

**The Reliability and Markets (R&M)
Committee is expected to consider R&M
Committee Agenda Item 7.2:**

***TMNP - Silverleaf and Cowpen 345/138-
kV Stations Regional Planning Group
Project***

at its meeting on December 18-19, 2023.

**The Board of Directors is expected to
hear the R&M Committee's
recommendation on this matter at the
Board meeting on December 19, 2023.**

**Attached are the Board and Committee
materials in relation to these agenda
items.**



Item 7.2: Silverleaf and Cowpen 345/138-kV Stations Regional Planning Group Project

Kristi Hobbs

Vice President, System Planning and
Weatherization

Reliability and Markets Committee Meeting

ERCOT Public

December 18-19, 2023

Silverleaf and Cowpen 345/138-kV Stations Project

- **Purpose**

- Provide an overview of the \$273.1 million Silverleaf and Cowpen 345/138-kV Stations Tier 1 Reliability Project.

- **Voting Items / Requests**

ERCOT staff requests and recommends that the Reliability and Markets (R&M) Committee recommend that the Board of Directors (Board):

1. Endorse the Silverleaf and Cowpen 345/138-kV Stations Regional Planning Group (RPG) Project based on NERC and ERCOT reliability planning criteria; and
2. Designate the project as critical to the reliability of the ERCOT System pursuant to PUCT Substantive Rule 25.101(b)(3)(D).

Key Takeaways:

- The Silverleaf and Cowpen 345/138-kV Stations Project is a Tier 1 project requiring Board consideration for endorsement, following a recommendation by the R&M Committee.
- The Project has completed RPG review and received an independent assessment from ERCOT staff and unanimous endorsement by the Technical Advisory Committee (TAC).
- ERCOT studied several options and recommends Option 1 to address the reliability violations, improve long-term load serving capability and improve operational flexibility in the Reeves and Ward Counties.

Tier 1 Project Requirement

- ERCOT Protocol Section 3.11.4, Regional Planning Group Project Review Process, defines the level of transmission projects that require Board consideration.
 - Projects with an estimated capital cost of \$100 Million or greater are Tier 1 projects (3.11.4.3)
 - Tier 1 projects require Board endorsement (3.11.4.7)
 - ERCOT shall present Tier 1 projects to TAC for review and comment; and comments from TAC shall be included in the presentation to the Board (3.11.4.9)
- Pursuant to R&M Committee Charter Section IV(B)(2)(a)
 - R&M Committee's duties include reviewing and making recommendations to the Board regarding any Tier 1 project

Key Takeaway: The Silverleaf and Cowpen 345/138-kV Stations Project is a Tier 1 project requiring Board consideration for endorsement, with prior review and recommendation by the R&M Committee.

Silverleaf and Cowpen 345/138-kV Stations Project

- TNMP submitted the Silverleaf and Cowpen 345/138-kV Stations Project for Regional Planning Group (RPG) review in May 2023
- The purpose of the project is to address the reliability need in the Reeves and Ward Counties in the Far West Weather Zone
- ERCOT performed an independent review of the project
 - ERCOT's endorsement of the project is based on the reliability need to relieve thermal overloads on five 345/138-kV transformers and 8.07 miles of 138-kV transmission lines in the Reeves and Ward Counties to meet NERC and ERCOT reliability planning criteria
- ERCOT presented the project to TAC on December 4, 2023
 - TAC voted unanimously to endorse the project (Option 1 from the ERCOT review)

Key Takeaway: The Silverleaf and Cowpen 345/138-kV Stations Project has completed RPG review and received an independent assessment from ERCOT staff.

Basis for ERCOT Board Endorsement

- ERCOT's independent review identified a reliability need for the Silverleaf and Cowpen 345/138-kV Stations Project to satisfy:
 - NERC TPL-001-5.1 Table 1 Reliability Criteria for category:
 - P0 contingency, pre-contingency loading
 - P1 contingency, loss of a single transmission element
 - P3 contingency, loss of generating unit followed by a single transmission element
 - P6-2 contingency, loss of a transformer followed by a single transmission element
 - ERCOT Planning Guide Section Reliability Performance Criteria contingency 4.1.1.2(1)(d).
 - Loss of a single 345/138-kV transformer followed by a single transmission element or common tower outage
 - New ERCOT Planning Guide Section 4.1.1.8, Maintenance Outage Reliability Criteria, which will become effective 01/01/24.
 - Loss of a single transmission element or common tower followed by a single transmission element or common tower outage

Key Takeaway: The Silverleaf and Cowpen 345/138-kV Stations Project is needed to meet reliability under both the NERC Transmission Planning standards and ERCOT Planning Guide.

ERCOT Recommendation

ERCOT recommends Option 1 from the ERCOT review of the TNMP project to:

- 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

Key Takeaway: ERCOT studied several options and recommends Option 1 to address the reliability violations, improve the long-term load serving capability and improve operational flexibility in the Reeves and Ward Counties.

Request for Committee Vote

ERCOT staff requests and recommends that the R&M Committee recommend that the Board:

- Endorse the need for the Silverleaf and Cowpen 345/138-kV Stations Project (Option 1) based on NERC and ERCOT reliability planning criteria
- Designate the Silverleaf and Cowpen 345/138-kV Stations Project (Option 1) as critical to the reliability of the ERCOT System pursuant to PUCT Substantive Rule 25.101(b)(3)(D) (which will expedite Commission consideration of the project)





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.

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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.

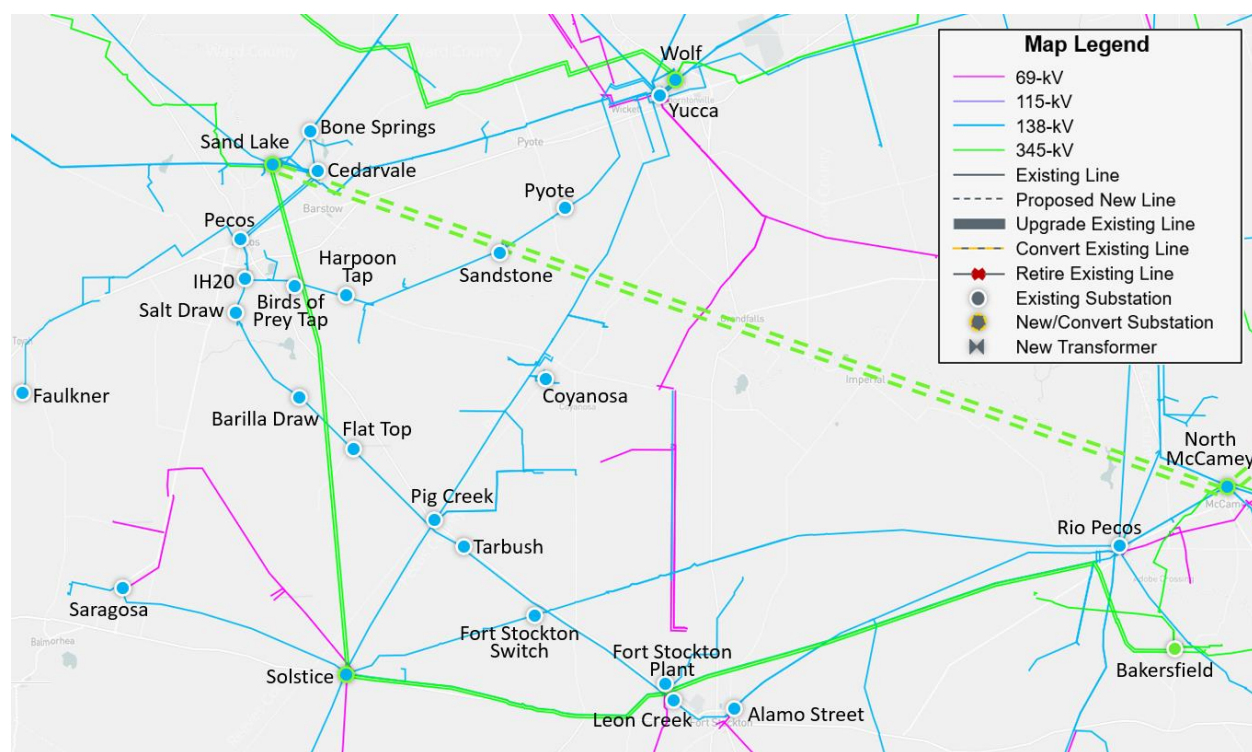


Figure 1.1: Map of Transmission System in the Study Area

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_12222022¹

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 Criteria⁴.

Contingencies⁵ 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

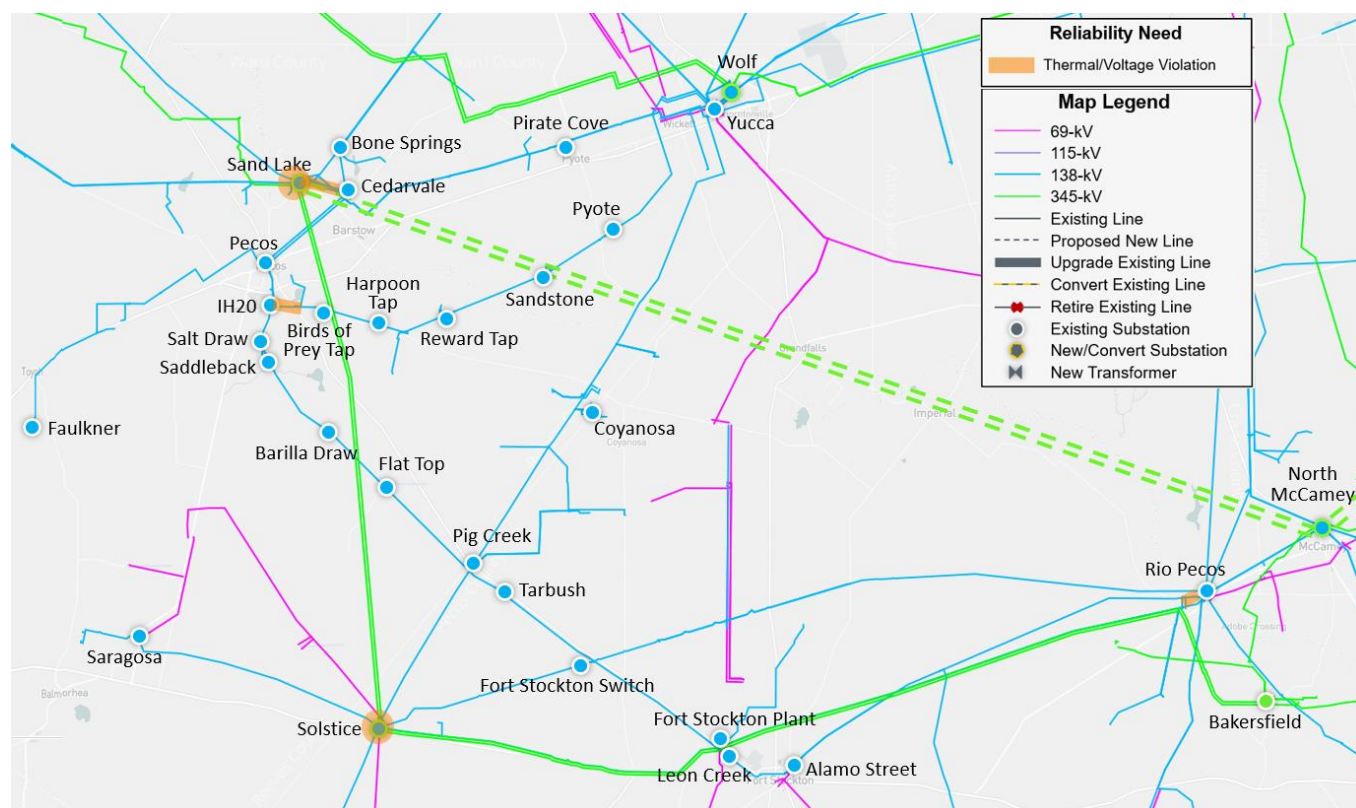


Figure 3.1: Study Area Map Showing Project Needs

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.

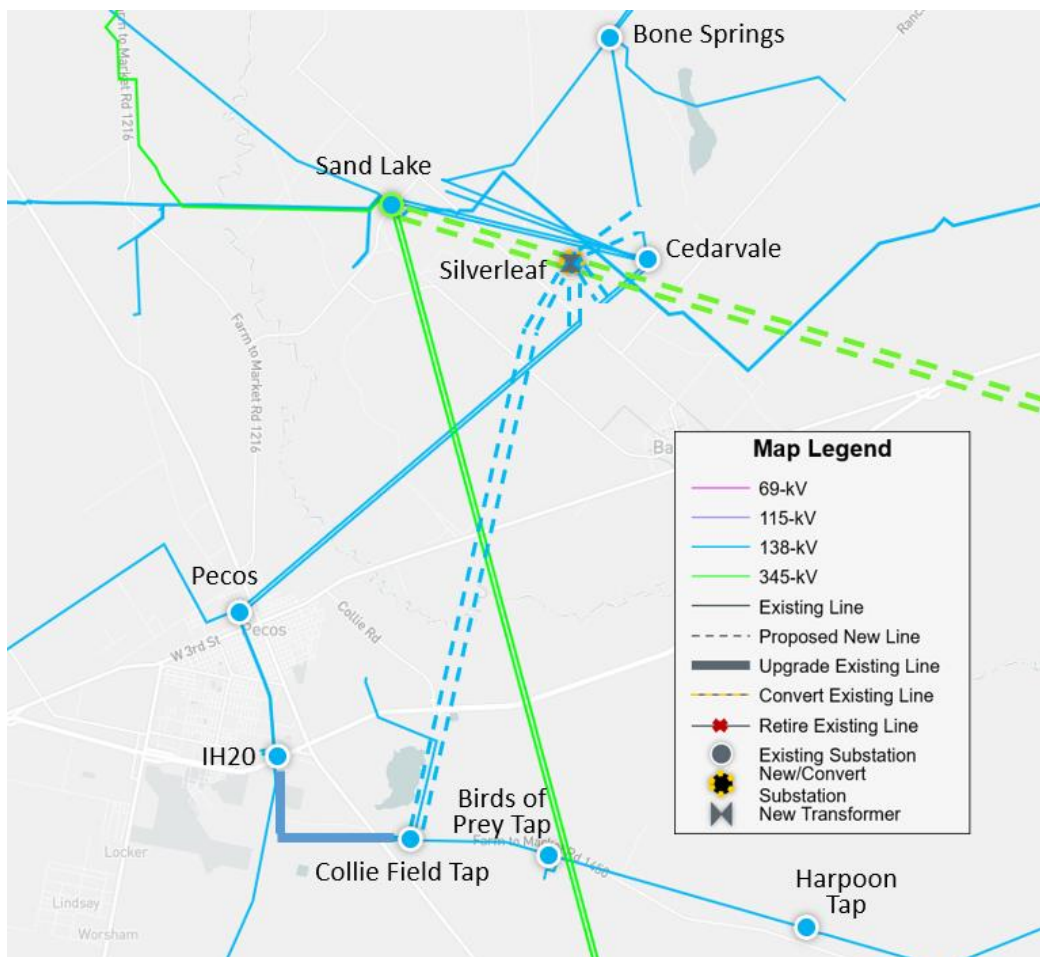


Figure 4.2: Map of Option 2

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.

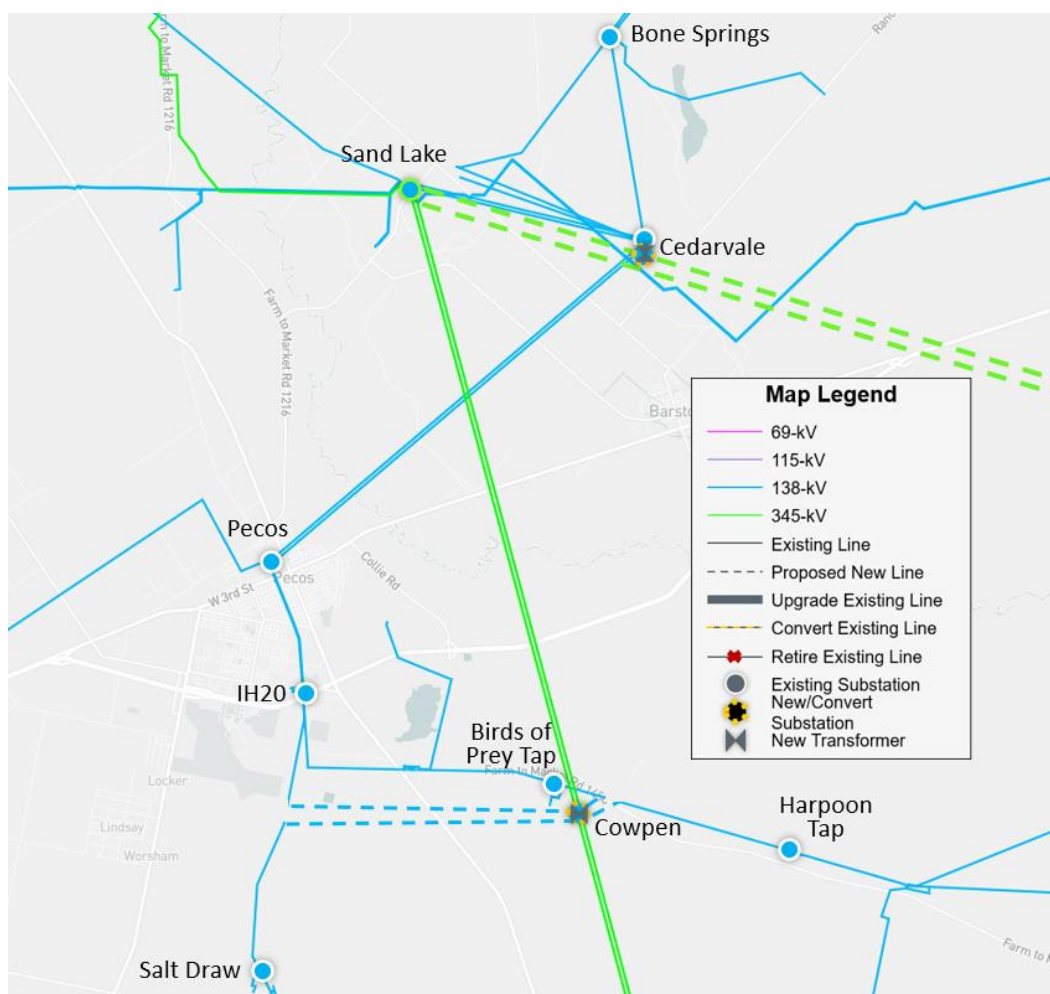


Figure 4.3: Map of Option 3

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.

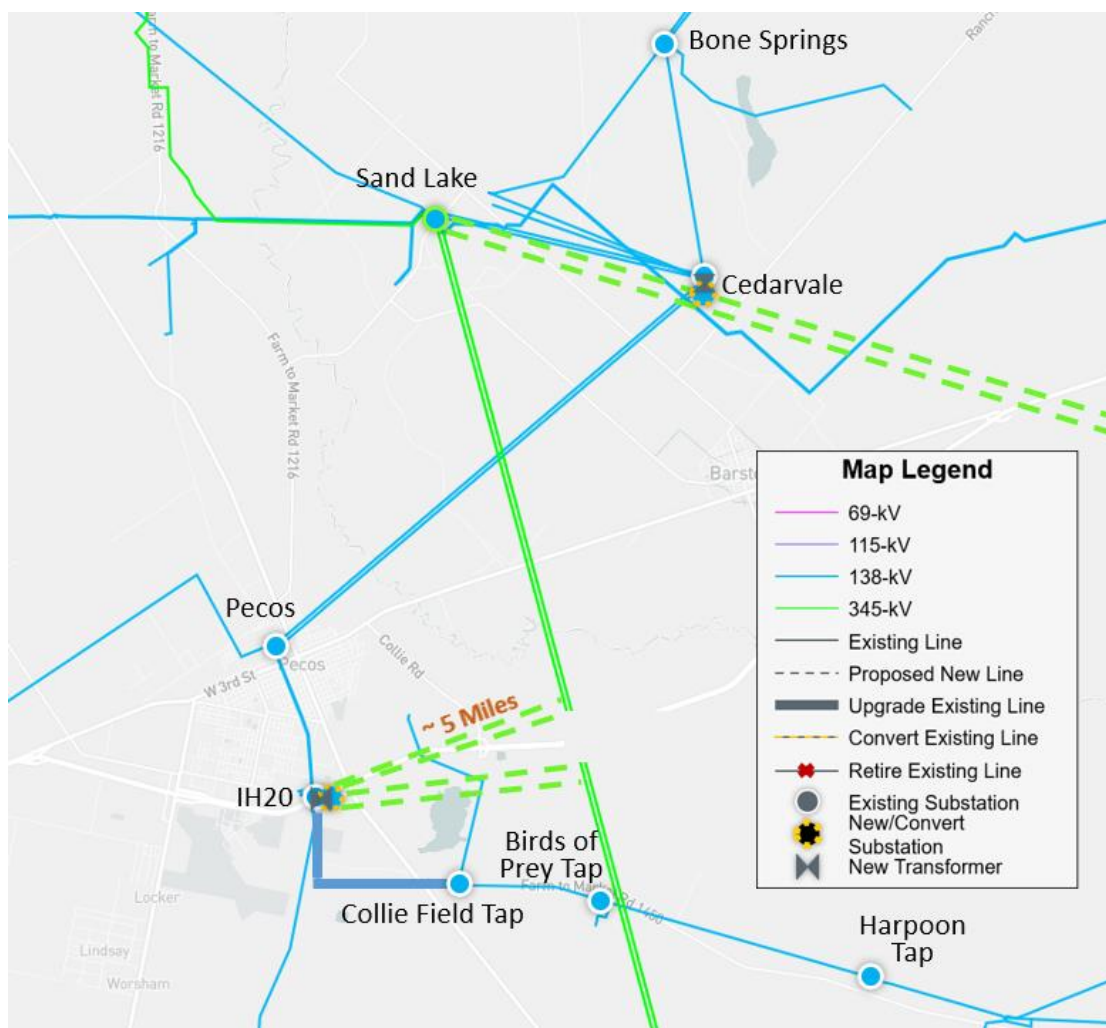


Figure 4.4: Map of Option 4

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 GIS⁶ 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.