**Date:** December 19, 2023
**To:** Board of Directors
**From:** Bob Flexon, Reliability and Markets (R&M) Committee Chair
**Subject:** TNMP - Silverleaf and Cowpen 345/138-kV Stations Regional Planning Group Project

## Issue for the ERCOT Board of Directors

**ERCOT Board of Directors Meeting Date:** December 19, 2023
**Item No.:** 14.3

**Issue:**
Whether the Board of Directors (Board) of Electric Reliability Council of Texas, Inc. (ERCOT) should accept the recommendation of ERCOT staff to: (1) endorse the need for the Tier 1 TNMP - Silverleaf and Cowpen 345/138-kV Stations Regional Planning Group (RPG) Project in order to meet the reliability requirements for the ERCOT System and address thermal overloads in the Reeves and Ward Counties in the Far West Weather Zone, which ERCOT staff has independently reviewed and which the Technical Advisory Committee (TAC) has voted unanimously to endorse, and (2) designate the TNMP - Silverleaf and Cowpen 345/138-kV Stations RPG Project as critical to the reliability of the ERCOT System pursuant to Public Utility Commission of Texas (PUCT) Substantive Rule 25.101(b)(3)(D).

**Background/History:**
TNMP has proposed the Silverleaf and Cowpen 345/138-kV Stations Project, a $273.1 million, Tier 1 project with an expected in-service date of June 2027, to meet reliability planning criteria and address thermal overloads in the Reeves and Ward Counties in the Far West Weather Zone with the following ERCOT System improvements to 8.07 miles of 138-kV transmission lines and five 345/138-kV transformers:

- Construct a new 345-kV New Substation 1 near the existing Cedarvale station, by cutting into the planned North McCamey – Sand Lake 345-kV double-circuit line
- Construct a new 345/138-kV Silverleaf station near New Substation 1, with three 668/750-MVA transformers, connecting to New Substation 1 via three 1793-MVA 345-kV tie lines
- Loop the existing Cedarvale – Pecos 138-kV line #1 and #2, and Cedarvale – Bone Springs 138-kV line into the new Silverleaf station, will require approximately 4.4 miles of new Rights of Way (ROW)
- Construct a new 345-kV New Substation 2, ~ 13 miles away from the existing Sand Lake station, by cutting into the existing Sand Lake – Solstice 345-kV double-circuit line
- Construct a new 345/138-kV Cowpen station near New Substation 2, with two 668/750-MVA transformers, connecting to New Substation 2 via two 1793-MVA 345-kV tie lines

- Loop the existing IH20 – Salt Draw 138-kV line and Birds of Prey Tap – Harpoon Tap 138-kV line into the new Cowpen station, will require approximately 14.2 miles of new ROW

For construction to meet the June 2027 in-service date, the Silverleaf and Cowpen 345/138-kV Stations Project requires Public Utility Commission of Texas (PUCT, Commission) approval of a Certificate of Convenience and Necessity, following Board designation of the project as critical to the reliability of the ERCOT System, which per PUCT Substantive Rule 25.101(b)(3)(D) authorizes Commission consideration on an expedited basis of 180-days from the date of filing for projects deemed critical to reliability. The reliability need for project completion as soon as possible and the need to limit the duration of any necessary Constraint Management Plans (CMPs) render the project critical to reliability.

TNMP proposed the Silverleaf and Cowpen 345/138-kV Stations Project with an initial cost estimate of $299 million for RPG review in May 2023. RPG considered project overviews during meetings in July and November 2023. Between July and November 2023, ERCOT staff presented scope and status updates at RPG meetings in September and October. Pursuant to Protocol Section 3.11.4.9(2), ERCOT presented the Tier 1 project to the Technical Advisory Committee (TAC) for review and comment, and on December 4, 2023 TAC endorsed the project as recommended by ERCOT.

Pursuant to Protocol Section 3.11.4.3(1)(a), projects with an estimated capital cost of $100 million or greater are Tier 1 projects, for which Section 3.11.4.7 requires endorsement by the Board. Section IV(B)(2)(a) requires the R&M Committee to review and make a recommendation to the Board regarding any Tier 1 project. Protocol Section 3.11.4.7 also requires ERCOT to independently review submitted projects. Of four options ERCOT analyzed during independent review of the Silverleaf and Cowpen 345/138-kV Stations Project, ERCOT preferred Option 1 as it addresses the reliability violations, improves the long-term load serving capability, and improves operational flexibility.

ERCOT's assessment of the Sub-Synchronous Resonance (SSR) of TNMP's existing facilities in the Reeves and Ward Counties in the Far West Weather Zone, conducted pursuant to Protocol Section 3.22.1.3, yielded no adverse SSR impacts to the existing and planned generation resources at the time of the study. Results of the congestion analysis ERCOT conducted pursuant to Planning Guide Section 3.1.3 indicate no additional congestion in the area with the addition of Option 1.

The project completion date may change depending on material acquisition, outage coordination, and construction. The cost estimate accounts for the expectation that some construction activities will occur in an energized transmission line corridor. TNMP cooperation with ERCOT could be necessary to develop and implement CMPs based on summer 2027 operational conditions.

The report describing the ERCOT Independent Review of the Silverleaf and Cowpen 345/138-kV Stations Project, including ERCOT staff's recommendation for Option 1, is attached as **Attachment A.**

**Key Factors Influencing Issue:**

1. ERCOT System improvements are needed to meet reliability planning criteria for the Reeves and Ward Counties in the Far West Weather Zone.
2. ERCOT staff found the recommended set of improvements to be the most efficient solution for meeting the planning reliability criteria and addressing thermal overloads.
3. Protocol Section 3.11.4.7 requires Board endorsement of a Tier 1 project, which is a project with an estimated capital cost of $100 million or greater pursuant to Section 3.11.4.3(1)(a).
4. TAC voted unanimously to endorse the Tier 1 TNMP - Silverleaf and Cowpen 345/138-kV Stations RPG Project (Option 1), as recommended by ERCOT, on December 4, 2023.
5. Since there is reliability need to have the project in place as soon as possible, ERCOT staff has deemed this project critical to reliability.
6. If the TNMP - Silverleaf and Cowpen 345/138-kV Stations RPG Project (Option 1) is designated as critical to the reliability of the ERCOT System, the review process at the PUCT will be expedited pursuant to Substantive Rule 25.101.(b)(3)(D).

**Conclusion/Recommendation:**

ERCOT staff recommends, and the R&M Committee is expected to recommend, that the Board: (1) endorse the need for the Tier 1 TNMP - Silverleaf and Cowpen 345/138-kV Stations RPG Project (Option 1), which ERCOT staff has independently reviewed and which TAC has voted unanimously to endorse, based on NERC and ERCOT reliability planning criteria, and (2) designate the TNMP - Silverleaf and Cowpen 345/138-kV Stations RPG Project (Option 1) as critical to the reliability of the ERCOT System pursuant to PUCT Substantive Rule 25.101(b)(3)(D).

## ELECTRIC RELIABILITY COUNCIL OF TEXAS, INC.
## BOARD OF DIRECTORS RESOLUTION

WHEREAS, pursuant to Section 3.11.4.3(1)(a) of the Electric Reliability Council of Texas, Inc. (ERCOT) Protocols, projects with an estimated capital cost of $100 million or greater are Tier 1 projects, for which Section 3.11.4.7 requires endorsement by the ERCOT Board of Directors (Board); and

WHEREAS, after due consideration of the alternatives, the Board deems it desirable and in the best interest of ERCOT to accept ERCOT staff's recommendation to (1) endorse the need for the Tier 1 TNMP - Silverleaf and Cowpen 345/138-kV Stations Regional Planning Group Project (Option 1), which ERCOT staff has independently reviewed and which the Technical Advisory Committee (TAC) and Reliability and Markets (R&M) Committee have voted to endorse, based on North American Electric Reliability Corporation (NERC) and ERCOT reliability planning criteria, and (2) designate the TNMP - Silverleaf and Cowpen 345/138-kV Stations Regional Planning Group Project (Option 1) as critical to the reliability of the ERCOT System pursuant to Public Utility Commission of Texas (PUCT) Substantive Rule 25.101(b)(3)(D); each as recommended by the Reliability and Markets (R&M) Committee;

THEREFORE, BE IT RESOLVED, that is the Board hereby (1) endorses the need for the Tier 1 TNMP - Silverleaf and Cowpen 345/138-kV Stations Regional Planning Group Project (Option 1), which ERCOT staff has independently reviewed and which TAC and the R&M Committee have voted to endorse, based on NERC and ERCOT reliability planning criteria, and (2) designates the TNMP - Silverleaf and Cowpen 345/138-kV Stations Regional Planning Group Project (Option 1) as critical to the reliability of the ERCOT System pursuant to PUCT Substantive Rule 25.101(b)(3)(D).

## CORPORATE SECRETARY'S CERTIFICATE

I, Jonathan M. Levine, Assistant Corporate Secretary of ERCOT, do hereby certify that, at its December 19, 2023 meeting, the Board passed a motion approving the above Resolution by _____.

IN WITNESS WHEREOF, I have hereunto set my hand this ___ day of December, 2023.

_____
Jonathan M. Levine
Assistant Corporate Secretary

# ERCOT Independent Review of the TNMP Silverleaf and Cowpen 345/138-kV Stations Project

# Document Revisions

| Date | Version | Description | Author(s) |
|---|---|---|---|
| 11/27/2023 | 1.0 | Final Draft | Ying Li |
| | | Reviewed by | Robert Golen, Prabhu Gnanam, Davida Dwyer |

# Executive Summary

TNMP submitted the Silverleaf and Cowpen 345/138-kV Stations Project to the Regional Planning Group (RPG) in May 2023. TNMP proposed this project to meet the reliability needs driven by the new, confirmed load additions primarily of Customers operating datacenters or virtual currency mining facilities in the Ward, Reeves, and Pecos Counties in the ERCOT Far West (FW) Weather Zone. The project will be needed before 2027 Summer Peak Load Season.

The proposed project was estimated to cost approximately $299 million and was classified as a Tier 1 project per ERCOT Nodal Protocol Section 3.11.4.3(1)(a). The proposed project cost exceeds the $100 million threshold and requires one or more Certificate of Convenience and Necessity (CCN) applications.

ERCOT performed an Independent Review; identified both thermal overloads and voltage violations in the Ward, Reeves, and Pecos Counties; and evaluated four different transmission project options.

Among the four different transmission project options evaluated in the Independent Review, ERCOT recommends Option 1 to address the reliability violations based on the study results described in Section 5 of this report. Option 1 consists of the following:

- Construct a new 345-kV New Substation 1 near the existing Cedarvale 138-kV substation. The New Substation 1 will be designed in a breaker-and-a-half configuration and interconnected by cutting the station into the planned North McCamey – Sand Lake 345-kV double-circuit transmission line.
- Construct a new Silverleaf 345/138-kV station near the New Substation 1. The Silverleaf 345/138-kV station includes:
    - Three 345/138-kV transformers, each with normal/emergency ratings of at least 668/750 MVA.
    - A high-side breaker with breaker-disconnect switches for each of the three 345/138-kV transformers. No bus bar connections between the high sides of the three transformers (bus connections between the high sides of the three transformers to be established at the 345-kV New Substation 1).
    - 138-kV switchyard to be designed in a breaker-and-a-half configuration.
- Silverleaf 345/138-kV station to be interconnected as follows:
    - Extend 345-kV tie-lines from the high sides of the three Silverleaf 345/138-kV transformers to positions within the 345-kV New Substation 1 (total of three 345-kV tie lines). The three 345-kV tie-lines will be on separate structures, with a normal and emergency rating of at least 1793 MVA per tie-line.
    - Loop the existing Cedarvale – Pecos 138-kV transmission line #1 into the new Silverleaf 138-kV station. The line extensions are estimated at approximately 0.4 miles each and will require new Rights of Way (ROW).

    - Loop the existing Cedarvale – Pecos 138-kV transmission line #2 into the new Silverleaf 138-kV station. The line extensions are estimated at approximately 1.2 miles each and will require new ROW.
    - Loop the existing Cedarvale – Bone Springs 138-kV transmission line into the new Silverleaf 138-kV station. The line extensions are estimated at approximately 0.6 miles each and will require new ROW.
- Construct a new 345-kV New Substation 2 approximately 13 miles south of the existing Sand Lake 345/138-kV station. The New Substation 2 will be designed in a breaker-and-a-half configuration and interconnected by cutting the station into the existing Sand Lake – Solstice 345-kV double-circuit transmission line.
- Construct a new Cowpen 345/138-kV station near the New Substation 2. The Cowpen 345/138-kV station includes:
    - Two 345/138-kV transformers, each with normal/emergency ratings of at least 668/750 MVA.
    - A high-side breaker with breaker-disconnect switches for each of the two 345/138-kV transformers. No bus bar connections between the high sides of the two transformers (bus connections between the high sides of the two transformers to be established at the 345-kV New Substation 2).
    - 138-kV switchyard to be designed in a breaker-and-a-half configuration.
- Cowpen 345/138-kV station to be interconnected as follows:
    - Extend 345-kV tie-lines from the high sides of the two Cowpen 345/138-kV transformers to positions within the 345-kV New Substation 2 (total of two 345-kV tie lines). The two 345-kV tie-lines will be on separate structures, with a normal and emergency rating of at least 1793 MVA per tie-line.
    - Loop the existing IH20 – Salt Draw 138-kV transmission line into the new Cowpen 138-kV station. The line extensions are estimated at approximately 6.8 miles each and will require new ROW.
    - Loop the existing Birds of Prey Tap – Harpoon Tap 138-kV transmission line into the new Cowpen 138-kV station. The line extensions are estimated at approximately 0.3 miles each and will require new ROW.

The cost estimate for this Tier 1 project is approximately $273.1 million. One or more CCN applications will be required for looping the existing 138-kV transmission lines to the new Silverleaf and Cowpen stations, approximately 18.5 miles of new ROW. The expected In-Service Date (ISD) of this project is June 2027.

TNMP requests this project be designated as critical to reliability of the ERCOT system for expedited processing of associated transmission line applications by the commission.

# Table of Contents

# 1 Introduction

In May 2023, TNMP submitted the Silverleaf and Cowpen 345/138-kV Stations Project to the RPG to address NERC TPL-001-5.1 and ERCOT Planning Guide criteria violations driven by the new confirmed load additions primarily of Customers operating datacenters or virtual currency mining facilities in the Ward, Reeves, and Pecos Counties in the FW Weather Zone. The new load additions are expected to cause both thermal overloads and voltage issues in the existing transmission grid under various contingency conditions. Figure 1.1 shows the map of the existing and planned transmission system in the study area.

The TNMP-proposed project was classified as a Tier 1 project pursuant to ERCOT Nodal Protocol Section 3.11.4.3, with an estimated cost of approximately $299 million. ERCOT conducted an Independent Review for this RPG project to identify any reliability needs in the area including the project need (345/138-kV transformers and 138-kV transmission lines thermal overloads in the Ward, Reeves, and Pecos Counties) and evaluated various transmission upgrade options. This report describes the study assumptions, methodology, and the results of the ERCOT Independent Review of the project.

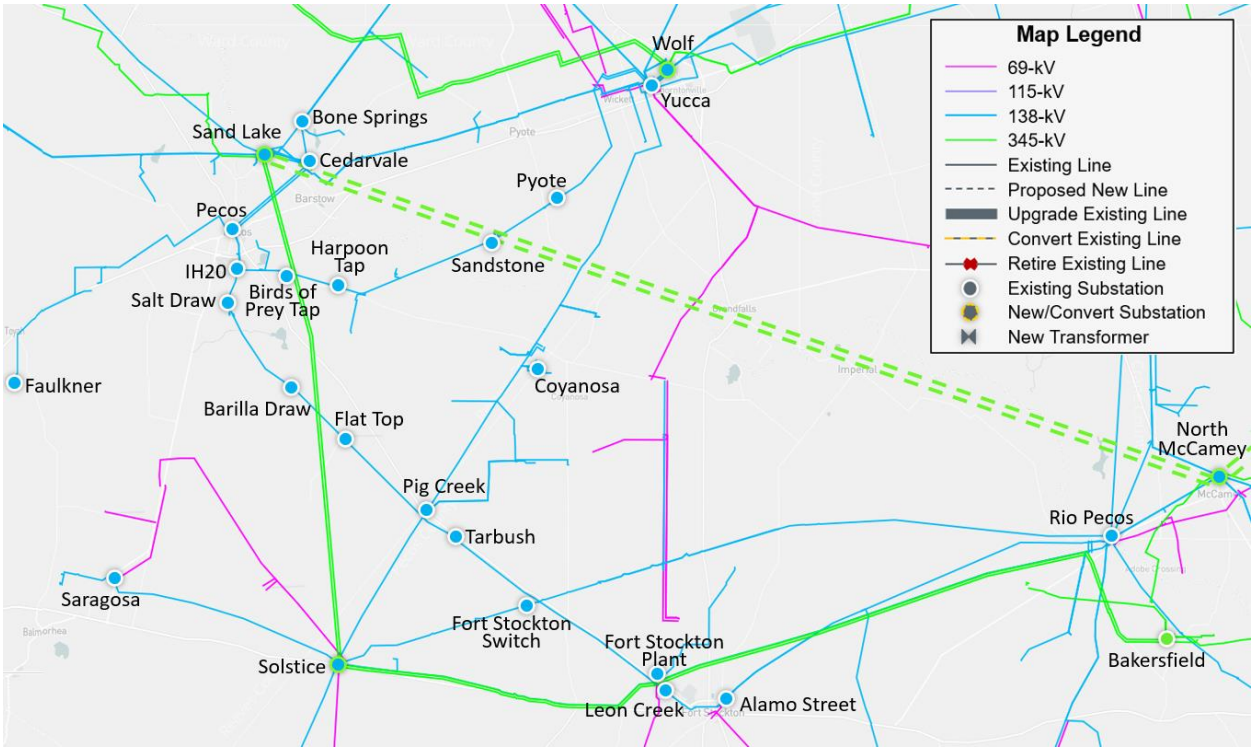


**Figure 1.1: Map of Transmission System in the Study Area**

# 2 Study Assumptions and Methodology

ERCOT performed studies under various system conditions to identify any reliability issues and to determine transmission upgrades to support the proposed Silverleaf and Cowpen 345/138-kV Stations Project, if an upgrade is deemed necessary. This section describes the study assumptions and criteria used to conduct the Independent Review.

## 2.1 Study Assumptions for Reliability Analysis

This project is in Ward and Reeves Counties in the FW Weather Zone. Nearby counties that were also studied because they are electrically close to the proposed project include Pecos, Winkler, and Loving Counties.

### 2.1.1 Steady-State Study Base Case

The Final 2022 RTP cases, published on the Market Information System (MIS) on December 22, 2022, were used as reference cases in this study. The 2027 Summer peak case was selected for the long-term analysis. The steady-state study base case was constructed by updating transmission, generation, and loads of the following 2022 RTP Summer Peak Load case for the West and Far West (WFW) Weather Zones.

- Case: 2022RTP_2027_SUM_WFW_12222022[1]

### 2.1.2 Transmission Topology

Transmission projects within the FW Weather Zone with In-Service Dates (ISDs) through June 2027 were added to the study base case. The ERCOT Transmission Project Information and Tracking (TPIT)[2] reports for June 2023 and October 2023 were used as reference. The added TPIT projects are listed in Table 2.1. These projects are all classified as Tier 2, Tier 3, and Tier 4 projects. No new Tier 1 projects were added to the study base case other than those already included in the final RTP cases.

**Table 2.1: List of Transmission Projects Added to the Study Base Case**

| TPIT No | Project Name | Tier | Project ISD | TSP | County |
|---|---|---|---|---|---|
| 66571 | Texaco Mabee Tap - Midland East 138 kV Line Rebuild | Tier 4 | Sep-23 | ONCOR | Midland |
| 66621 | Sandhills - Sandhills Tap 138 kV Line Rebuild | Tier 4 | May-23 | ONCOR | Ector |
| 68793 | Expanse 345/138 kV Switch | Tier 3 | May-23 | ONCOR | Martin |
| 70596 | LCRATSC_CraneEast_CB_Sub_Upgrade | Tier 4 | May-23 | LCRATSC | Upton |
| 66074 | Double ckt Soaptree-Holiday-AlamoSt | Tier 4 | Dec-23 | TNMP | Pecos |
| 45670 | East Stiles - Rocky Road 138 kV Line | Tier 4 | Dec-23 | ONCOR | Reagan |
| 45689 | Pronghorn - Salt Flat Road 138 kV Line | Tier 4 | Dec-23 | ONCOR | Midland |
| 48587 | Tesoro 345/138 kV Switch | Tier 3 | Dec-23 | ONCOR | Midland |
| 68780 | Triangle - Yosemite 138 kV Line | Tier 4 | Dec-23 | ONCOR | Midland |

[1] 2022 Regional Transmission Plan Postings: https://mis.ercot.com/secure/data-products/grid/regional-planning?id=PG3-2787-M.
[2] TPIT Report: https://www.ercot.com/gridinfo/sysplan/index.html.

| | | | | | |
|---|---|---|---|---|---|
| 71190 | Einstein - St Lawrence 138 kV Line | Tier 4 | Dec-23 | ONCOR | Glasscock |
| 71193 | Blue Acres - Yosemite 138 kV Line | Tier 4 | Dec-23 | ONCOR | Midland |
| 71196 | Grey Well Draw - Pecan Grove 138 kV Line | Tier 4 | Dec-23 | ONCOR | Midland |
| 50725 | Coalson Draw 138 kV Switch | Tier 4 | May-24 | ONCOR | Reeves |
| 51225 | Driver - Hadacol Corner 138 kV Line | Tier 4 | May-24 | ONCOR | Midland |
| 71172 | Luther - Vealmoor 138 kV Line | Tier 4 | May-24 | ONCOR | Borden |
| 45640 | Spraberry - Polecat Creek 138 kV Line | Tier 3 | Dec-24 | ONCOR | Midland |
| 45693 | Rocky Road - Stiles 138 kV Line | Tier 4 | Dec-24 | ONCOR | Reagan |
| 52332 | Lamesa - Paul Davis Tap 138 kV Line Section | Tier 3 | Dec-24 | ONCOR | Dawson |
| 71175 | Tall City - Pecan Grove 138 kV Line | Tier 4 | Dec-24 | ONCOR | Midland |
| 71968 | Midkiff - Pemkiff 138 kV Line | Tier 4 | Dec-24 | ONCOR | Upton |
| 71971 | Peck - Driver 138 kV Line | Tier 2 | Dec-24 | ONCOR | Glasscock |
| 71989 | Big Spring West - Stanton East 138 kV Line | Tier 4 | Dec-24 | ONCOR | Martin |
| 71993 | Tributary - Vincent 138 kV Line Section | Tier 4 | Dec-24 | ONCOR | Howard |
| 68669 | Adds Staghorn Switching Station | Tier 4 | Jun-25 | TNMP | Ward |
| 23RPG008 | Fort Stockton Plant to Lynx 138-kV Line Rebuild Project | Tier 4 | May-25 | AEPSC | Pecos |
| 68955 | Meteor 345 kV Switch | Tier 4 | May-24 | ONCOR | Ward |
| 68790 | Wolf - General Tire - Odessa EHV 138 kV Line | Tier 3 | Dec-25 | ONCOR | Ector |
| 71199 | Yucca Drive - Moss 138 kV Line | Tier 4 | May-24 | ONCOR | Ector |
| 70964 | WETT 345 kV Volta witch | Tier 3 | Jan-24 | WETT | Howard |
| 73452 | TNMP_WINK_FISHHOOK_RECONDUCTOR_AC_4-5-2023 | Tier 4 | Nov-23 | TNMP | Pecos |
| 73476 | TNMP_KERMIT_RECONDUCTOR | Tier 4 | Jan-24 | TNMP | Pecos |
| 72884 | Gonzales: Build 69 kV STATCOM | Tier 4 | May-24 | ETT | Presidio |
| 73406 | TMentone 138 kV POD | Tier 4 | May-25 | ONCOR | Loving |
| 68671 | Adds Foxtail Switching Station | Tier 4 | Oct-22 | TNMP | Reeves |
| 72863 | Delaware River 138 kV Switch | Tier 4 | May-24 | ONCOR | Culberson |
| 73434 | Shaw 138 kV POD | Tier 4 | May-24 | ONCOR | Reagan |
| 76348 | Reconductor Foxtail-PIGCreek-1926ACSS-138KV | Tier 4 | May-26 | TNMP | Pecos |
| 77320 | Add CapBANK in COYANOSA | Tier 4 | Jun-26 | TNMP | Ward |
| 76232 | Reconductor Mivida-Coachwhip-Fishhook 2045 ACCC | Tier 4 | May-26 | TNMP | Ward |
| 76291 | Upgraded Cedarvale–BoneSpringsTap–Fishhook | Tier 4 | May-26 | TNMP | Ward |
| 76293 | Upgraded Cedvale-MiDiva138KV | Tier 4 | May-26 | TNMP | Ward |

The RTP projects shown in Table 2.2 were used as placeholders for the Silverleaf and Cowpen 345/138-kV Stations Project and were removed from study base case.

**Table 2.2: List of Transmission Projects Removed from the Study Base Case**

| RTP Project ID | Project Name | TSP | County |
|---|---|---|---|
| 2022-FW2 | Cedarvale 345-kV Substation Expansion | TNMP, Oncor | Ward |
| 2022-FW4 | New Opyote to Pyote 138-kV Line Addition | TNMP, Oncor | Ward |
| 2022-FW6 | Far West Reactive Power Support Device Additions | TNMP, Oncor | Ward, Ector, Reeves, Pecos |
| 2022-FW9 | Cholla 345/138-kV Station Addition | TNMP, Oncor | Ward, Loving |
| 2022-FW11 | Pecos TNP - Faulkner Toyah TNP 138-kV Line Addition | TNMP | Reeves |
| 2022-FW12 | Tarbush TNP - Pig Creek 138-kV Line Upgrade | TNMP, AEP | Reeves |
| 2022-FW25 | Cedarvale Third 345/138-kV Transformer Addition | TNMP | Ward |
| 2022-FW26 | Tarbush TNP - Leon Creek TNP and Woodward - Airport TNP - Leon Creek TNP 138-kV Line Additions | TNMP | Pecos |

### 2.1.3 Generation

Based on the June 2023 Generator Interconnection Status (GIS)[3] report posted on the ERCOT website on July 3, 2023, generators in the FW Weather Zone that met ERCOT Planning Guide Section 6.9(1) conditions with Commercial Operations Date (COD) prior to June 2027 were added to the study base case if not already present in the case. These generation additions are listed in Table 2.3 below. All new generation dispatches were consistent with the 2022 RTP methodology.

**Table 2.3: List of Generation Added to the Study Base Case Based on June 2023 GIS Report**

| GINR | Project Name | Fuel | Project COD | Capacity (MW) | County |
|---|---|---|---|---|---|
| 18INR0043 | Lacy Creek wind | WIN | Jun-23 | 301.3 | Glasscock |
| 20INR0249 | Appaloosa Run Wind | WIN | Jul-23 | 175.0 | Upton |
| 20INR0269 | Texas Solar Nova 2 | SOL | Dec-23 | 201.1 | Kent |
| 20INR0296 | Sand Bluff Wind Repower | WIN | May-23 | 89.5 | Glasscock |
| 21INR0253 | Ulysses Solar | SOL | Nov-24 | 150.0 | Coke |
| 21INR0532 | Brazos Wind Repower | WIN | Aug-23 | 22.4 | Scurry |
| 22INR0349 | BRP Antlia BESS | OTH | Dec-23 | 71.0 | Val Verde |
| 22INR0363 | Hayhurst Texas Solar | SOL | Nov-23 | 24.8 | Culberson |
| 22INR0412 | Andromeda Solar | SOL | Jun-23 | 326.6 | Scurry |
| 22INR0454 | DR Solar | SOL | Jun-24 | 46.0 | Culberson |
| 22INR0455 | Blue Sky Sol | SOL | Jun-24 | 101.2 | Crockett |
| 22INR0485 | House Mountain | OTH | Aug-23 | 63.0 | Brewster |
| 22INR0495 | TIMBERWOLF BESS 2 | OTH | Sep-23 | 150.0 | Crane |
| 22INR0502 | Shamrock | WIN | Jul-24 | 223.9 | Crockett |
| 22INR0524 | St. Gall I Energy Storage | OTH | Dec-23 | 102.6 | Pecos |
| 23INR0371 | Rodeo Ranch Energy Storage | OTH | Jul-23 | 307.5 | Reeves |
| 23INR0387 | Pioneer DJ Wind | WIN | Apr-24 | 140.3 | Midland |
| 19INR0203 | Angelo Solar | SOL | May-24 | 195.4 | Tom Green |
| 23INR0418 | Angelo Storage | OTH | May-24 | 103.0 | Tom Green |

[3] GIS Report: https://www.ercot.com/mp/data-products/data-product-details?id=PG7-200-ER.

The status of each unit that was projected to be either indefinitely mothballed or retired at the time of the study was reviewed. The units listed in Table 2.4 were turned off in the study base case to reflect their mothballed/retired status.

**Table 2.4: List of Generation Opened to Reflect Mothballed/Retired Status**

| Bus No | Unit Name | Capacity (MW) | Weather Zone |
|---|---|---|---|
| 170121 | CALAVERS_JTD1 | 420.0 | South-Central |
| 170122 | CALAVERS_JTD2 | 420.0 | South-Central |
| 110020 | PNPI_GT2 | 71.0 | Coast |
| 150081 | OLINGR_OLING_1 | 78.0 | North Central |
| 170381 | OCI_ALM1_ASTRO | 1.0 | South-Central |
| 110111 | DOWGEN_DOW_G37 | 61.0 | Coast |
| 130003 | FLCNS_UNIT3 | 70.0 | Far West |
| 142761 | BRANDON_UNIT1 | 20.0 | North |
| 142714 | MASSENGL_G6 | 18.0 | North |
| 142716 | MASSENGL_G7 | 18.0 | North |
| 142713 | MASSENGL_G8 | 38.0 | North |
| 143671 | TY_COOKE_GT2 | 14.0 | North |
| 143672 | TY_COOKE_GT3 | 17.0 | North |
| 110941 | SL_SL_G1 | 65.0 | Coast |
| 110942 | SL_SL_G2 | 65.0 | Coast |
| 110943 | SL_SL_G3 | 30.0 | Coast |
| 110944 | SL_SL_G4 | 30.0 | Coast |
| 140042 | WFCOGEN_UNIT4 | 17.0 | North |

### 2.1.4 Loads

Loads in the FW Weather Zone were reviewed and updated to reflect the load level in the 2023 RTP study. As shown in Table 2.5, Far West Weather Zone total load is 14,349 MW in the study base case. Among the 14,349 MW of total load, 3,959 MW is associated with customers that have flexible loads.

**Table 2.5: FW Load Level in the Study Base Case**

| | Load (MW) |
|---|---|
| Far West Total | 14,349 |
| Far West Flexible Loads | 3,959 |

Loads outside the WFW Weather Zones were adjusted to maintain the minimum reserve requirements consistent with the 2022 RTP.

### 2.1.5 Long-Term Load Serving Capability Assessment

ERCOT performed long-term load serving capability assessment under base case and higher load conditions to compare the performance of the study options.

In the higher load condition evaluation, the loads at all 138-kV paths connecting to Sand Lake, Silverleaf/Cedarvale, and Cowpen/IH20 345-kV sources were increased (customers with flexible loads

remained at the same level as in the base case), and conforming load outside of the WFW Weather Zones were decreased to balance power.

### 2.1.6 Maintenance Outage Scenario

ERCOT developed an off-peak maintenance season scenario to further evaluate the study options.

The load level in the FW Weather Zone was reduced to 96% of its summer peak load level in the study base case. This scaling is meant to reflect assumed off-peak season loads based on ERCOT load forecast for future years as well as historical load in the FW Weather Zone.

## 2.2 Study Assumptions for Congestion Analysis

Congestion analysis was conducted to identify any new congestion in the study area with the addition of the preferred transmission upgrade option.

The 2027 economic case (based on the 2022 RTP) was updated based on the July 2023 GIS report for generation updates and the June 2023 and October 2023 TPIT reports for transmission updates to conduct congestion analysis. Customers with flexible loads in Ward, Reeves, and Pecos Counties were updated to reflect the 2023 RTP load level in Table 2.5. The 2027 study year was selected based on the proposed ISD of the project.

All TPIT projects listed in Table 2.1 were added and the RTP projects shown in Table 2.2 that were used as placeholders for the Silverleaf and Cowpen 345/138-kV Stations project were removed from the economic base case.

New generation additions listed in Table 2.6 below were added to the economic base case and all generation listed in Table 2.4 above were turned off in the study base case to reflect their mothballed/retired status.

**Table 2.6: List of Generation Added to the Economic Base Case Based on July 2023 GIS Report**

| GINR | Project Name | Fuel | Project COD | Capacity (MW) | County |
|---|---|---|---|---|---|
| 14INR0033 | Goodnight Wind | WIN | 12/30/2023 | 258.1 | Armstrong |
| 18INR0043 | Lacy Creek wind | WIN | 8/1/2023 | 301.3 | Glasscock |
| 18INR0058 | Texana Solar | SOL | 9/27/2024 | 152.3 | Wharton |
| 19INR0134 | Cottonwood Bayou Solar | SOL | 6/30/2024 | 351.4 | Brazoria |
| 19INR0177 | Crawfish | WIN | 12/31/2023 | 163.2 | Wharton |
| 19INR0203 | Angelo Solar | SOL | 5/3/2024 | 195.4 | Tom Green |
| 20INR0035 | Angus Solar | SOL | 4/1/2025 | 112.0 | Bosque |
| 20INR0047 | Siete | WIN | 10/31/2024 | 375.1 | Webb |
| 20INR0069 | Danish Fields Solar | SOL | 12/15/2023 | 602.8 | Wharton |
| 20INR0074 | Pitts Dudik Solar | SOL | 8/18/2023 | 49.6 | Hill |
| 20INR0080 | Frye Solar | SOL | 3/15/2024 | 514.1 | Swisher |
| 20INR0164 | BPL Files Solar | SOL | 7/26/2023 | 148.7 | Hill |
| 20INR0208 | Signal Solar | SOL | 3/15/2025 | 51.8 | Hunt |
| 20INR0210 | Hopkins Solar | SOL | 12/31/2023 | 253.1 | Hopkins |

| | | | | | |
|---|---|---|---|---|---|
| 20INR0246 | Ryan Energy Storage | OTH | 10/21/2024 | 50.0 | Coryell |
| 20INR0249 | Appaloosa Run Wind | WIN | 7/7/2023 | 175.0 | Upton |
| 20INR0250 | Aguayo Wind | WIN | 7/15/2023 | 196.0 | Mills |
| 20INR0269 | Texas Solar Nova 2 | SOL | 12/29/2023 | 201.1 | Kent |
| 20INR0296 | Sand Bluff Wind Repower | WIN | 6/15/2023 | 89.5 | Glasscock |
| 21INR0012 | Air Products GCA | GAS | 11/30/2023 | 14.0 | Galveston |
| 21INR0019 | Zier Solar | SOL | 3/5/2024 | 163.0 | Kinney |
| 21INR0027 | Zier Storage | OTH | 3/5/2024 | 40.4 | Kinney |
| 21INR0203 | Eastbell Milam Solar | SOL | 11/30/2023 | 244.9 | Milam |
| 21INR0220 | Maleza Solar | SOL | 12/1/2024 | 254.9 | Wharton |
| 21INR0223 | Tulsita Solar | SOL | 12/31/2024 | 261.0 | Goliad |
| 21INR0253 | Ulysses Solar | SOL | 11/1/2024 | 150.0 | Coke |
| 21INR0257 | Mercury Solar | SOL | 6/30/2024 | 206.1 | Hill |
| 21INR0324 | Board Creek Wind | WIN | 7/30/2023 | 299.2 | Navarro |
| 21INR0325 | Sheep Creek Wind | WIN | 12/31/2023 | 153.0 | Callahan |
| 21INR0344 | Lunis Creek Solar SLF | SOL | 12/31/2024 | 617.1 | Jackson |
| 21INR0351 | 7V Solar | SOL | 4/30/2024 | 240.6 | Fayette |
| 21INR0353 | Big Elm Solar | SOL | 7/31/2024 | 203.6 | Bell |
| 21INR0368 | Eliza Solar | SOL | 11/1/2024 | 151.9 | Kaufman |
| 21INR0389 | Hollywood Solar | SOL | 6/30/2024 | 353.4 | Wharton |
| 21INR0401 | Young Wind | WIN | 7/7/2023 | 499.1 | Young |
| 21INR0442 | Myrtle Storage | OTH | 12/15/2023 | 155.0 | Brazoria |
| 21INR0458 | Porter Solar | SOL | 3/31/2024 | 245.8 | Denton |
| 21INR0484 | Mustang Creek Storage | OTH | 8/15/2023 | 70.5 | Jackson |
| 21INR0492 | Stockyard Grid Batt | OTH | 3/29/2024 | 150.6 | Tarrant |
| 21INR0499 | Neptune Solar | SOL | 12/22/2023 | 204.7 | Jackson |
| 21INR0511 | Wolf Ridge Repower | WIN | 12/31/2024 | 9.0 | Cooke |
| 21INR0515 | Roadrunner Crossing Wind II | WIN | 12/31/2023 | 126.7 | Eastland |
| 21INR0532 | Brazos Wind Repower | WIN | 8/14/2023 | 22.4 | Scurry |
| 22INR0223 | Eiffel Solar | SOL | 10/30/2023 | 241.0 | Lamar |
| 22INR0251 | Shaula I Solar | SOL | 10/30/2025 | 205.2 | DeWitt |
| 22INR0254 | Pisgah Ridge Solar | SOL | 5/15/2023 | 253.9 | Navarro |
| 22INR0260 | Eliza Storage | OTH | 11/1/2024 | 100.2 | Kaufman |
| 22INR0267 | Shaula II Solar | SOL | 5/30/2026 | 205.2 | DeWitt |
| 22INR0295 | Coral Solar | SOL | 12/15/2023 | 151.6 | Falls |
| 22INR0302 | Bright Arrow Storage | OTH | 9/19/2023 | 103.6 | Hopkins |
| 22INR0327 | Hummingbird Storage | OTH | 2/24/2024 | 103.8 | Denton |
| 22INR0335 | Estonian Solar | SOL | 10/15/2024 | 202.5 | Delta |
| 22INR0336 | Estonian Storage | OTH | 2/24/2024 | 101.6 | Delta |
| 22INR0338 | Limousin Oak Storage | OTH | 2/23/2024 | 104.6 | Grimes |
| 22INR0349 | BRP Antlia BESS | OTH | 12/1/2024 | 71.0 | Val Verde |
| 22INR0359 | Dileo Solar | SOL | 8/18/2023 | 71.4 | Bosque |
| 22INR0363 | Hayhurst Texas Solar | SOL | 11/1/2023 | 24.8 | Culberson |
| 22INR0366 | BRP Libra BESS | OTH | 11/27/2023 | 206.2 | Guadalupe |

| | | | | | |
|---|---|---|---|---|---|
| 22INR0368 | Padua Grid BESS | OTH | 12/31/2024 | 50.8 | Bexar |
| 22INR0397 | Buckeye Corpus Fuels Solar | SOL | 2/22/2025 | 57.6 | Nueces |
| 22INR0398 | Sabal Storage | OTH | 9/30/2023 | 18.0 | Cameron |
| 22INR0404 | Fence Post Solar | SOL | 7/12/2024 | 237.3 | Navarro |
| 22INR0405 | Fence Post BESS | OTH | 6/19/2024 | 71.6 | Navarro |
| 22INR0409 | Stampede Solar | SOL | 12/20/2024 | 255.7 | Hopkins |
| 22INR0410 | Stampede BESS | OTH | 9/21/2024 | 71.6 | Hopkins |
| 22INR0412 | Andromeda Solar | SOL | 8/30/2023 | 326.6 | Scurry |
| 22INR0429 | Sun Valley BESS | OTH | 9/10/2023 | 101.4 | Hill |
| 22INR0454 | DR Solar | SOL | 6/1/2024 | 46.0 | Culberson |
| 22INR0455 | Blue Sky Sol | SOL | 6/15/2024 | 101.2 | Crockett |
| 22INR0485 | House Mountain | OTH | 10/26/2023 | 63.0 | Brewster |
| 22INR0490 | Callisto I Energy Center | OTH | 6/1/2024 | 203.0 | Harris |
| 22INR0495 | TIMBERWOLF BESS 2 | OTH | 9/1/2023 | 150.0 | Crane |
| 22INR0502 | Shamrock | WIN | 7/1/2024 | 223.9 | Crockett |
| 22INR0509 | Turquoise Storage | OTH | 7/31/2023 | 196.2 | Hunt |
| 22INR0524 | St. Gall I Energy Storage | OTH | 12/28/2023 | 102.6 | Pecos |
| 22INR0549 | Tanzanite Storage | OTH | 12/1/2024 | 257.7 | Henderson |
| 22INR0550 | BLUE SUMMIT I REPOWER | WIN | 7/1/2023 | 4.4 | Wilbarger |
| 22INR0551 | Wolf Tank Storage | OTH | 7/1/2023 | 155.5 | Webb |
| 22INR0552 | Sowers Storage | OTH | 12/1/2024 | 200.8 | Kaufman |
| 23INR0007 | Outpost Solar | SOL | 10/31/2024 | 513.7 | Webb |
| 23INR0047 | Charger Solar | SOL | 5/31/2025 | 406.8 | Refugio |
| 23INR0054 | Tanglewood Solar | SOL | 1/16/2025 | 257.0 | Brazoria |
| 23INR0062 | Noria Storage | OTH | 9/1/2025 | 75.0 | Nueces |
| 23INR0111 | GULF STAR SOLAR | SOL | 2/1/2024 | 300.5 | Wharton |
| 23INR0124 | Coral Storage | OTH | 12/15/2023 | 99.0 | Falls |
| 23INR0153 | Mercury II Solar | SOL | 6/30/2024 | 206.1 | Hill |
| 23INR0154 | Ebony Energy Storage | OTH | 4/1/2024 | 208.4 | Comal |
| 23INR0159 | Five Wells Storage | OTH | 12/29/2023 | 220.8 | Bell |
| 23INR0160 | Grimes County Solar | SOL | 3/15/2025 | 210.0 | Grimes |
| 23INR0162 | Redonda Solar | SOL | 12/1/2024 | 253.2 | Zapata |
| 23INR0166 | Great Kiskadee Storage | OTH | 8/1/2024 | 103.1 | Hidalgo |
| 23INR0223 | Garcitas Creek Solar | SOL | 3/31/2025 | 201.9 | Jackson |
| 23INR0239 | Giga Texas Energy Storage | OTH | 12/15/2023 | 131.1 | Travis |
| 23INR0331 | Talitha BESS | OTH | 6/30/2024 | 61.4 | Jim Wells |
| 23INR0339 | Remy Jade Power Station | GAS | 4/1/2024 | 408.0 | Harris |
| 23INR0343 | Guajillo Energy Storage | OTH | 9/30/2024 | 201.1 | Webb |
| 23INR0363 | Brazos Bend BESS | OTH | 4/15/2024 | 101.6 | Fort Bend |
| 23INR0369 | Anemoi Energy Storage | OTH | 12/20/2023 | 205.0 | Hidalgo |
| 23INR0371 | Rodeo Ranch Energy Storage | OTH | 11/6/2023 | 307.5 | Reeves |
| 23INR0387 | Pioneer DJ Wind | WIN | 4/20/2024 | 140.3 | Midland |
| 23INR0408 | TECO GTG2 | GAS | 2/18/2024 | 50.0 | Harris |
| 23INR0418 | Angelo Storage | OTH | 5/3/2024 | 103.0 | Tom Green |

| | | | | | |
|---|---|---|---|---|---|
| 23INR0419 | SOHO BESS | OTH | 1/1/2025 | 206.3 | Brazoria |
| 23INR0460 | GULF STAR STORAGE | OTH | 2/1/2024 | 301.0 | Wharton |
| 23INR0472 | Frontera Energy Center | GAS | 7/14/2023 | 524.0 | Hidalgo |
| 23INR0506 | Beachwood II Power Station | GAS | 3/1/2024 | 102.0 | Brazoria |
| 23INR0524 | Temple II Repower | GAS | 10/15/2023 | 0.0 | Bell |
| 23INR0551 | Brotman II Power Station | GAS | 8/7/2023 | 102.0 | Brazoria |
| 23INR0637 | Goodnight Wind II | WIN | 12/30/2023 | 258.3 | Armstrong |
| 24INR0015 | Five Wells Solar | SOL | 12/29/2023 | 322.8 | Bell |
| 24INR0147 | Citadel BESS | OTH | 5/7/2024 | 201.3 | Harris |
| 24INR0427 | CPS AvR CT1 Rotor Replacement | GAS | 1/30/2024 | 11.3 | Bexar |
| 23INR0470 | BoCo BESS | OTH | 6/22/2024 | 155.5 | Borden |
| 22INR0353 | BRP Carina BESS | OTH | 12/31/2024 | 151.9 | Nueces |
| 21INR0450 | Danish Fields Storage | OTH | 2/15/2024 | 152.4 | Wharton |
| 22INR0261 | Dorado Solar | SOL | 12/31/2025 | 406.3 | Callahan |
| 20INR0040 | Montgomery Ranch Wind | WIN | 2/29/2024 | 200.2 | Foard |
| 21INR0424 | Tierra Bonita Solar | SOL | 8/1/2024 | 309.7 | Pecos |
| 23INR0296 | Trojan Solar | SOL | 2/28/2026 | 151.3 | Cooke |
| 24INR0382 | Remy Jade II Power Station | GAS | 11/30/2024 | 102.0 | Harris |
| 21INR0444 | Long Point Storage | OTH | 12/1/2025 | 100.6 | Brazoria |
| 21INR0505 | Ramsey Storage | OTH | 6/1/2024 | 510.4 | Wharton |
| 22INR0422 | Ferdinand Grid BESS | OTH | 5/31/2026 | 202.7 | Bexar |
| 23INR0219 | Dogfish BESS | OTH | 12/31/2024 | 75.0 | Pecos |
| 23INR0381 | Soportar ESS | OTH | 3/15/2025 | 102.1 | Bexar |
| 24INR0039 | SP Jaguar BESS | OTH | 6/30/2025 | 300.0 | McLennan |
| 24INR0109 | Oriana BESS | OTH | 7/2/2025 | 60.3 | Victoria |
| 24INR0265 | Ironman BESS | OTH | 11/1/2024 | 304.2 | Brazoria |
| 24INR0281 | Red Egret BESS | OTH | 6/1/2025 | 309.0 | Galveston |
| 24INR0436 | Carambola BESS | OTH | 5/31/2026 | 97.4 | Hidalgo |
| 25INR0162 | SOHO II BESS | OTH | 1/1/2025 | 206.3 | Brazoria |
| 21INR0302 | Aureola Solar | SOL | 6/28/2024 | 203.0 | Milam |
| 21INR0303 | Mandorla Solar | SOL | 1/2/2024 | 254.0 | Milam |
| 21INR0304 | Halo Solar | SOL | 6/20/2024 | 254.0 | Bell |
| 22INR0354 | XE MURAT Solar | SOL | 5/13/2024 | 60.4 | Harris |
| 23INR0367 | Fewell Solar | SOL | 9/9/2025 | 203.5 | Limestone |
| 24INR0038 | SP Jaguar Solar | SOL | 6/30/2025 | 300.0 | McLennan |
| 19INR0054 | Monte Cristo 1 Wind | WIN | 12/31/2024 | 236.9 | Hidalgo |

## 2.3 Methodology

This section lists the Contingencies and Criteria used for project review along with tools used to perform the various analyses.

### 2.3.1 Contingencies and Criteria

The reliability assessments were performed based on NERC Reliability Standard TPL-001-5.1, ERCOT Nodal Protocols, and Planning Criteria[4].

Contingencies[5] were updated based on the changes made to the topology as described in Section 2.1 of this document. The following steady state contingencies were simulated for the study region:

- P0 (System Intact);
- P1, P2-1, P7 (N-1 conditions);
- P2-2, P2-3, P4, and P5 (Extra High Voltage (EHV) only);
- P3: G-1 + N-1 (G-1: generation outages) {Permian Basin Units 1-5, and Riggins Solar}; and
- P6-2: X-1 + N-1 (X-1: 345/138-kV transformers only) {Sand Lake, and Solstice}.

All 69-kV and above buses, transmission lines, and transformers in the study region were monitored (excluding generator step-up transformers) and the following thermal and voltage limits were enforced:

- Thermal
  - Rate A (normal rating) for pre-contingency conditions;
  - Rate B (emergency rating) for post-contingency conditions;
- Voltages
  - Voltages exceeding pre-contingency and post-contingency limits; and
  - Voltage deviations exceeding 8% on non-radial load buses.

### 2.3.2 Study Tool

ERCOT utilized the following software tools to perform this independent study:

- PowerWorld Simulator version 22 for Security Constrained Optimal Power Flow (SCOPF) and steady-state contingency analysis and
- UPLAN version 11.4.0.27191 for congestion analysis.

# 3 Project Need

Steady-state reliability analysis was performed in accordance with NERC TPL-001-5.1 and ERCOT Planning Criteria described in Section 2.3 of this document. This analysis indicated both thermal overload issues under various contingency conditions and one unsolvable contingency under NERC Category P3 (G-1 + N-1) contingency condition in the study area.

The one unsolvable contingency was observed under the following NERC Category P3 contingency condition:

- REDACTED

[4] ERCOT Planning Criteria: http://www.ercot.com/mktrules/guides/planning/current.
[5] Details of each event and contingency category are defined in the NERC reliability standard TPL-001-5.1.

Both Sand Lake 345/138-kV transformers were overloaded under P0 of system intact. Solstice and Riverton 345/138-kV transformers were overloaded under P6-2 (X-1 + N-1) contingency conditions. Besides the 345/138-kV transformers overloads, six 138-kV transmission lines overloads were also observed under various contingency conditions. These issues are summarized in Table 3.1. Figure 3.1 visually illustrates the project need.

**Table 3.1: Thermal Overloads Observed in the Study Area**

| NERC Contingency Category | Overloaded Element | Voltage Level (kV) | Length (miles) | Loading % |
|---|---|---|---|---|
| P0: System Intact | Sand Lake 345/138-kV Transformer #1 | 345/138 | | 112.9 |
| P0: System Intact | Sand Lake 345/138-kV Transformer #2 | 345/138 | | 113.5 |
| P0: System Intact | Sand Lake - Cedarvale 138-kV Circuit 1 | 138 | 0.98 | 103.3 |
| P0: System Intact | Sand Lake - Cedarvale 138-kV Circuit 2 | 138 | 0.98 | 103.3 |
| P1: N-1 | IH20 - Collie Field Tap 138-kV Line | 138 | 2.95 | 113.3 |
| P3: G-1+N-1 | Rio Pecos - Girvin 138-kV Circuit 2 | 138 | 0.56 | 102.8 |
| P6-2: X-1 + N-1 | Solstice 345/138-kV Transformer #2 | 345/138 | | 104.5 |
| P6-2: X-1 + N-1 | Riverton 345/138-kV Transformer #1 | 345/138 | | 100.2 |
| P6-2: X-1 + N-1 | Riverton 345/138-kV Transformer #2 | 345/138 | | 100.1 |
| P6-2: X-1 + N-1 | Wink Sub - Wink Tnp 138-kV Circuit 1 | 138 | 1.42 | 112.1 |
| P6-2: X-1 + N-1 | Wink Sub - Wink Tnp 138-kV Circuit 2 | 138 | 1.18 | 113.3 |

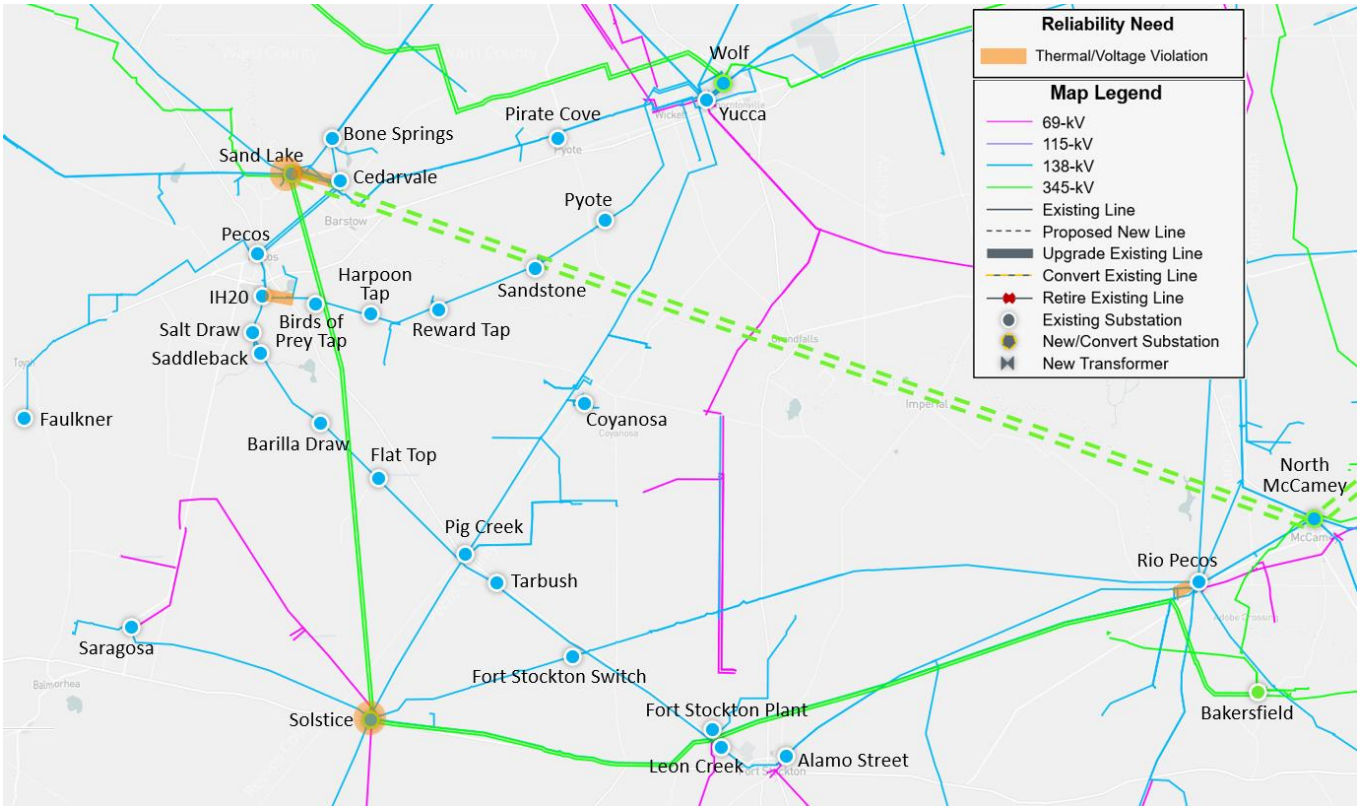


**Figure 3.1: Study Area Map Showing Project Needs**

# 4 Description of Project Options

ERCOT evaluated four system-improvement options to address the reliability violations that were observed in the study base case. All four options resolved the reliability violations in the summer peak condition in the study area.

Option 1 (TNMP Proposed Solution) consists of the following:

- Construct a new 345-kV New Substation 1 near the existing Cedarvale 138-kV substation. The New Substation 1 will be designed in a breaker-and-a-half configuration and interconnected by cutting the station into the planned North McCamey – Sand Lake 345-kV double-circuit transmission line.
- Construct a new Silverleaf 345/138-kV station near the New Substation 1. The Silverleaf 345/138-kV station includes:
    - Three 345/138-kV transformers, each with normal/emergency ratings of at least 668/750 MVA.
    - A high-side breaker with breaker-disconnect switches for each of the three 345/138-kV transformers. No bus bar connections between the high sides of the three transformers (bus connections between the high sides of the three transformers to be established at the 345-kV New Substation 1).
    - 138-kV switchyard to be designed in a breaker-and-a-half configuration.
- Silverleaf 345/138-kV station to be interconnected as follows:
    - Extend 345-kV tie-lines from the high sides of the three Silverleaf 345/138-kV transformers to positions within the 345-kV New Substation 1 (total of three 345-kV tie lines). The three 345-kV tie-lines will be on separate structures, with a normal and emergency rating of at least 1793 MVA per tie-line.
    - Loop the existing Cedarvale – Pecos 138-kV transmission line #1 into the new Silverleaf 138-kV station. The line extensions are estimated at approximately 0.4 miles each and will require new ROW.
    - Loop the existing Cedarvale – Pecos 138-kV transmission line #2 into the new Silverleaf 138-kV station. The line extensions are estimated at approximately 1.2 miles each and will require new ROW.
    - Loop the existing Cedarvale – Bone Springs 138-kV transmission line into the new Silverleaf 138-kV station. The line extensions are estimated at approximately 0.6 miles each and will require new ROW.
- Construct a new 345-kV New Substation 2 approximately 13 miles south of the existing Sand Lake 345/138-kV station. The New Substation 2 will be designed in a breaker-and-a-half configuration and interconnected by cutting the station into the existing Sand Lake – Solstice 345-kV double-circuit transmission line.
- Construct a new Cowpen 345/138-kV station near the New Substation 2. The Cowpen 345/138-kV station includes:

- Two 345/138-kV transformers, each with normal/emergency ratings of at least 668/750 MVA.
- A high-side breaker with breaker-disconnect switches for each of the two 345/138-kV transformers. No bus bar connections between the high sides of the two transformers (bus connections between the high sides of the two transformers to be established at the 345-kV New Substation 2).
- 138-kV switchyard to be designed in a breaker-and-a-half configuration.

- Cowpen 345/138-kV station to be interconnected as follows:
  - Extend 345-kV tie-lines from the high sides of the two Cowpen 345/138-kV transformers to positions within the 345-kV New Substation 2 (total of two 345-kV tie lines). The two 345-kV tie-lines will be on separate structures, with a normal and emergency rating of at least 1793 MVA per tie-line.
  - Loop the existing IH20 – Salt Draw 138-kV transmission line into the new Cowpen 138-kV station. The line extensions are estimated at approximately 6.8 miles each and will require new ROW.
  - Loop the existing Birds of Prey Tap – Harpoon Tap 138-kV transmission line into the new Cowpen 138-kV station. The line extensions are estimated at approximately 0.3 miles each and will require new ROW.


**Figure 4.1: Map of Option 1**

Option 2 consists of the following:

- Construct a new 345-kV New Substation 1 near the existing Cedarvale 138-kV substation. The New Substation 1 will be designed in a breaker-and-a-half configuration and interconnected by cutting the station into the planned North McCamey – Sand Lake 345-kV double-circuit transmission line.
- Construct a new Silverleaf 345/138-kV station near the New Substation 1. The Silverleaf 345/138-kV station includes:
    - Three 345/138-kV transformers, each with normal/emergency ratings of 668/750 MVA.
    - A high-side breaker with breaker-disconnect switches for each of the three 345/138-kV transformers. No bus bar connections between the high sides of the three transformers (bus connections between the high sides of the three transformers to be established at the 345-kV New Substation 1).
    - 138-kV switchyard to be designed in a breaker-and-a-half configuration.
- Silverleaf 345/138-kV station to be interconnected as follows:
    - Extend 345-kV tie-lines from the high sides of the three Silverleaf 345/138-kV transformers to positions within the 345-kV New Substation 1 (total of three 345-kV tie lines). The three 345-kV tie-lines will be on separate structures, with a normal and emergency rating of at least 1793 MVA per tie-line.
    - Loop the existing Cedarvale – Pecos 138-kV transmission line #1 into the new Silverleaf 138-kV station. The line extensions are estimated at approximately 0.4 miles each and will require new ROW.
    - Loop the existing Cedarvale – Pecos 138-kV transmission line #2 into the new Silverleaf 138-kV station. The line extensions are estimated at approximately 1.2 miles each and will require new ROW.
    - Loop the existing Cedarvale – Bone Springs 138-kV transmission line into the new Silverleaf 138-kV station. The line extensions are estimated at approximately 0.6 miles each and will require new ROW.
- Construct a new, 14-mile Silverleaf – Collie Field Tap 138-kV double-circuit transmission line with a normal and emergency rating of at least 717 MVA per circuit. This transmission line will require new ROW.
- Rebuild the existing, 2.95-mile IH20 – Collie Field Tap 138-kV transmission line with a normal and emergency rating of at least 717 MVA.

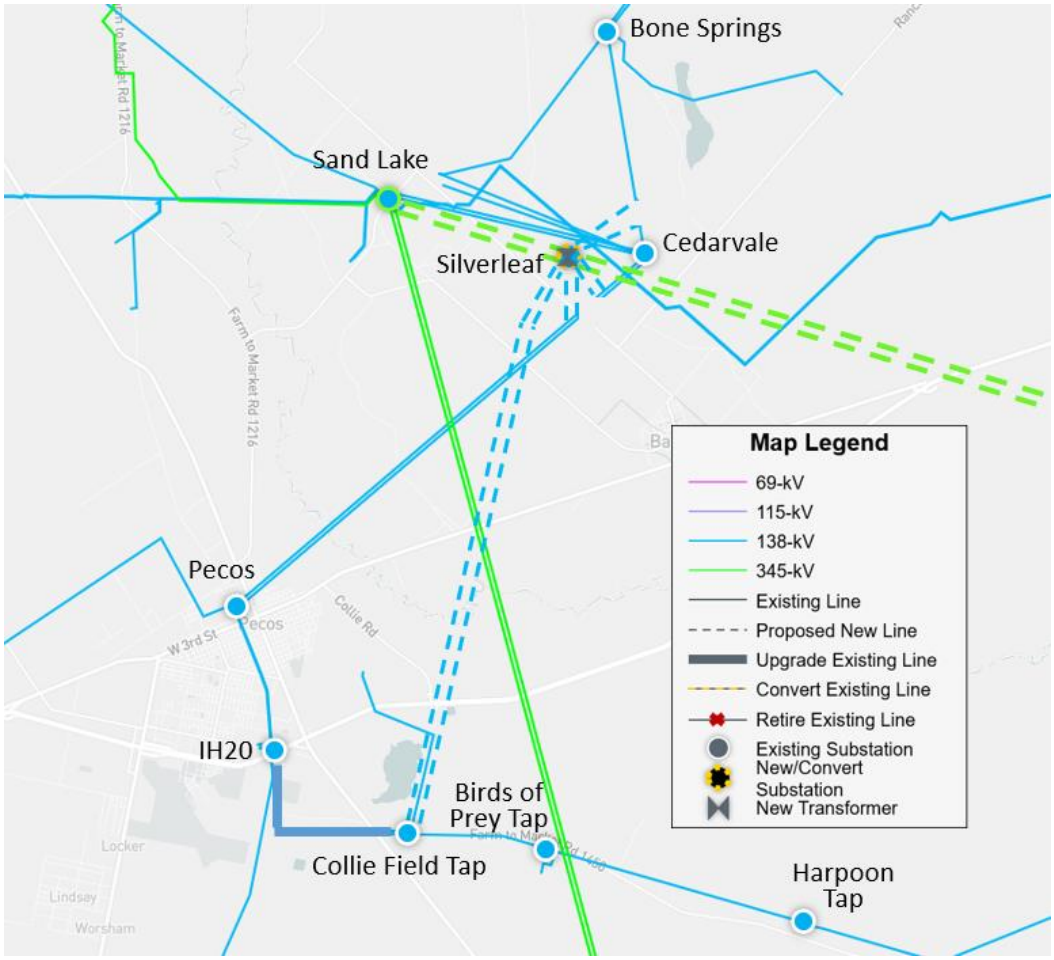


**Figure 4.2: Map of Option 2**

Option 3 consists of the following:

- Expand the existing Cedarvale 138-kV station to 345/138-kV, including three 345/138-kV transformers, each with normal/emergency ratings of at least 668/750 MVA.
- Loop the planned North McCamey – Sand Lake 345-kV double-circuit transmission line into the Cedarvale 345-kV station.
- Construct a new 345-kV New Substation 2 approximately 13 miles south of the existing Sand Lake 345/138-kV station. The New Substation 2 will be designed in a breaker-and-a-half configuration and interconnected by cutting the station into the existing Sand Lake – Solstice 345-kV double-circuit transmission line.
- Construct a new Cowpen 345/138-kV station near the New Substation 2. The Cowpen 345/138-kV station includes:
    - Two 345/138-kV transformers, each with normal/emergency ratings of at least 668/750 MVA.
    - A high-side breaker with breaker-disconnect switches for each of the two 345/138-kV transformers. No bus bar connections between the high sides of the two transformers

(bus connections between the high sides of the two transformers to be established at the 345-kV New Substation 2).

- 138-kV switchyard to be designed in a breaker-and-a-half configuration.

- Cowpen 345/138-kV station to be interconnected as follows:
  - Extend 345-kV tie-lines from the high sides of the two Cowpen 345/138-kV transformers to positions within the 345-kV New Substation 2 (total of two 345-kV tie lines). The two 345-kV tie-lines will be on separate structures, with a normal and emergency rating of at least 1793 MVA per tie-line.
  - Loop the existing IH20 – Salt Draw 138-kV transmission line into the new Cowpen 138-kV station. The line extensions are estimated at approximately 6.8 miles each and will require new ROW.
  - Loop the existing Birds of Prey Tap – Harpoon Tap 138-kV transmission line into the new Cowpen 138-kV station. The line extensions are estimated at approximately 0.3 miles each.

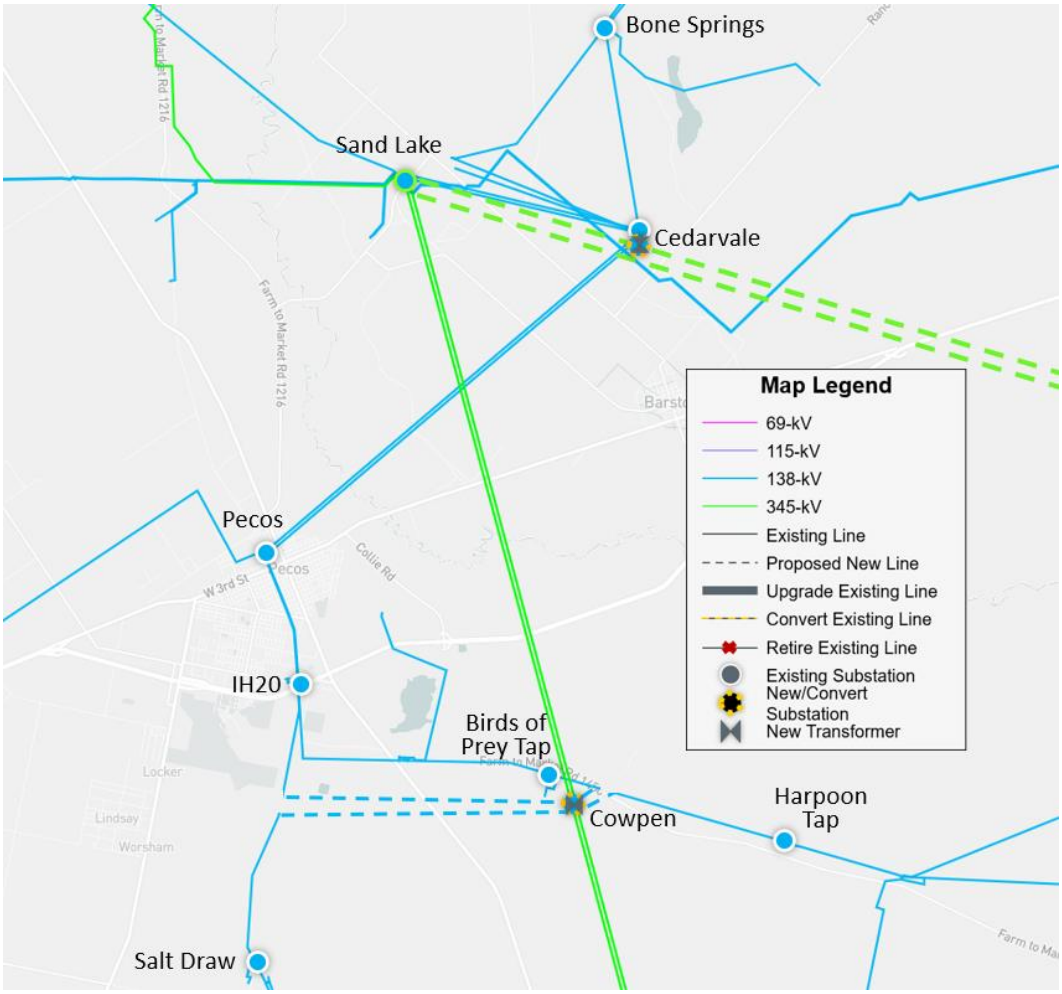


**Figure 4.3: Map of Option 3**

Option 4 consists of the following:

- Expand the existing Cedarvale 138-kV station to 345/138-kV, including three 345/138-kV transformers, each with normal/emergency ratings of at least 668/750 MVA.
- Loop the planned North McCamey – Sand Lake 345-kV double-circuit transmission line into the Cedarvale 345-kV station.
- Expand the existing IH20 138-kV station to 345/138-kV, including two 345/138-kV transformers, each with normal/emergency ratings of at least 668/750 MVA.
- Loop the existing Sand Lake – Solstice 345-kV double-circuit transmission line into the IH20 345-kV station. The line extensions are estimated at approximately 5 miles each and will require new ROW.
- Rebuild the existing, 2.95-mile IH20 – Collie Field Tap 138-kV transmission line with a normal and emergency rating of at least 717 MVA.

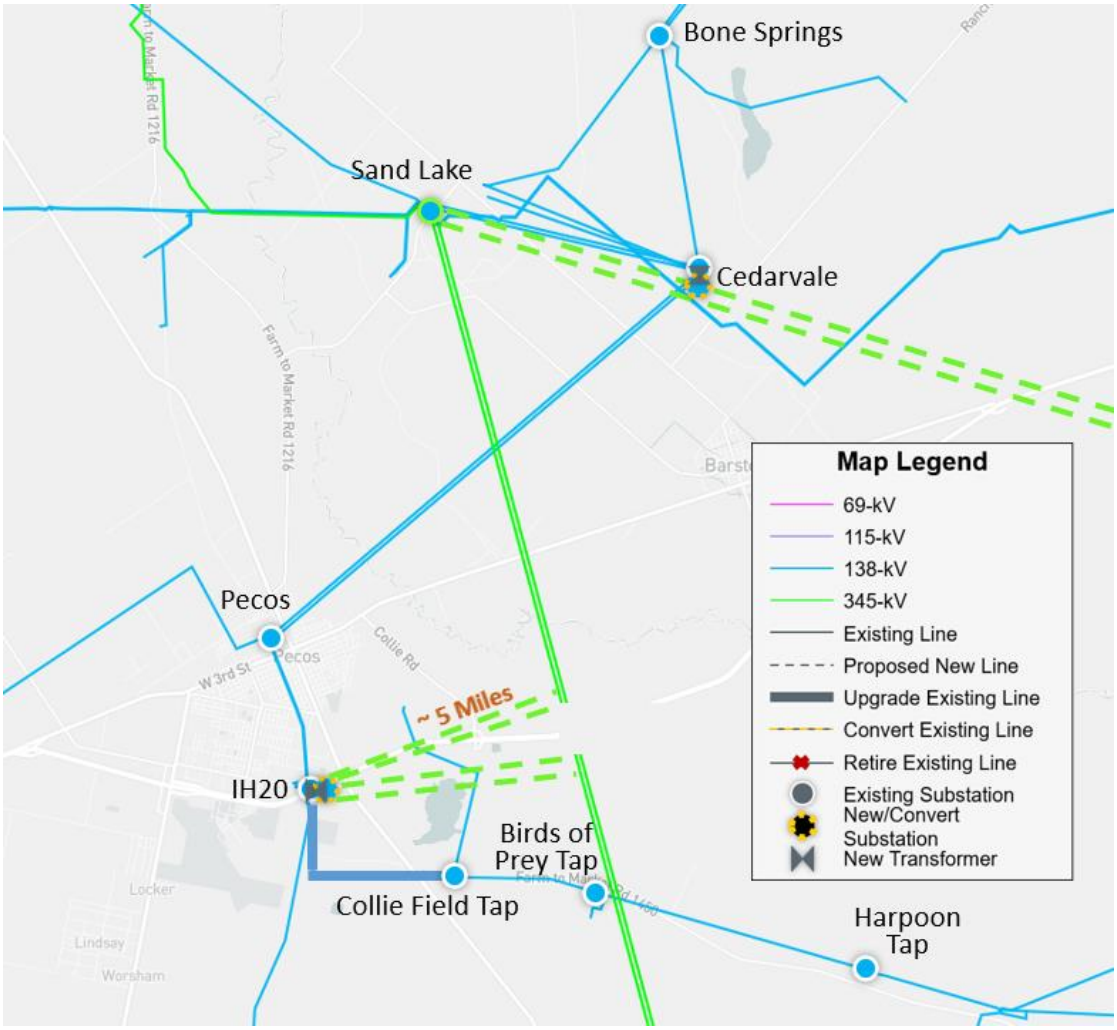


**Figure 4.4: Map of Option 4**

# 5 Option Evaluations

ERCOT performed reliability analysis to evaluate all four options and to identify any reliability impacts of the options in the study area. This section details these studies and their results and compares the options.

## 5.1 Results of Reliability Analysis

All four options were evaluated based on the contingencies described in the methodology section of the report, and no reliability criteria violations were identified for all four options under summer peak load condition as shown in Table 5.1.

**Table 5.1: Results of Reliability Assessment of Study Options**

| Option | Unsolved Power Flow | N-1 | | X-1 + N-1 | | G-1 + N-1 | |
|---|---|---|---|---|---|---|---|
| | | Thermal Overloads | Voltage Violations | Thermal Overloads | Voltage Violations | Thermal Overloads | Voltage Violations |
| Option 1 | None | None | None | None | None | None | None |
| Option 2 | None | None | None | None | None | None | None |
| Option 3 | None | None | None | None | None | None | None |
| Option 4 | None | None | None | None | None | None | None |

## 5.2 Long-Term Load Serving Capability Assessment

The Far West Weather Zone, which includes the study area, has experienced an average annual peak demand growth rate of approximately 14% from 2018 to 2023 due to significant growth in oil and natural gas industry demand. In addition to the oil and natural gas industry demand, significant increases in the demand of Customers operating datacenters or virtual currency mining facilities are also forecasted in the study area for the future years. Due to the historical and expected high load growth in this area, ERCOT performed a long-term load serving capability assessment on all four options.

The need drivers of this RPG project are adding additional 345/138-kV transformer capacity to meet the forecasted loads in the area and providing another source to the IH20 area to address the maintenance outage issues. All four options provide another source to the IH20 area. Options 1, 3, and 4 add five 345/138-kV transformers, while Option 2 adds three 345/138-kV transformers. The long-term load serving capability assessment is to evaluate the loadings on the existing and new 345/138-kV transformers under base case and higher load conditions to compare the performance of the four study options. In the higher load condition evaluation, the loads at all 138-kV paths connecting to Sand Lake, Silverleaf/Cedarvale, and Cowpen/IH20 stations were increased (Customers with flexible loads remained the same level as in the base case), and conforming loads outside of the WFW Weather Zones were decreased to balance power. The results of the long-term load serving capability assessment are shown in Tables 5.2 and 5.3.

Table 5.2 shows the loadings on the 345/138-kV transformers at study base case load level under N-1 and X-1 + N-1 contingency conditions. Overall, the loadings on the 345/138-kV transformers for Option 2 are higher than Options 1, 3, and 4 under both N-1 and X-1 + N-1 conditions.

**Table 5.2: Loadings on the 345/138-kV Transformers at Study Base Case Load Level**

| Transformer | N-1 | | | | X-1 + N-1 | | | |
|---|---|---|---|---|---|---|---|---|
| | O1 | O2 | O3 | O4 | O1 | O2 | O3 | O4 |
| Sand Lake | 56.3 | 68.7 | 50.7 | < 50 | 66.3 | 83.5 | 62.1 | 57.5 |
| Silverleaf | < 50 | 65.1 | N/A | N/A | 65.7 | 86.7 | N/A | N/A |
| Cedarvale | N/A | N/A | 52.1 | < 50 | N/A | N/A | 67.3 | 66.4 |
| Cowpen | 57.9 | N/A | 58.3 | N/A | 72.4 | N/A | 72.8 | N/A |
| IH20 | N/A | N/A | N/A | 64.5 | N/A | N/A | N/A | 77.2 |
| Solstice | 54.3 | 60.3 | 54.0 | 54.1 | 85.6 | 88.0 | 85.6 | 85.7 |

Table 5.3 shows the loadings on the 345/138-kV transformers at higher load level (additional 700 MW) under N-1 and X-1 + N-1 contingency conditions. In this evaluation, the loads in the area were increased until an overload was observed. For Option 2, with additional 700 MW of load in the area, the Silverleaf 345/138-kV transformers are overloaded, and the loadings on the Sand Lake 345/138-kV transformers are close to the emergency ratings under X-1 + N-1 contingency conditions. The loadings on the Sand Lake and the Silverleaf 345/138-kV transformers are significantly lower in Options 1, 3, and 4 when compared to Option 2 under both N-1 and X-1 + N-1 conditions.

**Table 5.3: Loadings on the 345/138-kV Transformers at Higher Load Level (Additional 700 MW Load)**

| Transformer | N-1 | | | | X-1 + N-1 | | | |
|---|---|---|---|---|---|---|---|---|
| | O1 | O2 | O3 | O4 | O1 | O2 | O3 | O4 |
| Sand Lake | 65.0 | 80.2 | 58.8 | 54.9 | 76.6 | 99.2 | 71.8 | 66.5 |
| Silverleaf | 56.9 | 75.9 | N/A | N/A | 75.2 | 100.9 | N/A | N/A |
| Cedarvale | N/A | N/A | 59.6 | 55.3 | N/A | N/A | 76.9 | 75.8 |
| Cowpen | 71.6 | N/A | 71.8 | N/A | 88.5 | N/A | 88.9 | N/A |
| IH20 | N/A | N/A | N/A | 78.1 | N/A | N/A | N/A | 93.9 |
| Solstice | 55.7 | 63.3 | 55.5 | 55.7 | 92.3 | 95.7 | 92.7 | 92.7 |

## 5.3 Planned Maintenance Outage Evaluation

Using the P1, P2.1, and P7 contingencies based on the review of the system topology of the area, ERCOT conducted an N-2 contingency analysis for each of the study options to represent system element outages under planned maintenance condition (N-1-1) in the area. Then, each N-2 violation was run as an N-1-1 contingency scenario, with system adjustments in between the contingencies. The transmission elements in the local area of Silverleaf and Cowpen 345/138-kV Stations Project were monitored in the maintenance outage evaluation.

In August 2023, TNMP submitted the Pecos County Transmission Improvement Project to address the reliability issues under maintenance outage condition in the Pecos County. As such, this Pecos

County Transmission Improvement Project was modelled as a placeholder project in the planned maintenance outage evaluation of this RPG review.

As shown in Table 5.4, the results of this maintenance assessment indicate that Options 1, 2, and 3 performed similarly and better than Option 4. Options 1, 2, and 3 resolved all the reliability issues in the local area, while two 138-kV transmission line overloads were not resolved by Option 4.

**Table 5.4: Results of Planned Maintenance Outage Evaluation**

| Option | Unsolved Power Flow | Thermal Overloads | Voltage Violations |
|---|---|---|---|
| Option 1 | None | 0 | None |
| Option 2 | None | 0 | None |
| Option 3 | None | 0 | None |
| Option 4 | None | 2 | None |

## 5.4 Cost Estimate and Feasibility Assessment

TNMP concluded the feasibility assessments for all the four options and determined that Options 3 and 4 were infeasible due to land-use reasons. TNMP, Oncor, and AEP provided cost estimates for the Options 1 and 2. Table 5.5 summarizes the cost estimates, estimated mileage of CCN required, and feasibility of the four study options.

**Table 5.5: Cost Estimates and Feasibility of the Study Options**

| Option | Cost Estimates ($M) | CCN Required (Miles) | Feasibility |
|---|---|---|---|
| Option 1 | ~ 273.1 | ~ 18.5 | Feasible |
| Option 2 | ~ 182.6 | ~ 18.3 | Feasible |
| Option 3 | N/A | N/A | Not Feasible |
| Option 4 | N/A | N/A | Not Feasible |

# 6 Options Comparison

Based on input from TNMP, Options 3 and 4 were deemed infeasible due to land-use reasons. As such, they were removed from the options comparison provided in Table 6.1 below. Table 6.1 summarizes the comparisons of Options 1 and 2, with corresponding cost estimates provided by TNMP, Oncor, and AEP.

**Table 6.1: Comparison of Options 1 and 2 with Cost Estimates**

| | Option 1 | Option 2 |
|---|---|---|
| Meets ERCOT and NERC Reliability Criteria | Yes | Yes |
| Improves Long-Term Load Serving Capability | Yes (Better) | Yes |
| Improves Operational Flexibility | Yes | Yes |
| Requires CCN (Miles) | Yes (~ 18.5) | Yes (~ 18.3) |
| Cost Estimate ($M) | ~ 273.1 | ~ 182.6 |

ERCOT recommends Option 1 as the preferred option to address the reliability need in the study area based on the following considerations:

- Although Option 2 is less expensive, Option 1 provides better long-term load serving capability. Considering the historical and expected high load growth in this area, additional 345-kV source with more 345/138-kV transformers in Option 1 will better accommodate the future load growth in this area.
- Option 1 further improves operational flexibility.

# 7 Additional Analyses and Assessment

The preferred option (Option 1, approximately $273.1 million) is categorized as a Tier 1 project, pursuant to ERCOT Protocol 3.11.4.3(1)(a). ERCOT performed generation and load sensitivity studies to identify the preferred option performance, as required under Planning Guide Section 3.1.3 (4). Additionally, a Sub-synchronous Resonance (SSR) Assessment was performed.

## 7.1 Generation Addition Sensitivity Analysis

ERCOT performed a generation addition sensitivity analysis based on Planning Guide Section 3.1.3(4)(a).

Based on a review of the September 2023 GIS[6] reports, 11 units were found within the Far West Weather Zone that could have an impact on the identified reliability issues. These units are listed in Table 7.1. After the addition of the units to the Option 1 case, no new thermal or voltage violations were identified.

**Table 7.1: List of Units that Could Have Impact on the Identified Reliability Issues**

| GINR | Unit Name | Fuel Type | Capacity (MW) | County |
|---|---|---|---|---|
| 16INR0104 | Big Sampson Wind | Wind | 400 | Crockett |
| 21INR0021 | Green Holly Solar | Solar | 413.6 | Dawson |
| 21INR0022 | Red Holly Solar | Solar | 260 | Dawson |
| 21INR0029 | Green Holly Storage | Battery | 50 | Dawson |
| 21INR0033 | Red Holly Storage | Battery | 50 | Dawson |
| 21INR0268 | Greyhound Solar | Solar | 608.7 | Ector |
| 23INR0287 | BRP Avila BESS | Battery | 164.95 | Pecos |
| 23INR0300 | Greater Bryant G Solar | Solar | 41.6 | Midland |
| 23INR0340 | Larkspur Energy Storage | Battery | 307.46 | Upton |
| 24INR0273 | Al Pastor BESS | Battery | 100.8 | Dawson |
| 25INR0208 | Iron Belt Energy Storage | Battery | 401.9 | Borden |

[6] GIS Report: https://www.ercot.com/mp/data-products/data-product-details?id=PG7-200-ER.

## 7.2 Load Scaling Sensitivity Analysis

Planning Guide Section 3.1.3(4)(b) requires an evaluation of the potential impact of load scaling on the criteria violations seen in this ERCOT independent review. As stated in Section 2.1, ERCOT used the 2027 WFW summer peak case from the 2022 RTP and adjusted the load to create the 2027 WFW summer peak case to study this area in the FW Weather Zone. This study base case, which was created in accordance with the 2022 RTP Study Scope and Process document and Section 2.1 of this document, included load scaled down from the respective non-coincident peaks in the North, North Central, South, South Central, East, and Coast Weather Zones.

The Outage Transfer Distribution Factors (OTDFs) of overloaded elements with respect to the load transfer for each Weather Zone (excluding the West and Far West Weather Zones) were calculated using PowerWorld Simulator. The OTDFs were less than 1% for each of the overloaded elements, *i.e.*, they were not significant enough to have an impact on the overloaded elements. ERCOT concluded that the load scaling used to develop the base case in this study did not have a material impact on the project need, which was primarily driven by thermal overloads in the study area.

## 7.3 Sub-synchronous Resonance (SSR) Assessment

Pursuant to Nodal Protocol Section 3.22.1.3(2), ERCOT conducted a sub-synchronous-resonance (SSR) screening for the preferred option (Option 1) and found no adverse SSR impacts to the existing and planned generation resources in the study area.

# 8 Congestion Analysis

ERCOT conducted a congestion analysis to identify any potential impact on system congestion related to the addition of the recommend project, Option 1, using the 2022 RTP 2027 final economic case.

The results of the congestion analysis indicated no additional congestion in the area with the addition of the recommend project of Option 1.

# 9 Conclusion

ERCOT evaluated the four transmission-upgrade options to resolve the reliability violations observed in the study area. Based on the results of the independent review, ERCOT recommends Option 1 as the preferred solution because it addresses the reliability violations, improves the long-term load serving capability, and improves operational flexibility.

Option 1 consists of the following upgrades and is estimated to cost approximately $273.1 million:

- Construct a new 345-kV New Substation 1 near the existing Cedarvale 138-kV substation. The New Substation 1 will be designed in a breaker-and-a-half configuration and interconnected by cutting the station into the planned North McCamey – Sand Lake 345-kV double-circuit transmission line.

- Construct a new Silverleaf 345/138-kV station near the New Substation 1. The Silverleaf 345/138-kV station includes:
    - Three 345/138-kV transformers, each with normal/emergency ratings of at least 668/750 MVA.
    - A high-side breaker with breaker-disconnect switches for each of the three 345/138-kV transformers. No bus bar connections between the high sides of the three transformers (bus connections between the high sides of the three transformers to be established at the 345-kV New Substation 1).
    - 138-kV switchyard to be designed in a breaker-and-a-half configuration.
- Silverleaf 345/138-kV station to be interconnected as follows:
    - Extend 345-kV tie-lines from the high sides of the three Silverleaf 345/138-kV transformers to positions within the 345-kV New Substation 1 (total of three 345-kV tie lines). The three 345-kV tie-lines will be on separate structures, with a normal and emergency rating of at least 1793 MVA per tie-line.
    - Loop the existing Cedarvale – Pecos 138-kV transmission line #1 into the new Silverleaf 138-kV station. The line extensions are estimated at approximately 0.4 miles each and will require new ROW.
    - Loop the existing Cedarvale – Pecos 138-kV transmission line #2 into the new Silverleaf 138-kV station. The line extensions are estimated at approximately 1.2 miles each and will require new ROW.
    - Loop the existing Cedarvale – Bone Springs 138-kV transmission line into the new Silverleaf 138-kV station. The line extensions are estimated at approximately 0.6 miles each and will require new ROW.
- Construct a new 345-kV New Substation 2 approximately 13 miles south of the existing Sand Lake 345/138-kV station. The New Substation 2 will be designed in a breaker-and-a-half configuration and interconnected by cutting the station into the existing Sand Lake – Solstice 345-kV double-circuit transmission line.
- Construct a new Cowpen 345/138-kV station near the New Substation 2. The Cowpen 345/138-kV station includes:
    - Two 345/138-kV transformers, each with normal/emergency ratings of at least 668/750 MVA.
    - A high-side breaker with breaker-disconnect switches for each of the two 345/138-kV transformers. No bus bar connections between the high sides of the two transformers (bus connections between the high sides of the two transformers to be established at the 345-kV New Substation 2).
    - 138-kV switchyard to be designed in a breaker-and-a-half configuration.
- Cowpen 345/138-kV station to be interconnected as follows:
    - Extend 345-kV tie-lines from the high sides of the two Cowpen 345/138-kV transformers to positions within the 345-kV New Substation 2 (total of two 345-kV tie

lines). The two 345-kV tie-lines will be on separate structures, with a normal and emergency rating of at least 1793 MVA per tie-line.

- Loop the existing IH20 – Salt Draw 138-kV transmission line into the new Cowpen 138-kV station. The line extensions are estimated at approximately 6.8 miles each and will require new ROW.
- Loop the existing Birds of Prey Tap – Harpoon Tap 138-kV transmission line into the new Cowpen 138-kV station. The line extensions are estimated at approximately 0.3 miles each and will require new ROW.

This project will require one or more CCN applications for looping the existing 138-kV transmission lines to the new Silverleaf and Cowpen stations, approximately 18.5 miles of new ROW. The expected ISD of this project is June 2027.