0.63
Pyote	69	0.861	0.81	0.80

4. Project Options

ERCOT considered three options to resolve the identified criteria violations. The detailed description of the three options are listed below. For Option 3, three different variations have been studied.

▪ Option 1

- Rebuild Line 69H from IH-20 to Wickett to 138 kV standards with Cumberland 1926 ACSR conductor (~39 miles).
- Rebuild three existing substations (Pyote, Worsham and Collie Field tap) along Line 69H to 138 kV standards.
- Connect Line 69H to IH-20 138 kV substation.
- Build a new Wickett 138 kV ring substation.
- Install a new Wickett 138/69 kV autotransformer.
- Build a new Wickett to Oncor Wolf 138 kV transmission line with 1926 ACSR conductor (~6.0 miles; ~1.0 miles on new Right of Way).

The total cost estimate for Option 1 is approximately \$50.6 million.

▪ Option 2

- Rebuild Line 69H from IH-20 to Wickett to 138 kV standards with 1926 ACSR conductor but operate at 69 kV (~39 miles).
- Rebuild three existing substations (Pyote, Worsham and Collie Field Tap) along Line 69H to 138 kV standards.
- Install a 20Mvar capacitor bank at Collie Field Tap substation.

The total cost estimate for Option 2 is approximately \$36.5 million.

▪ Option 3

- Create a 138 kV tie connection to Oncor Yucca Drive – Sand Lake – Culberson 138 kV double circuit transmission line.
- Build a 138 kV ring substation at the tie location.
- Build a new 69 kV ring substation at the tie location.
- Install a 138/69 kV autotransformer at the tie location.
- Rebuild Line 69H from the new 138 kV ring substation to IH-20 to 138 kV standards with Cumberland 1926 ACSR conductor (~37 miles)
- Rebuild three existing substations (Pyote, Worsham and Collie Field Tap) along Line 69H to 138 kV standards.

The total cost estimate for Option 3 is approximately \$48.4 million.

In Option 3, the following three possible tie connections to the Oncor Yucca Drive – Sand Lake – Culberson 138 kV double circuit transmission line were studied:

- Create a tie connection to the White Oil to Pyote line.
- Create a tie connection to the Yucca Drive to Barstow line.

- Create tie connections to both the White Oil to Pyote line and the Yucca Drive to Barstow line.

5. Option Comparison

In order to compare the three options, ERCOT performed the following contingency analysis.

- N-1 (NERC P1, P2-1 and P7), G-1+N-1(NERC P3) and X-1+N-1(NERC P6-2) analysis using the 2022 WFW summer peak case from the 2016 RTP.
- Sensitivity analysis using the 2019 Min case from the 2016 RTP.

The N-1 analysis of Option 2 using the 2022 WFW summer peak case showed that the power flow cannot be solved with the outage of the Flat Top to Pig Creek 138 kV line. As a result, Option 2 was not evaluated further.

The analysis of Option 1 and Option 3 using the 2022 WFW summer peak case showed that both options can resolve the identified reliability issues. No lines were loaded above 90% of their emergency rating (Rate B), and no bus had voltage violations. While both Option 1 and Option 3 could resolve the identified reliability issues, Option 1 offered one additional benefit, which is the overall improved transmission line loading in the nearby Barrilla Junction to Rio Pecos area. The TNMP 16th street to TNMP Woodward Tap 138 kV line was loaded either above 99% or above 101% with Option 3 depending on the variations studied, and it was loaded around 97% with Option 1 for the worst case contingencies.

In addition to the high loading conditions observed for Option 3, TNMP in their RPG submission also pointed out the following for Option 3:

- The cost estimate for Option 3 has more uncertainty due to the fact that it has not been fully studied by Oncor.
- The area where the TNMP Line 69H crosses the Oncor Yucca Drive – Culberson 138 kV line is in the middle of a congested oil and gas field, which may make it difficult to acquire the land for new 138 kV and 69 kV switchyards.

A summary of the option comparison is listed in Table 6.1.

Table 6.1 Option Comparison

Option	Resolved Reliability Issues?	Improved line loading in Barrilla Junction to Rio Pecos area?		Cost Uncertainty	Cost	New Right of Way Required?
1	Yes	Yes		Minimal	\$50.6M	Yes, (one mile 138 kV line)
2	No	N/A		Minimal	\$36.5M	No
3	Yes	No		Considerable	\$48.4M	No

Sensitivity studies were also performed for Option 1 using the 2019 Min case from 2016 RTP. No reliability criteria violations were found.

6. Conclusion and Recommendation

Even though Option 1 requires one mile 138kV new right of way and is estimated to cost \$2.2 million dollars more than Option 3, it has the benefit of improving the transmission line loadings from Barrilla

Junction to Rio Pecos. Based on the independent review, ERCOT recommends Option 1 to meet the reliability needs of the area of study:

- Rebuild Line 69H from IH-20 to Wickett to 138 kV standards with Cumberland 1926 ACSR conductor (~39 miles)
- Rebuild three existing substations (Pyote, Worsham and Collie Field tap) along Line 69H to 138 kV standards.
- Connect Line 69H to IH-20 138 kV substation.
- Build a new Wickett 138 kV ring substation
- Install a new Wickett 138/69 kV autotransformer.
- Build Wickett to Oncor Wolf 138kV transmission line with 1926 ACSR conductor (~6.0 miles; ~1.0 miles on new Right of Way)


The total cost estimate for Option 1 is approximately \$50.6 million.

7. Designated Provider of Transmission Facilities

In accordance with the ERCOT Nodal Protocols Section 3.11.4.8, ERCOT staff is to designate transmission providers for projects reviewed in the RPG. The default providers will be those that own the end points of the new projects. These providers can agree to provide or delegate the new facilities or inform ERCOT if they do not elect to provide them. If different providers own the two ends of the recommended projects, ERCOT will designate them as co-providers and they can decide between themselves what parts of the recommended projects they will each provide.

ERCOT designates TNMP as the provider for the rebuild of Line 69H from IH-20 to Wickett to 138 kV standards, the rebuild of the Pyote, Worsham and Collie Field Tap substations along Line 69H to 138 kV standards, the construction of the new Wickett 138 kV ring substation, and the installation of the Wickett 138/69 kV autotransformer. ERCOT designates TNMP and Oncor as the providers for the building of the Wickett to Oncor Wolf 138 kV transmission line.

8. Appendix

AC Contingency Analysis Result of all the options (N-1, G-1+N-1, and X-1+N-1 analysis)	 AC Contingency Analysis Results.xlsx
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AC Contingency
Analysis Results.xlsx