



Date: August 24, 2023
To: Board of Directors
From: Bob Flexon, Reliability and Markets (R&M) Committee Chair
Subject: CPS Energy – San Antonio South Reliability Regional Planning Group Project

Issue for the ERCOT Board of Directors

ERCOT Board of Directors Meeting Date: August 31, 2023

Item No.: 11.2

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 CPS Energy – San Antonio South Reliability Regional Planning Group (RPG) Project in order to meet the reliability requirements for the ERCOT System and address thermal overloads in the San Antonio Area, which ERCOT staff has independently reviewed and which the Technical Advisory Committee (TAC) has voted unanimously to endorse; and (2) designate the CPS Energy – San Antonio South Reliability 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:

CPS Energy (CPS) has proposed the San Antonio South Reliability Project, a \$329.1 million, Tier 1 project with an expected in-service date of June 2027, to meet reliability planning criteria and address thermal overloads in the San Antonio area with the following ERCOT System improvements to 26.9 miles of 138-kV transmission lines:

- Construct new 50-mile Howard Road to San Miguel double circuit 345-kV transmission line with a minimum rating of 1982 MVA,
- Rebuild 14.9-mile Cagnon to Howard Road 345-kV double circuit transmission line with a minimum rating of 1746 MVA,
- Rebuild 4.9-mile Howard Road to Leon Creek 138-kV transmission line with a minimum of 698 MVA,
- Add a third 600-MVA 345/138-kV autotransformer at Howard Road substation, and
- Rebuild 2.9-mile Leon Creek to Southsan 138-kV transmission line with a minimum rating of 478 MVA.

For construction to meet the June 2027 in-service date, the San Antonio South Reliability 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.

CPS proposed the San Antonio South Reliability Project with an initial cost estimate of \$281 million for RPG review in December 2022. RPG considered project overviews during meetings in January and June 2023. Between January and June 2023, ERCOT staff presented scope and status updates at RPG meetings in February, March, April, and May. 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 July 25, 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 five options ERCOT analyzed during independent review of the San Antonio South Reliability Project, ERCOT preferred Option 5 as the least cost option to address reliability; improve ability to serve long-term Load growth; and improve operational flexibility, including providing an additional transfer path from Southern Texas to San Antonio.

ERCOT's assessment of the Sub-Synchronous Resonance (SSR) of CPS's of existing facilities in the San Antonio area, 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 the project would relieve three existing congestions and result in one new congestion (for the one new congestion, upgrades would yield no economic benefits according to test results for revenue reduction and cost savings):

- Howard Road to Leon Creek 138-kV Line (24.02 percent existing congestion)
- Leon Creek to Southsan 138-kV Line (0.83 percent existing congestion)
- Spruce to Pawnee 345-kV Line (0.74 percent existing congestion)
- Cagnon to Vlsi 138-kV Line (0.73 percent new congestion)

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. CPS 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 San Antonio South Reliability Project, including ERCOT staff's recommendation for Option 5, is attached as **Attachment A**.

Key Factors Influencing Issue:

1. ERCOT System improvements are needed to meet reliability planning criteria and address thermal overloads in the San Antonio area.
2. ERCOT staff found the recommended set of improvements to be the most efficient solution for meeting the planning 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 CPS Energy – San Antonio South Reliability Regional Planning Group Project (Option 5), as recommended by ERCOT, on July 25, 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 CPS Energy – San Antonio South Reliability RPG Project (Option 5) 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 CPS Energy – San Antonio South Reliability RPG Project (Option 5), 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 CPS Energy – San Antonio South Reliability RPG Project (Option 5) 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 CPS Energy – San Antonio South Reliability Regional Planning Group Project (Option 5), which ERCOT staff has independently reviewed and which the Technical Advisory Committee (TAC) has voted unanimously to endorse, based on North American Electric Reliability Corporation (NERC) and ERCOT reliability planning criteria; and (2) designate the CPS Energy – San Antonio South Reliability Regional Planning Group Project (Option 5) 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 the Board hereby (1) endorses the need for the Tier 1 CPS Energy – San Antonio South Reliability Regional Planning Group Project (Option 5), which ERCOT staff has independently reviewed and which TAC has voted unanimously to endorse, based on NERC and ERCOT reliability planning criteria; and (2) designates the CPS Energy – San Antonio South Reliability Regional Planning Group Project (Option 5) 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 August 31, 2023 meeting, the Board passed a motion approving the above Resolution by _____.

IN WITNESS WHEREOF, I have hereunto set my hand this ____ day of August, 2023.

Jonathan M. Levine
Assistant Corporate Secretary



ERCOT Independent Review of the CPS Energy (CPS) San Antonio South Reliability Project

Document Revisions

Date	Version	Description	Author(s)
06/23/2023	1.0	Final Draft	Caleb Holland, Tanzila Ahmed
		Reviewed by	Robert Golen, Prabhu Gnanam, Davida Dwyer

Executive Summary

CPS Energy (CPS) submitted the San Antonio South Reliability Project to the Regional Planning Group (RPG) in December 2022. CPS proposed this project to address NERC Category P1 thermal overloads of the J.K. Spruce to Pawnee 345-kV transmission line. The project will be needed by 2027 Summer Peak.

The proposed project was estimated to cost approximately \$281 million and was classified as a Tier 1 project per ERCOT Nodal Protocol Section 3.11.4.3. The proposed project cost exceeds the \$100 million threshold and would require a Certificate of Convenience and Necessity (CCN) application.

ERCOT performed an Independent Review, identified thermal overloads in the San Antonio area, and evaluated five different transmission project options.

Among the five different transmission project options evaluated in the Independent Review, ERCOT recommends Option 5 to address the thermal overload based on the study results described in Sections 5 and 6 of this report. Option 5 consists of the following:

- Construct a new 50-mile Howard Road to San Miguel 345-kV double-circuit transmission line with a normal and emergency rating of at least 1,982 MVA per circuit; this transmission line will require new Rights of Way (ROW);
- Rebuild the existing 14.9-mile Cagnon to Howard Road 345-kV double-circuit transmission line with a normal and emergency rating of at least 1,746 MVA per circuit;
- Rebuild the existing 4.9-mile Howard Road to Leon Creek 138-kV transmission line with a normal and emergency rating of at least 698 MVA; this will require 1.7 miles of new ROW;
- Add a third 600-MVA 345/138-kV autotransformer at Howard Road substation; and
- Rebuild the existing 2.9-mile Leon Creek to Southsan 138-kV transmission line with a normal and emergency rating of at least 478 MVA.

The cost estimate for this Tier 1 project is approximately \$329.1 million. One or more CCN applications will be required for 1) the construction of the new 345-kV double-circuit transmission line from Howard Road 345-kV substation to San Miguel 345-kV substation due to approximately 50.0 miles of new ROW and 2) the rebuild of the existing 138-kV transmission line from Howard Road 138-kV Substation to Leon Creek 138-kV Substation due to approximately 1.7 miles of new ROW. The expected In-Service Date (ISD) of this project is June 2027.

CPS requests this project be designated as critical to reliability of the ERCOT system based on historic line loading reflected in the recent high congestion costs, new renewable generation development, and local CPS generation reaching technical and potential end of life.

Table of Contents

- Executive Summary ii
- 1 Introduction 1
- 2 Study Assumptions and Methodology 2
 - 2.1 Study Assumptions for Reliability Analysis 2
 - 2.1.1 Steady-State Study Base Case 2
 - 2.1.2 Transmission Topology 2
 - 2.1.3 Generation 3
 - 2.1.4 Loads 4
 - 2.1.5 Maintenance Outage Scenario 4
 - 2.2 Study Assumption for Sensitivity Scenario 4
 - 2.2.1 Operation Summer Peak Sensitivity Analysis 4
 - 2.3 Study Assumptions for Congestion Analysis 4
 - 2.4 Methodology 5
 - 2.4.1 Contingencies and Criteria 5
 - 2.4.2 Study Tool 6
- 3 Project Need 6
- 4 Description of Project Options 7
- 5 Option Evaluations 9
 - 5.1 Results of Reliability Analysis 9
- 6 Short-listed Options 10
 - 6.1 Long-Term Load Serving Capability Assessment 12
 - 6.2 Planned Maintenance Outage Evaluation 13
 - 6.3 Operations Summer Peak Sensitivity Analysis 13
 - 6.4 Cost Estimate and Feasibility Assessment 14
- 7 Comparison of Short-listed Options 14
- 8 Additional Analyses and Assessment 15
 - 8.1 Generation Addition Sensitivity Analysis 15
 - 8.2 Load Scaling Sensitivity Analysis 15
 - 8.3 Sub-synchronous Resonance (SSR) Assessment 16
- 9 Congestion Analysis 16
- 10 Conclusion 16
- 11 Appendix 18

1 Introduction

In December 2022, CPS submitted the San Antonio South Reliability Project to the RPG to address NERC Category P1 thermal overloads of the 345-kV J.K. Spruce to Pawnee transmission line. As shown in Figure 1.1, there are currently only two 345-kV transmission paths from Southern Texas into the San Antonio area. One of these paths approaches San Antonio from the South and is a single circuit with a total normal capacity of 1,051 MVA. The other is a double circuit with a combined total normal capacity of 2,372 MVA, which loops around San Antonio to the East and enters the San Antonio area from the North. As of 2027, there will be three 345-kV corridors from Southern Texas to the two substations shown at the bottom of Figure 1.1 (San Miguel and Pawnee). These stations are approximately 50 miles south of San Antonio. With the contingent loss of either of the two paths from those substations into San Antonio, only one path that would be left to serve San Antonio and modeling shows this path would be subjected to a significant increase in loading.

The CPS-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 \$281 million. ERCOT conducted an Independent Review for this RPG project to identify any reliability needs in the area including the project need (138-kV transmission line thermal overloads in the South and Northeast San Antonio areas) and evaluated various transmission upgrade options. This report describes the study assumptions, methodology, and the results of the ERCOT Independent Review of the project.

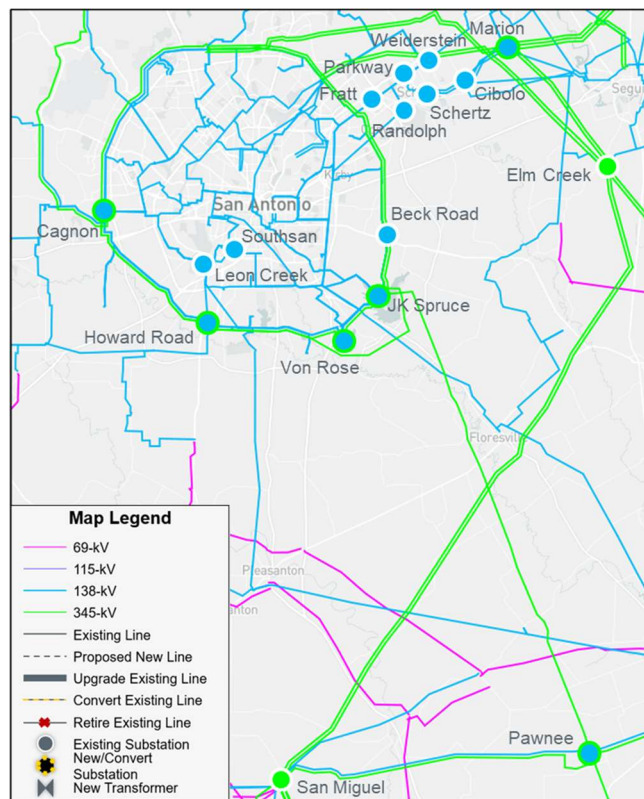


Figure 1.1: Map of Transmission System in The San Antonio Area

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 San Antonio South Reliability 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 the South and South-Central weather zones in Bexar and Atascosa Counties. Nearby counties that were also studied because they are electrically close via the 345-kV transmission system include Karnes, Wilson, and Guadalupe 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 outlook. 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 South and South-Central (SSC) weather zones.

- Case: 2022RTP_2027_SUM_SSC_12222022¹

2.1.2 Transmission Topology

Transmission projects within the study area with In-Service Dates (ISDs) through June 2027 were added to the study base case. The ERCOT Transmission Project Information and Tracking (TPIT)² report for October 2022 was used as reference. The added TPIT projects are listed in Table 2.1. These projects are all classified as Tier 3 and Tier 4 projects. No new Tier 1 or Tier 2 projects were added to the study base case because these were already modeled in the final RTP cases.

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>.

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

TPIT No	Project Name	Tier	Project ISD	TSP	County
45084B	Braunig to Highland Rebuild	Tier 4	Jul-23	CPS	Bexar
70536	New 138 kV Verde Circle Substation	Tier 4	Oct-24	CPS	Bexar
45029	Grandview Highland Hills Rebuild	Tier 4	Jun-25	CPS	Bexar
45084A	Braunig to Highland Rebuild	Tier 4	Jun-25	CPS	Bexar
67992B	CPSE_345KV_Howard_Switching_Station, CPSE_Hamilton_to_MedCtr_Upgrade, CPSE_Medina_to_36th_Street_Upgrade	Tier 3	Jun-25	CPS	Bexar
67992C	CPSE_345KV_Howard_Switching_Station, CPSE_Hamilton_to_MedCtr_Upgrade, CPSE_Medina_to_36th_Street_Upgrade	Tier 3	Jun-25	CPS	Bexar
67992A	CPSE_345KV_Howard_Switching_Station, CPSE_Hamilton_to_MedCtr_Upgrade, CPSE_Medina_to_36th_Street_Upgrade	Tier 3	Jun-25	CPS	Bexar
15TPIT0031	Chavaneaux_Chavaneaux Tap Rebuild (Brooks to Chavaneaux ckt)	Tier 4	Jun-26	CPS	Bexar
4320	CPSE_Brooks to Chavaneaux MLSE	Tier 4	Dec-26	CPS	Bexar
4323	CPSE_Braunig to Brooks MLSE	Tier 4	Jun-27	CPS	Bexar

The RTP project shown in Table 2.2 was used as a placeholder for the San Antonio South Reliability project and was removed from study base case.

Table 1.2: List of Transmission Projects Removed from the Study Base Case

RTP Project ID	Project Name	TSP	County
2022-SC6	Howard - San Miguel 345-kV Double Circuit Line Addition and Beck Road 345/138-kV Substation Expansion	CPS, STEC	Bexar, Atascosa

2.1.3 Generation

Based on the December 2022 Generator Interconnection Status (GIS)³ report posted on the ERCOT website on January 3, 2023, generators in the study area 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. 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 December 2022 GIS Report

GINR	Project Name	Fuel	Project COD	Capacity (MW)	County
22INR0368	Padua Grid BESS	OTH	Mar-24	202.6	Bexar

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 opened in the study base case to reflect their mothballed/retired status.

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

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
110273	AMOCOOIL_AMOCO_5	32.0	Coast
110020	PNPI_GT2	71.0	Coast
150081	OLINGR_OLING_1	78.0	North Central
170381	OCI_ALM1_ASTRO	1.0	South-Central
170131	BRAUNIG_VHB1	217.0	South-Central
170132	BRAUNIG_VHB2	230.0	South-Central
170133	BRAUNIG_VHB3	412.0	South-Central

2.1.4 Loads

Loads in the study weather zones were consistent with the 2022 RTP.

Loads outside the study weather zones were adjusted to maintain the minimum reserve requirements consistent with the 2022 RTP.

2.1.5 Maintenance Outage Scenario

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

The load levels in the South and South-Central weather zones were reduced to 91.2%⁴ and 83.7%⁴ of their summer peak load levels, respectively. This scaling is meant to reflect assumed off-peak season loads based on historical real-time load data of the South and South-Central weather zones.

2.2 Study Assumption for Sensitivity Scenario

2.2.1 Operation Summer Peak Sensitivity Analysis

The 2022 Operations Peak Sensitivity case was created based on the July 20, 2022, Summer Peak Operations case. The CPS Howard Switching Station (TPIT Project 67992) was added to this case, which was necessary for connecting Options 3 and 5 for testing. Critical contingencies and circuits seen in the N-1 reliability study, maintenance outage scenario analysis, and long-term load serving capability assessment were monitored under N-0 and N-1 conditions. Then, scenarios for Options 3, 4, and 5 (the short-listed options) were created based on this case, and the contingencies were tested to determine the potential impact of each option.

2.3 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.

⁴ This percentage was determined based on the review of top ten historical loads in Spring, Fall, and Winter for the last three years associated with the South and South-Central Weather Zones.

The 2022 RTP 2027 economic final case was updated based on the December 2022 GIS report for generation updates and the October 2022 TPIT report for transmission updates to conduct congestion analysis. 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 project shown in Table 2.2 that was used as a placeholder for the San Antonio South Reliability project was removed from the economic base case.

New generation additions listed in Table 2.5 were added to the economic base case and all generation listed in Table 2.4 were opened in the study base case to reflect their mothballed/retired status.

Table 2.5: List of Generation Added to the Economic Base Case Based on December 2022 GIS Report

GINR	Project Name	Fuel	Project COD	Capacity (MW)	County
21INR0203	Eastbell Milam Solar	SOL	Oct-23	244.9	Milam
21INR0223	Tulsita Solar	SOL	Dec-24	261.0	Goliad
21INR0351	7V Solar	SOL	Nov-23	244.6	Fayette
22INR0368	Padua Grid BESS	OTH	Mar-24	202.6	Bexar
22INR0397	Buckeye Corpus Fuels Solar	SOL	Dec-23	57.6	Nueces
22INR0398	Sabal Storage	OTH	May-23	18.0	Cameron
22INR0551	Wolf Tank Storage	OTH	Mar-23	155.5	Webb
23INR0007	Outpost Solar	SOL	Apr-24	513.7	Webb
23INR0047	Charger Solar	SOL	May-24	406.8	Refugio
23INR0162	Redonda Solar	SOL	Dec-24	253.2	Zapata
23INR0166	Great Kiskadee Storage	OTH	Aug-24	103.1	Hidalgo
23INR0343	Guajillo Energy Storage	OTH	Sep-24	201.1	Webb
23INR0369	Anemoi Energy Storage	OTH	Dec-23	205.0	Hidalgo
23INR0472	Frontera Energy Center	GAS	Jun-23	524.0	Hidalgo

2.4 Methodology

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

2.4.1 Contingencies and Criteria

The reliability assessments were performed based on NERC Reliability Standard TPL-001-5.1, ERCOT Nodal Protocols, and Planning Criteria⁵.

Contingencies⁶ 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);

⁵ ERCOT Planning Criteria: <http://www.ercot.com/mktrules/guides/planning/current>.

⁶ Details of each event and contingency category are defined in the NERC reliability standard TPL-001-5.1.

- P3-1: G-1 + N-1 (G-1: generation outages) {OW Sommers Unit 2, San Miguel Unit 1, JK Spruce Unit 2, and Leon Creek Peaker Units 1-4}; and
- P6-2: X-1 + N-1 (X-1: 345/138-kV transformers only) {Howard Road, San Miguel, and Pawnee Switch}.

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.

2.4.2 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 a thermal overload issue under G-1+N-1 contingency in the study area. Under the G-1 scenario with Sommers Unit 2 taken out-of-service, six N-1 violations were observed. Per CPS, Sommers Unit 2 has a planned retirement in March 2029, which further validates its study as a G-1 scenario.

Various 345-kV and 138-kV transmission line outages caused overloads in the 138-kV system. 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 %
P7: N-1	HOWARD (5230) -> LEON_CRK (5260) CKT 1	138	4.88	101.39
P1: N-1	L_MARION8_1Y (7178) -> L_CIBOLO8_1Y (7608) CKT 1	138	4.81	102.91
P1: N-1	L_MARION8_1Y (7178) -> L_CIBOLO8_1Y (7608) CKT 2	138	4.81	103.24
P7: N-1	L_PARKWA8_1Y (7611) -> FRATT (5165) CKT 1	138	4.09	103.52
P7: N-1	L_SCHERT8_1Y (7610) -> L_PARKWA8_1Y (7611) CKT 1	138	2.83	105.01
P7: N-1	L_WEIDER8_1Y (7461) -> RANDOLPH (5360) CKT 1	138	5.47	102.74

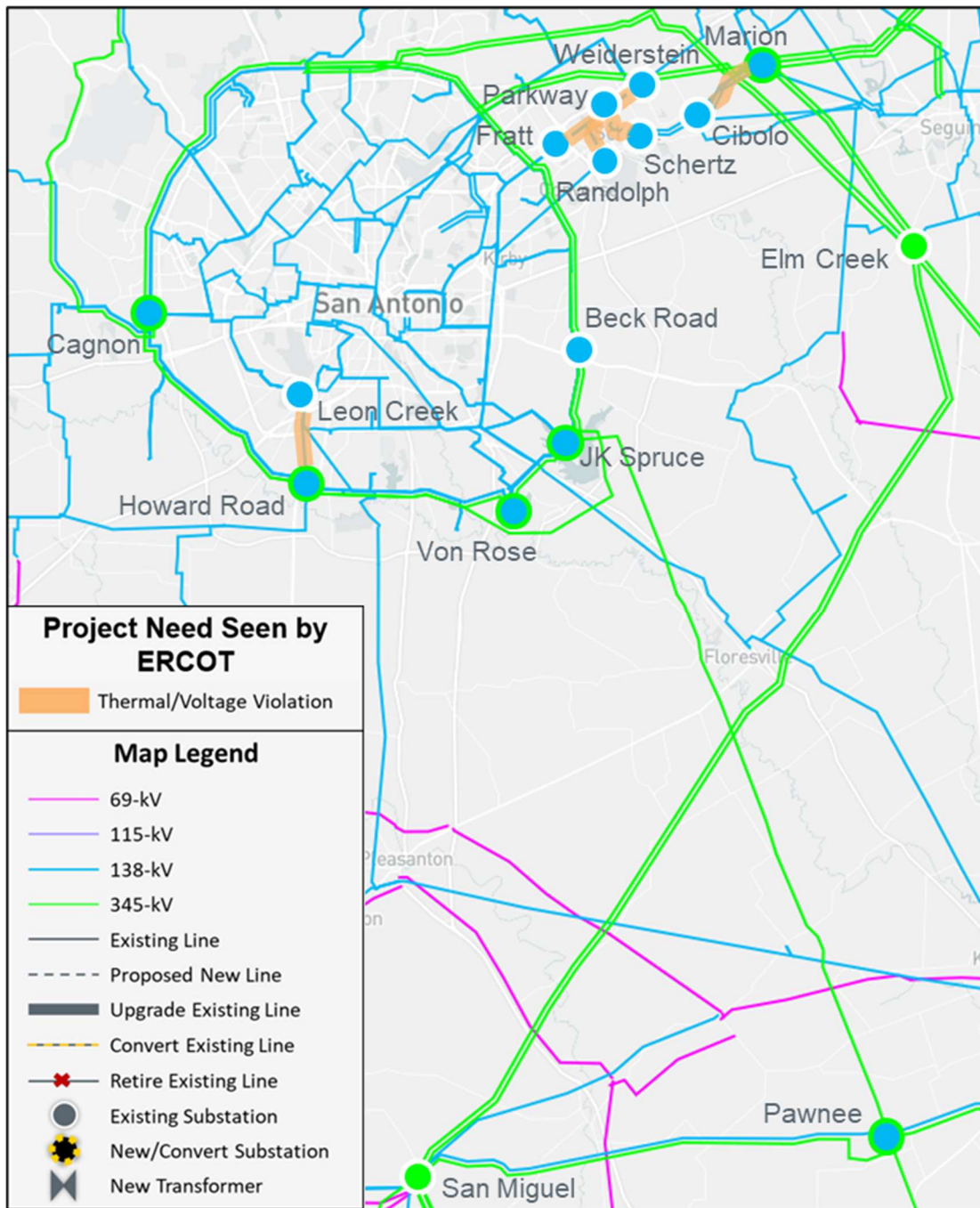


Figure 3.1: Study Area Map Showing Project Needs

4 Description of Project Options

ERCOT initially evaluated five system-improvement options to address the thermal overloads that were observed in the study base case in the San Antonio area. All five options resolved the N-1 thermal overloads in the study area. Detailed maps of each option are provided in Appendix A.

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

- Construct a new, 50-mile Howard Road to San Miguel 345-kV double-circuit transmission line with a normal and emergency rating of at least 1,982 MVA per circuit; this transmission line will require new ROW;
- Rebuild the existing 14.9-mile Cagnon to Howard Road 345-kV double-circuit transmission line with a normal and emergency rating of at least 1,746 MVA per circuit;
- Rebuild the existing 4.9-mile Howard Road to Leon Creek 138-kV transmission line with a normal and emergency rating of at least 478 MVA, will require 1.7 miles of new ROW; and
- Add a third 600-MVA 345/138-kV autotransformer at Howard Road substation.

Option 2 consists of the following:

- Construct a new, 345-kV substation (New Station) between Spruce to Pawnee and San Miguel to Elm Creek 345-kV circuits;
- Construct a new, 38-mile, Howard Rd to (New Station) double-circuit 345-kV transmission line with a normal and emergency rating of at least 1,982 MVA per circuit; this transmission line will require new ROW;
- Rebuild and convert the existing, 26-mile (New Station) to Pawnee 345-kV transmission line to a double-circuit transmission line with a normal and emergency rating of at least 1,982 MVA per circuit;
- Rebuild the existing, 13.9-mile Elm Creek to Marion 345-kV double-circuit transmission line with a normal and emergency rating of at least 1,746 MVA per circuit;
- Rebuild the existing, 4.9-mile Howard Road to Leon Creek 138-kV transmission line with a normal and emergency rating of at least 478 MVA; this will require 1.7 miles of new ROW; and
- Add a third 600-MVA 345/138-kV autotransformer at Howard Road substation.

Option 3 consists of the following:

- Rebuild and convert the existing, 45.8-mile Spruce to Pawnee 345-kV line to a double-circuit transmission line with a normal and emergency rating of at least 1,982 MVA per circuit;
- Rebuild the existing, 35-mile Howard Rd to Spruce and Howard Rd to Von Rose 345-kV transmission lines with normal and emergency ratings of at least 1,746 MVA per circuit;
- Rebuild the existing, 13.9-mile Elm Creek to Marion 345-kV double-circuit transmission line with a normal and emergency rating of at least 1,746 MVA per circuit;
- Rebuild the existing, 5.2-mile Beck to Spruce 345-kV double-circuit transmission line with a normal and emergency rating of at least 1,792 MVA per circuit; and
- Build Beck Road 345/138-kV switchyard and install two 600-MVA autotransformers.

Option 4 consists of the following:

- Rebuild the existing, 4.9-mile Howard Rd to Leon Creek 138-kV transmission line with a normal and emergency rating of at least 478 MVA; this will require 1.7 miles of new ROW;
- Rebuild the existing, 2.9-mile Leon Creek to Southsan 138-kV transmission line with a normal and emergency rating of at least 478 MVA;

- Rebuild the existing, 4.1-mile Fratt to Parkway 138-kV transmission line with a normal and emergency rating of at least 478 MVA;
- Rebuild the existing, 5.5-mile Randolph to Weiderstein 138-kV transmission line with a normal and emergency rating of at least 478 MVA;
- Rebuild the existing, 4.8-mile Marion to Cibolo Double Circuit 138-kV transmission line with a normal and emergency rating of at least 478 MVA per circuit; and
- Rebuild the existing, 2.8-mile Schertz to Parkway 138-kV transmission line with a normal and emergency rating of at least 478 MVA.

Option 5 consists of the following:

- Construct a new, 50-mile Howard Road to San Miguel 345-kV double-circuit transmission line with a normal and emergency rating of at least 1,982 MVA per circuit; this transmission line will require new ROW;
- Rebuild the existing, 14.9-mile Cagnon to Howard Road 345-kV double-circuit transmission line with a normal and emergency rating of at least 1,746 MVA per circuit;
- Rebuild the existing, 4.9-mile Howard Road to Leon Creek 138-kV transmission line with a normal and emergency rating of at least 698 MVA; this will require 1.7 miles of new ROW;
- Add a third 600-MVA 345/138-kV autotransformer at Howard Road substation; and
- Rebuild the existing, 2.9-mile Leon Creek to Southsan 138-kV transmission line with a normal and emergency rating of at least 478 MVA.

5 Option Evaluations

ERCOT performed reliability analysis to evaluate all initial options and to identify any reliability impacts of the options in the study area. Based on the results of these analyses, short-listed options were selected for further evaluations. This section details these studies and their results and compares the short-listed options.

5.1 Results of Reliability Analysis

All initial options were evaluated based on the contingencies described in the methodology section of the report, and no reliability criteria violations were identified for Options 3, 4, and 5 as shown in Table 5.1.

Table 5.1: Results of Initial Reliability Assessment of All Five Options

Option	Unsolved Power Flow	N-1		X-1 + N-1		G-1 + N-1	
		Thermal Overload	Voltage Violation	Thermal Overload	Voltage Violation	Thermal Overload	Voltage Violation
1	None	None	None	1	None	None	None
2	None	None	None	1	None	None	None
3	None	None	None	None	None	None	None
4	None	None	None	None	None	None	None
5	None	None	None	None	None	None	None

6 Short-listed Options

As shown in Table 5.1, Options 3, 4, and 5 met all the reliability criteria, and these options were short-listed for further assessment. These three options are illustrated in Figures 6.1, 6.2, and 6.3.

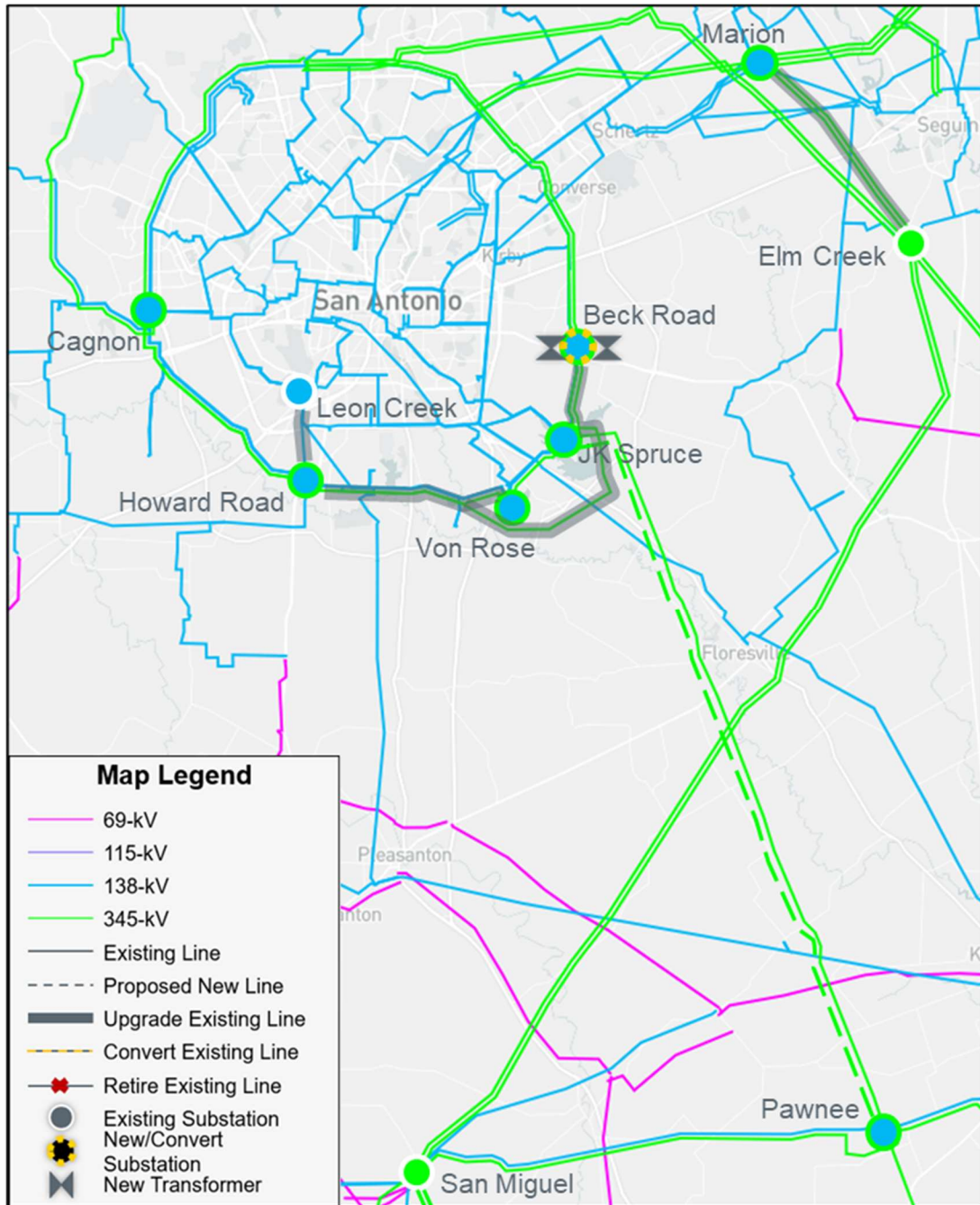


Figure 6.1: Map of Option 3

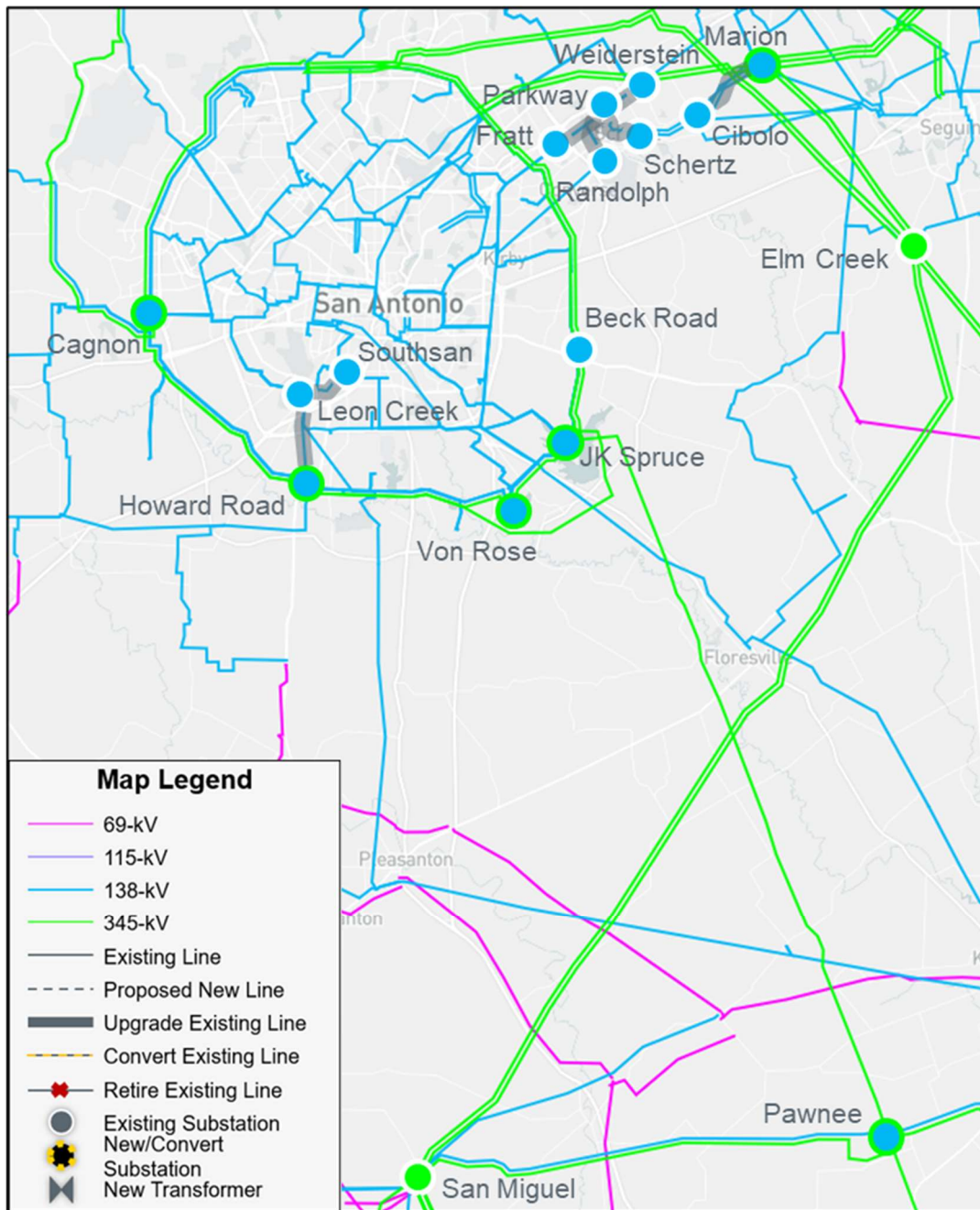


Figure 6.2: Map of Option 4

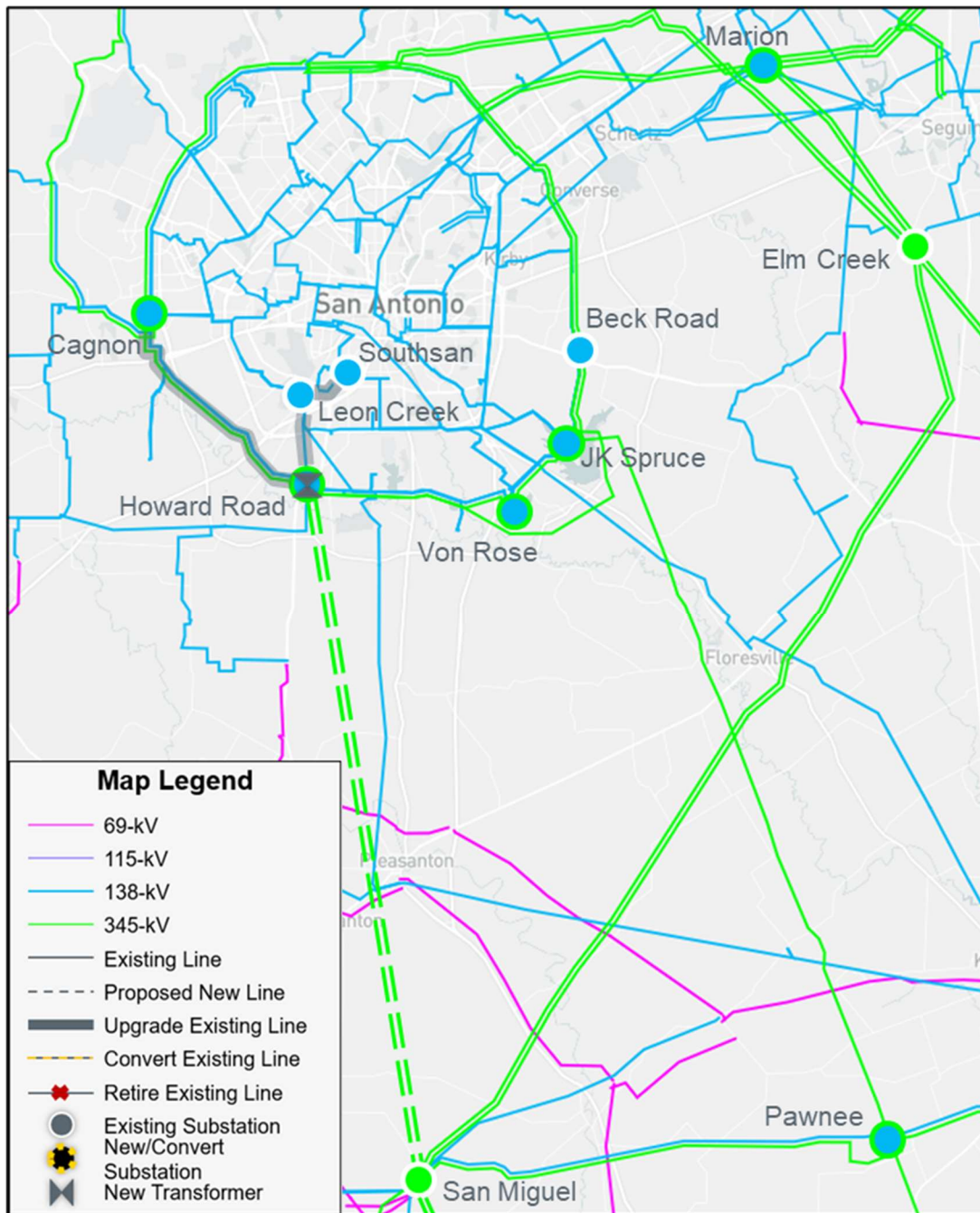


Figure 6.3: Map of Option 5

6.1 Long-Term Load Serving Capability Assessment

ERCOT performed a long-term load serving capability assessment on the short-listed options. Scenario 1 assess the load serving capability of the San Antonio Area, and Scenario 2 assess the same in a high Southern wind export condition. In Scenario 1, ERCOT increased load at substations within the San Antonio area and decreased conforming load outside of the South-Central weather zone to balance power. In Scenario 2, ERCOT increased load at substations within the study area and

increased wind generation within the Southern weather zone to balance power. The results of the long-term load serving capability assessment are shown in Table 6.1 below.

Table 6.1: Results of Long-Term Load Serving Capability Assessment of Base Case and Options 3, 4, and 5

Option	Incremental Load Serving Capability (MW)	
	Scenario 1	Scenario 2
Base case	353	359
3	813	845
4	393	403
5	510	534

6.2 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 short-listed option 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. As shown in Table 6.2, the results of this maintenance assessment indicate that Options 3 and 5 performed similarly and better than Option 4.

Table 6.2: Results of Planned Maintenance Outage Evaluation for the Short-Listed Options

Option	Unsolved Power Flow	Thermal Overloads	Thermal Loading Change from Base case	Voltage Violations
3	None	1	Reduced	None
4	None	1	Increased	None
5	None	1	Reduced	None

6.3 Operations Summer Peak Sensitivity Analysis

ERCOT conducted a sensitivity analysis based on the July 20, 2022, Summer Peak Operations case. Critical contingencies and circuits seen in the N-1 reliability study, maintenance outage scenario analysis, and long-term load serving capability assessment were monitored under N-0 and N-1 conditions. The only circuit with significant loading in this study was the Spruce to Pawnee 345-kV transmission line. Therefore, Table 6.3 focuses on that circuit. Both Options 3 and 5 addressed the project need as seen by CPS, whereas Option 4 did not, as shown in Table 6.3.

Table 6.3: Results of 2022 Operations Summer Peak Case Sensitivity for the Short-Listed Options

Option	N-0 Loading on Spruce to Pawnee 345-kV Line (% MVA Limit)	N-1 Loading on Spruce to Pawnee 345-kV Line (% MVA Limit)
Base case	62	102
Option 3	27	37
Option 4	62	102
Option 5	47	54

6.4 Cost Estimate and Feasibility Assessment

CPS, South Texas Electric Cooperative (STEC), Lower Colorado River Authority (LCRA), Brazos Electric Cooperative (BREC), and Guadalupe Valley Electric Cooperative (GVEC) performed feasibility assessments and provided cost estimates for the three short-listed options. Based on input from CPS, Option 4 was deemed infeasible due to the complete de-energization of an existing substation that would be required during construction. Table 6.4 summarizes the cost estimates, mileage of CCN required, and feasibility of the three short-listed options.

Table 6.4: Cost Estimates and Feasibility of the Short-Listed Options

Option	Cost Estimates (\$M)	CCN Required (Miles)	Feasibility
Option 3	505.6*	0.0	Feasible
Option 4	N/A	1.7	Not Feasible
Option 5	329.1	51.7	Feasible

* Updated cost estimate from the original estimate in the RPG submittal and may increase to include additional transmission upgrades

7 Comparison of Short-listed Options

The study results demonstrated that all three short-listed options addressed the project need as seen by ERCOT in the study area. Comparisons of the short-listed options, with corresponding cost estimates provided by CPS, STEC, LCRA, BREC, and GVEC, is summarized in Table 7.

Table 7: Comparison of Short-listed Options with Cost Estimates

	Option 3	Option 4	Option 5
Meets ERCOT and NERC Reliability Criteria	Yes	Yes	Yes
Improves Long-Term Load Serving Capability	Yes (Better)	Marginally	Yes
Improves Performance in Summer Peak Operations Case Sensitivity	Yes	No	Yes
Improves Operational Flexibility	No	No	Yes
Provides an additional transfer path from South	No	No	Yes
Requires CCN (Miles)	No	Yes (1.7)	Yes (51.7)
Construction Feasible (Based on TSP assessment)	Yes	No	Yes
Cost Estimate* (\$M)	505.6*	N/A	329.1

* Updated cost estimate from the original estimate in the RPG submittal and may increase to include additional transmission upgrades

ERCOT recommends Option 5 as the preferred option to address the reliability need in the San Antonio area based on the following considerations:

- Options 3 and 5 both improve long-term load serving capability and improve performance in the summer peak operations case sensitivity. However, Option 5 improves operational flexibility and provides an additional transfer path from Southern Texas into the San Antonio area;
- Further, Option 5 is significantly less expensive than Option 3.

8 Additional Analyses and Assessment

The preferred option (Option 5, approximately \$329.1 million) is categorized as a Tier 1 project, pursuant to ERCOT Protocol 3.11.4.3. 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.

8.1 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 March 2023 GIS⁷ reports, 11 units were found within the South and South-Central weather zones load pocket which could have an impact on the identified reliability issues. These units are listed in Table 8.1. After the addition of the units to the Option 5 case, no new thermal or voltage violations were identified.

Table 8.1: List of Units that Could Have Impact on the Identified Reliability Issues

GINR	Unit Name	Fuel Type	Capacity (MW)	County
19INR0022	Monte Alto I	WIN	189.00	Willacy
19INR0023	Monte Alto 2 Wind	WIN	272.76	Willacy
20INR0086	Arroyo Solar	SOL	180.00	Cameron
21INR0226	Equinox Solar 1	SOL	200.00	Starr
21INR0391	Grandslam Solar	SOL	121.89	Atascosa
22INR0251	Shaula I Solar	SOL	205.20	DeWitt
22INR0257	Corazon Solar Phase II	SOL	203.90	Webb
22INR0267	Shaula II Solar	SOL	205.20	DeWitt
23INR0061	Noria Solar DCC	SOL	145.00	Nueces
23INR0093	Alila Solar	SOL	256.50	San Patricio
25INR0223	Uhland Maxwell	GAS	184.00	Caldwell

8.2 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 SSC summer peak case from the 2022 RTP and adjusted the load to create the 2027 SSC summer peak case to study the San Antonio area. 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, West, Far West, 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 South and South-Central weather zones) were calculated

⁷ GIS Report: <https://www.ercot.com/mp/data-products/data-product-details?id=PG7-200-ER>.

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 San Antonio area.

8.3 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 5) and found no adverse SSR impacts to the existing and planned generation resources in the study area.

9 Congestion Analysis

ERCOT conducted a congestion analysis to identify any potential impact on system congestion related to the addition of the recommend project, Option 5, using the 2022 RTP 2027 final economic case.

The results of congestion analysis indicated Option 5 relieved three existing congestions and caused one new congestion as shown in Table 9.1.

Table 9.1: List of New and Existing Congestion Due to Transmission Upgrade of Option 5

Monitored Line	% Time of Congestion	New / Existing
Howard Road to Leon Creek 138-kV Line	24.02	Existing
Leon Creek to Southsan 138-kV Line	0.83	Existing
Spruce to Pawnee 345-kV Line	0.74	Existing
Cagnon to Vlsi 138-kV Line	0.73	New

An additional test was conducted by upgrading Cagnon to Vlsi 138-kV line to see if this alleviated the new congestion. Based on the results summarized in Table 9.2, the additional upgrade did not yield any economic benefit. Therefore, no upgrades will be recommended to solve this new congestion as part of Option 5.

Table 9.2: Test Results with Cagnon to Vlsi 138-kV Line Upgrade

Upgrade Tested	Mileage (mi)	Passed Production Cost Savings Test	Passed Generation Revenue Reduction Test
Cagnon to Vlsi 138-kV Line Upgrade	8.7	No	No

10 Conclusion

ERCOT evaluated the five transmission-upgrade options to resolve the thermal violations observed in the San Antonio area. Based on the results of the independent review, ERCOT recommends Option 5 as the preferred solution because it addresses the thermal violations while introducing no new reliability issues, improves the long-term load serving capability of the San Antonio Area, improves performance in the summer peak operations case sensitivity, improves operational flexibility, and


provides a new transmission path from Southern Texas to the San Antonio area while also being the least cost of the two feasible short-listed options.

Option 5 consists of the following upgrades and is estimated to cost approximately \$329.1 million:

- Construct a new, 50-mile Howard Road to San Miguel 345-kV double-circuit transmission line with a normal and emergency rating of at least 1,982 MVA per circuit; this transmission line will require 50 miles of new ROW;
- Rebuild the existing, 14.9-mile Cagnon to Howard Road 345-kV double-circuit transmission line with a normal and emergency rating of at least 1,746 MVA per circuit;
- Rebuild the existing, 4.9-mile Howard Road to Leon Creek 138-kV transmission line with a normal and emergency rating of at least 698 MVA; this will require 1.7 miles of new ROW;
- Add a third 600-MVA 345/138-kV autotransformer at Howard Road substation; and
- Rebuild the existing, 2.9-mile Leon Creek to Southsan 138-kV transmission line with a normal and emergency rating of at least 478 MVA.

This project will require one or more CCN applications for 1) the construction of the new, 345-kV double-circuit transmission line from Howard Road 345-kV Substation to San Miguel 345-kV Substation due to approximately 50.0 miles of new ROW and 2) to rebuild the existing, 138-kV transmission line from Howard Road 138-kV Substation to Leon Creek 138-kV Substation due to approximately 1.7 miles of new ROW. The expected ISD of this project is June 2027.

11 Appendix

Index	Description	Document
A	Maps of all options	 Appendix A.pdf