LS Power Grid

JULY 21, 2026

Project Overview of CTT Panhandle Reliability Transmission Plan

ERCOT RPG Meeting

Cross Texas Transmission

an LS Power Grid Company

Introduction

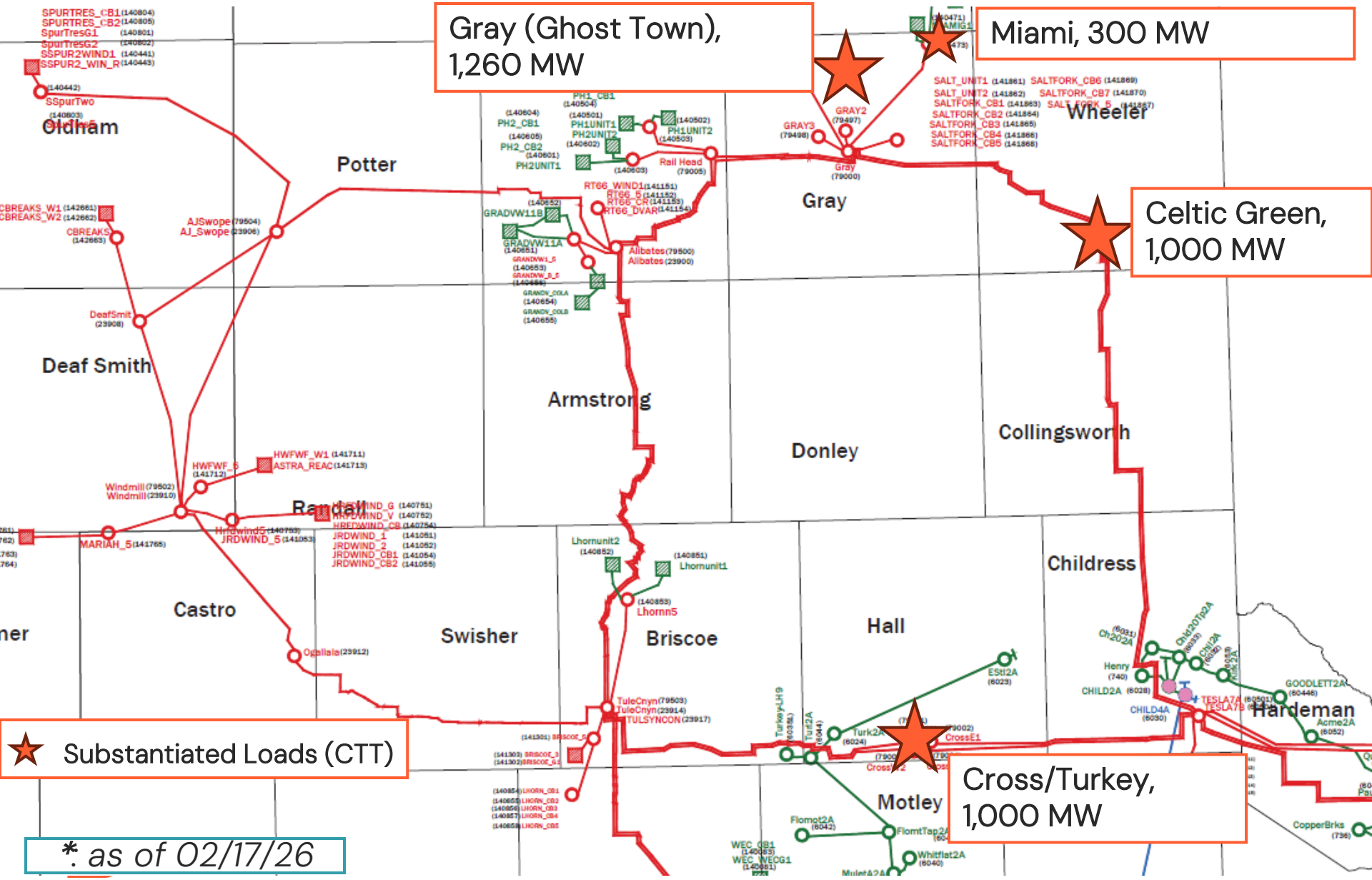
Introduction

- Panhandle and Nearby Panhandle regions are experiencing a high volume of substantiated load forecast
- A system wide study is necessary to address the reliability violations in this region
- CTT Panhandle Reliability Transmission Plan is proposed here as a Tier 1 project to ERCOT RPG for independent review
- This plan primarily consists of 765 kV transmission improvements with the main goal of reliably integrating large data center loads and reinforcing Panhandle resiliency under stressed system conditions
- The 765 kV system also better accommodates new generation resources and the uncertainty of their locations.

CTT System Needs

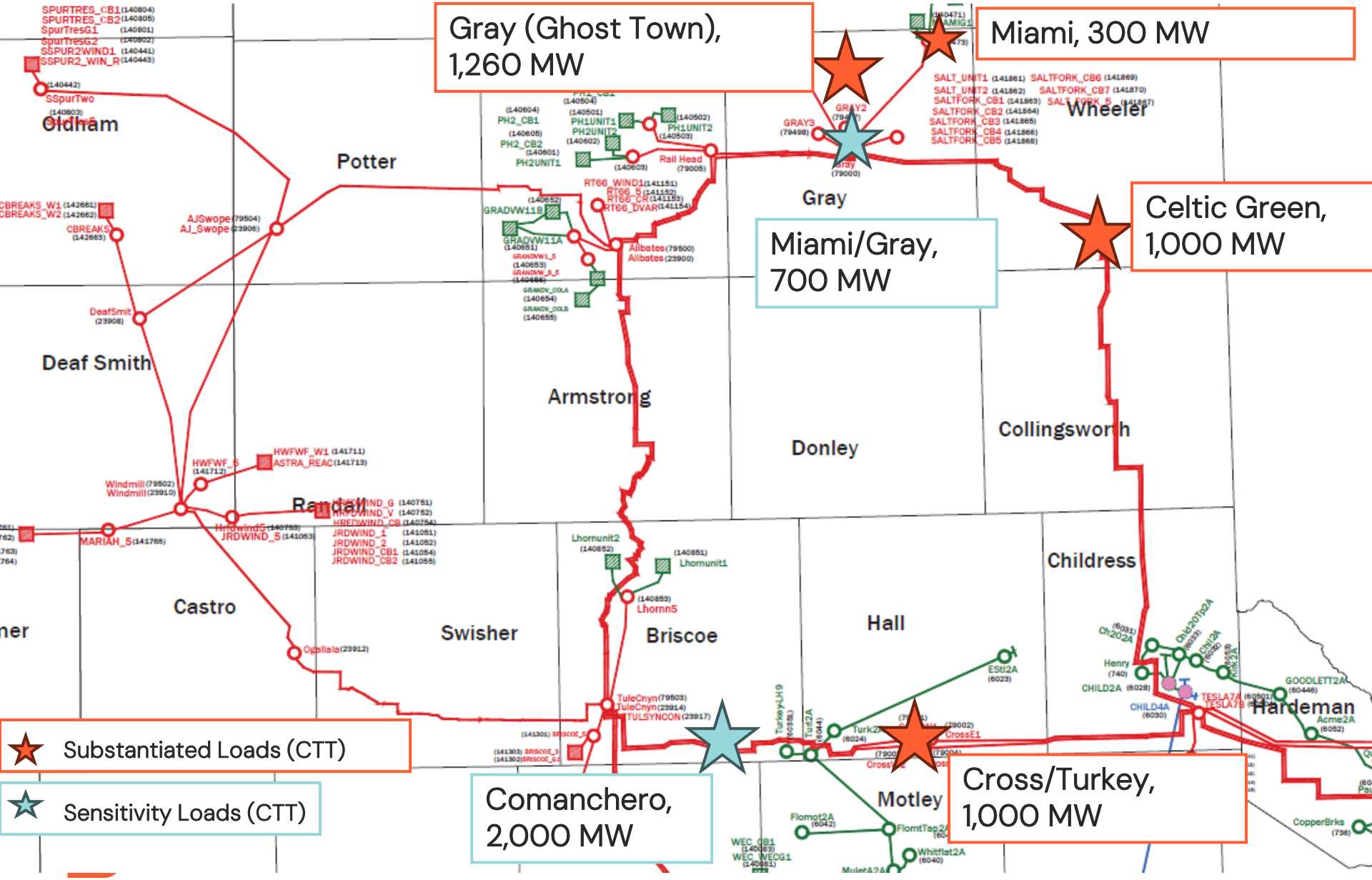
- CTT has received multiple large load interconnection requests in the Panhandle region
- FIRM loads: 3,560 MW (all qualifying as "Substantiated Load" per ERCOT Protocol Section 2)
- Additional pending requests: 2,700 MW
- Primary load type: 24/7 data centers
- These loads — combined with nearby area loads — create significant reliability violations that exceed what the existing 345 kV infrastructure can handle
- CTT's load sites (Gray, Celtic Green, Turkey) are served by only two 345 kV double circuits
- A single element outage followed by a tower outage causes severe voltage violations across the entire CTT and neighboring TSP systems
- With continued load growth, 345 kV or reactive support solutions alone were found to be insufficient as the violations are widespread across these regions
- Incremental transfer analysis in the past also confirmed insufficient import capability into the Panhandle region
- As a result, at least one additional, robust transmission import path is recommended

Substantiated* Loads (Base = 3,560 MW)



*: as of 02/17/26

Loads Under Review (Sensitivity = Addl. 2,700 MW)



Assumptions and Methodology

Study Approach

Study Area

- Panhandle and Nearby Panhandle regions, chiefly focusing on the 345 kV system and above

Two Load Scenarios Evaluated:

- *BASE LOAD SCENARIO*
  - 3,560 MW of FIRM (substantiated) load
  - Evaluated under: Summer Peak, Maintenance Outage, and Sunset conditions
- *SENSITIVITY LOAD SCENARIO*
  - Base loads + 2,700 MW of near-FIRM load
  - Evaluated under: Summer Peak conditions
  - For informational purposes to support planning for future system needs

Analyses Performed:

- Steady State
- Dynamic Stability
- Short Circuit
- Subsynchronous Oscillation (SSO) Screening
- Shunt Reactor sizing assessment for 765 kV lines

Contingencies and Criteria

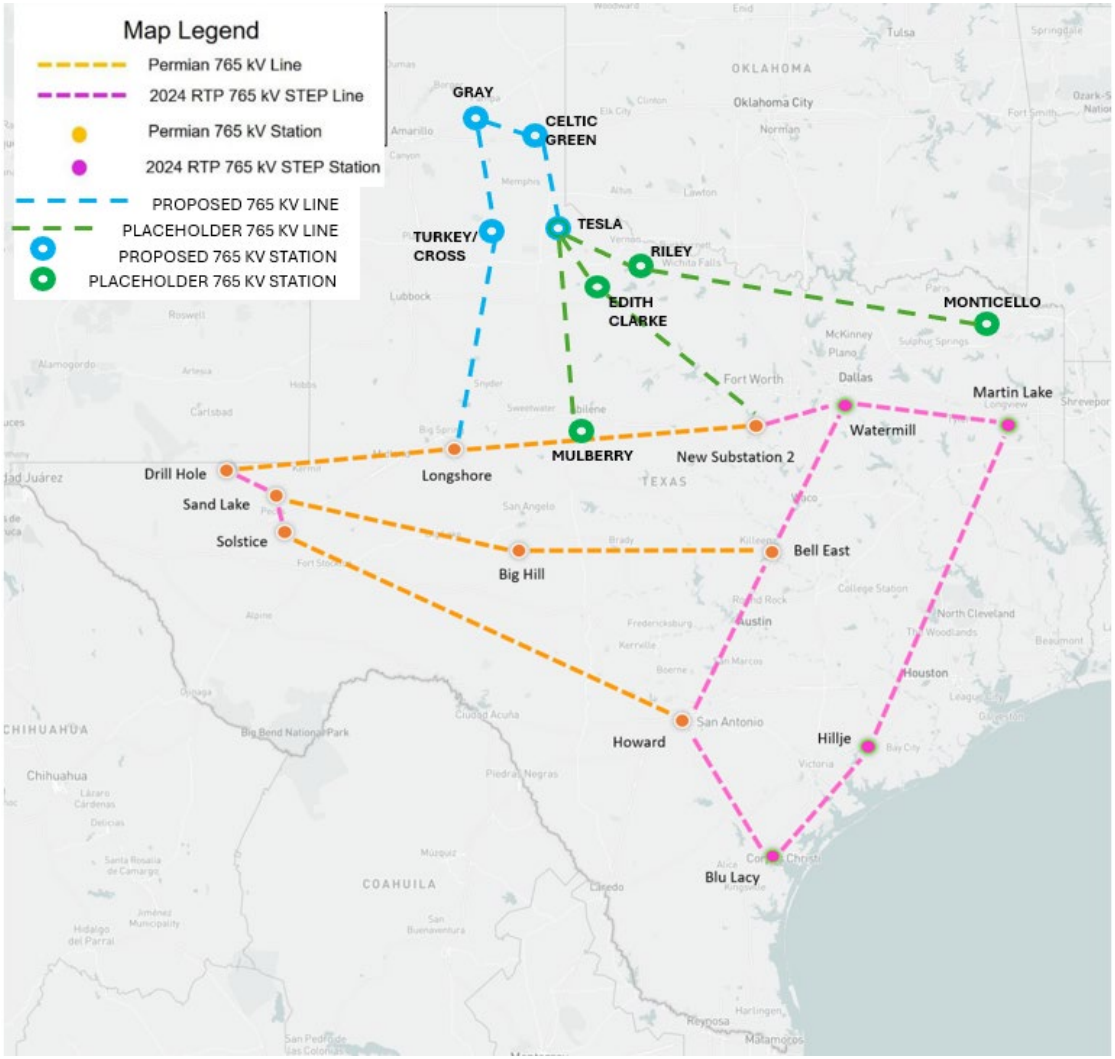
- Contingencies for Study Region
  - NERC TPL-001-5.1, ERCOT Planning Criteria, CTT Planning Criteria
    - P0 (system intact)
    - P1, P1-2, P7
    - P2 (remaining), P4, P5
    - P3: G-1 + N-1
    - P6: X-1 + N-1
    - P6: N-1-1 (reactive shunts were also included; P1+P1, P1+P7 and P7+P7 were studied under both summer peak and maintenance outage conditions)
- Criteria
  - Monitor all 345-kV and above busses, transmission lines, and transformers in the study region (excluding generator step-up transformers)
    - Thermal
      - Use Rate A for normal conditions
      - Use Rate B for emergency conditions
    - Voltage
      - Voltages exceeding their pre-contingency and post-contingency limits
      - Voltage deviations exceeding 8% on non-radial load buses

Placeholder Improvements

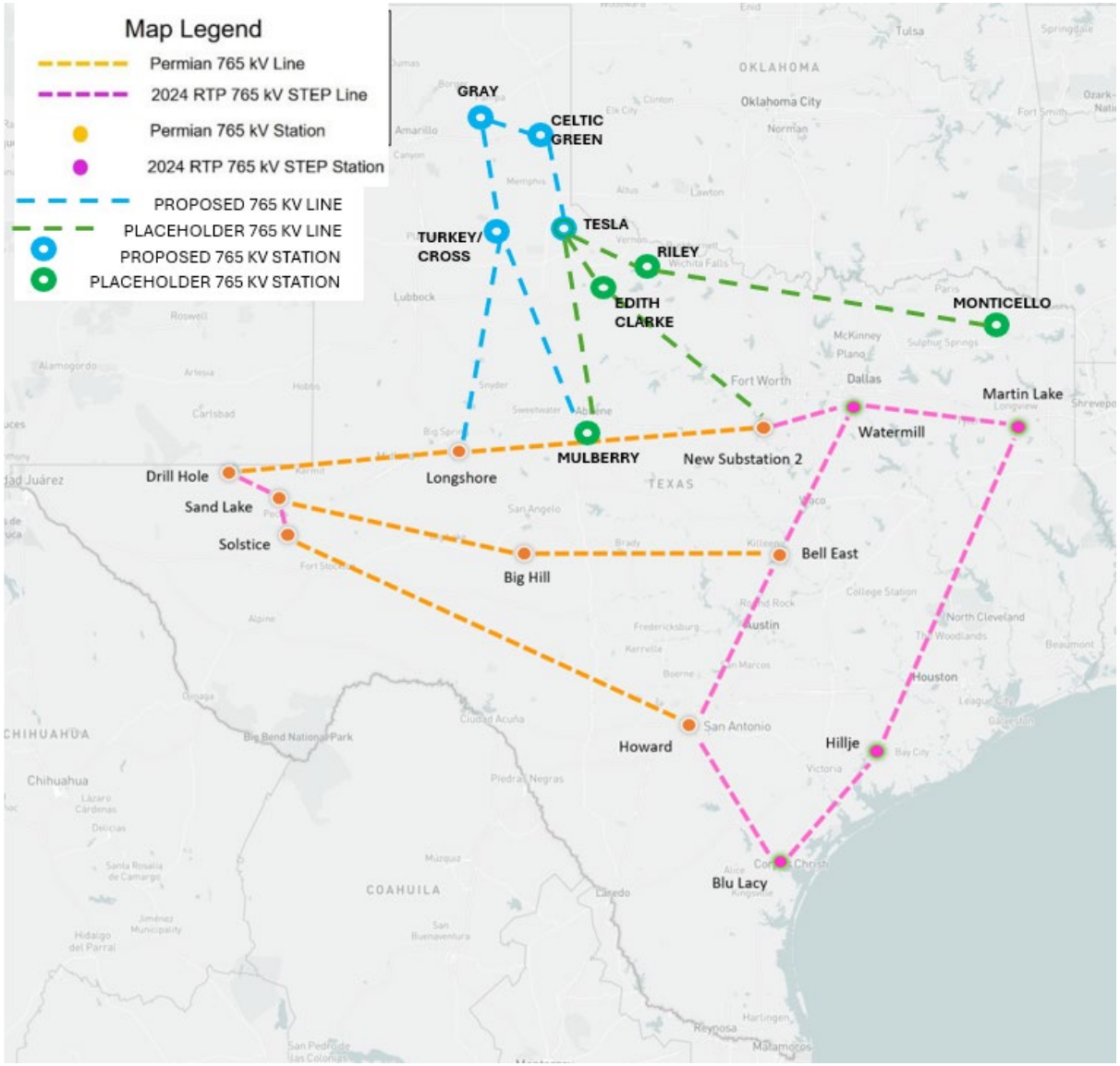
- Initial analysis of the Base Load Scenario showed significant system issues in CTT and nearby TSP systems. As a result, a placeholder solution was assumed in the Base Load Scenario to avoid non-convergence issues.
- It is to be noted here that these end points were chosen based on initial reliability screening results.
- These upgrades along with CTT Option 1 resolve all incremental non-convergence issues caused by the addition of large loads in the study cases. These upgrades, as a by-product, also relieve substantial thermal violations and low voltage issues in these areas.
- These placeholder improvements were only added to the extent of resolving non-convergences (P1 through P7) caused by base load additions. Any remaining thermal or voltage violations in the neighboring systems are under the purview of the respective TSPs and ERCOT and therefore beyond the scope of CTT's study.

Base Scenario Plan

OPTION 1


Map Legend
Permian 765 kV Line
2024 RTP 765 kV STEP Line
Permian 765 kV Station
2024 RTP 765 kV STEP Station
PROPOSED 765 KV LINE
PLACEHOLDER 765 KV LINE
PROPOSED 765 KV STATION
PLACEHOLDER 765 KV STATION
GRAY
CELTIC
GREEN
TURKEY/
CROSS
TESLA
RILEY
EDITH
CLARKE
MONTICELLO
MULBERRY
New Substation 2
Watermill
Martin Lake
Drill Hole
Longshore
Sand Lake
Solstice
Big Hill
Bell East
Howard
San Antonio
Hillje
Blu Lacy
Houston
Austin
Dallas
Fort Worth
OKLAHOMA
TEXAS
CHIHUAHUA
COAHUILA

OPTION 2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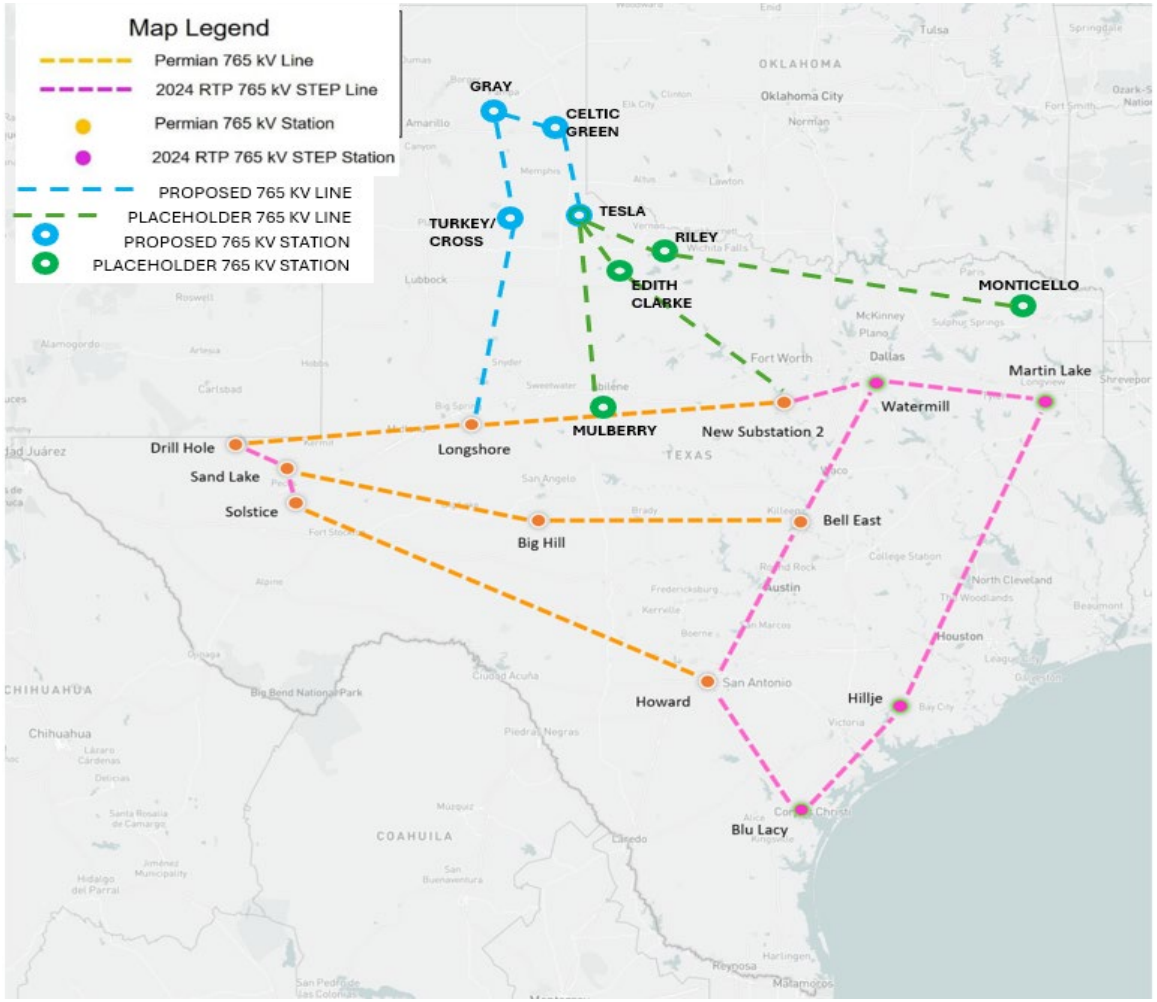
OKLAHOMA
TEXAS
COAHUILA
CHIHUAHUA
Chihuahua

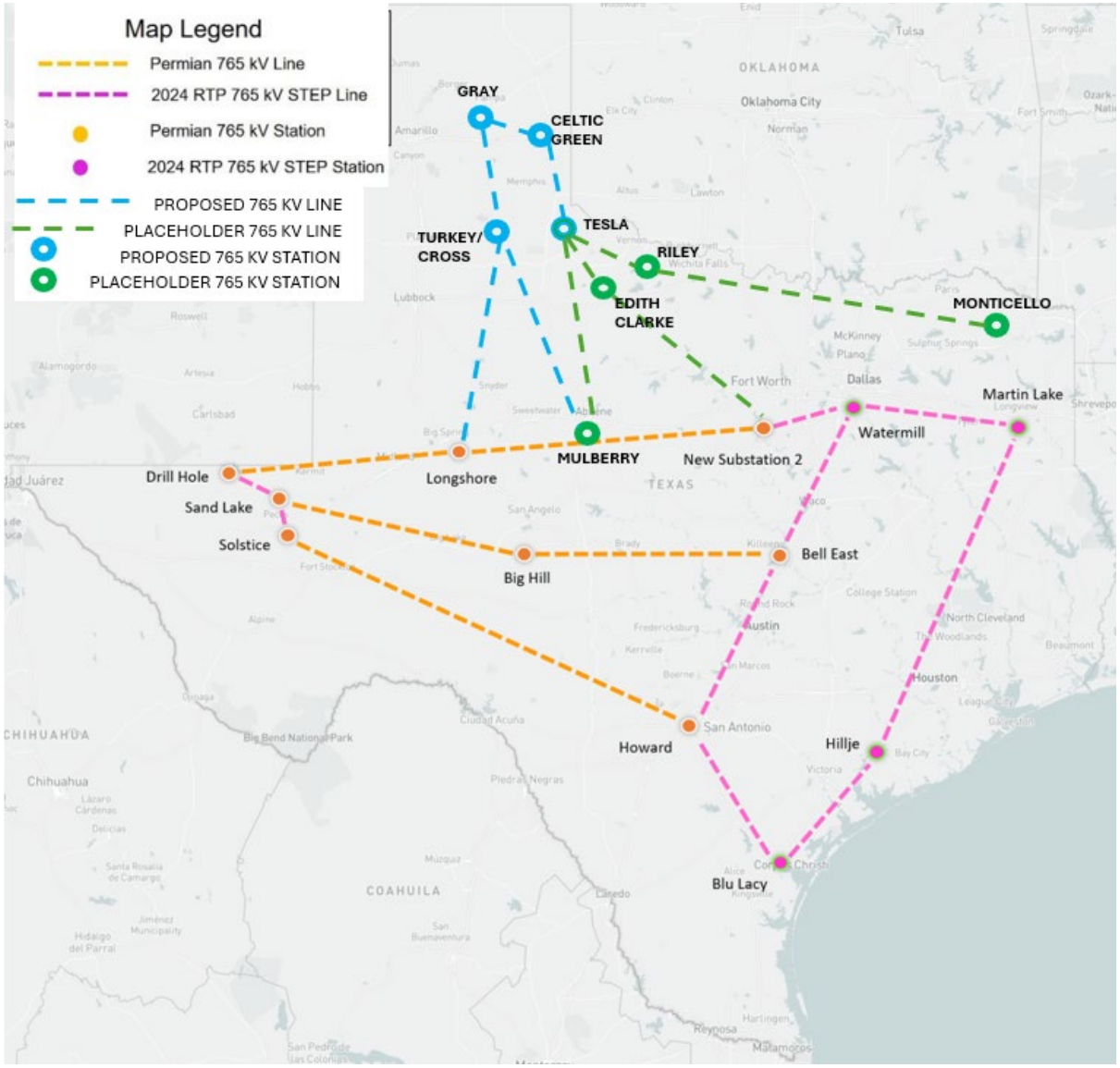
Sensitivity Scenario Plan

Option 3 (Sensitivity Load Scenario only)



- Includes all Option 1 improvements.
- Upgrade of Oncor's Tule Canyon 345 kV station
- 350 MVar STATCOM at CTT's 345 kV Comanchero station

Option 4 (Sensitivity Load Scenario only)



- Includes all Option 2 improvements.
- Upgrade of Oncor's Tule Canyon 345 kV station
- 350 MVar STATCOM at CTT's 345 kV Comanchero station

Study Results

Steady State Results Summary – Base Load Pre-Project Summer Peak

Contingency Category	Non-Convergence	Low Voltage Limit Violations	Thermal
Normal (P0)	NO	NO	NO
P1, P2-1, P7	NO	NO	NO
P2, P4, P5	NO	YES	NO
P3 (G-1+N-1)	NO	YES	NO
P6 (X-1+N-1)	NO	NO	NO
P6 (P1 + P1/P7)	NO	YES	YES
P6 (P7 + P1/P7)	YES	YES	NO

Steady State Results Summary – Base Load Pre-Project Maintenance

Contingency Category	Non-Convergence	Low Voltage Limit Violations	Thermal
Normal (P0)	NO	NO	NO
P1, P2-1, P7	NO	NO	NO
P2, P4, P5	NO	YES	YES
P3 (G-1+N-1)	NO	YES	NO
P6 (X-1+N-1)	NO	NO	NO
P6 (P1 + P1/P7)	NO	YES	YES
P6 (P7 + P1/P7)	YES	YES	YES

Steady State Results Summary – Base Load Pre-Project Sunset

Contingency Category	Non-Convergence	Low Voltage Limit Violations	Thermal
Normal (P0)	NO	NO	NO
P1, P2-1	NO	YES	YES
P7	YES	YES	YES

Performance Comparison for CTT System – Base Load

CONDITIONS	VIOLATION CATEGORY	OPTION 1	OPTION 2
SUMMER PEAK	NON-CONVERGENCE ISSUES	NONE	NONE
	VOLTAGE LIMIT VIOLATIONS	NONE	NONE
	THERMAL VIOLATIONS	NONE	NONE
MAINTENANCE	NON-CONVERGENCE ISSUES	NONE	NONE
	VOLTAGE LIMIT VIOLATIONS	NONE	NONE
	THERMAL VIOLATIONS	NONE	NONE
SUNSET	NON-CONVERGENCE ISSUES	NONE	NONE
	VOLTAGE LIMIT VIOLATIONS	NONE	NONE
	THERMAL VIOLATIONS	NONE	NONE

Performance Comparison for other TSP Regions – Base Load

CONDITIONS	VIOLATION CATEGORY	OPTION 1	OPTION 2
SUMMER PEAK	NON-CONVERGENCE ISSUES	NONE	NONE
	VOLTAGE LIMIT VIOLATIONS	Yes – For P6 events	NONE
	THERMAL VIOLATIONS	NONE	NONE
MAINTENANCE	NON-CONVERGENCE ISSUES	NONE	NONE
	VOLTAGE LIMIT VIOLATIONS	Yes – For P6 events	Yes – For P6 events (few additional reactive devices required)
	THERMAL VIOLATIONS	NONE	NONE
SUNSET	NON-CONVERGENCE ISSUES	NONE	NONE
	VOLTAGE LIMIT VIOLATIONS	Yes – For P1 event	NONE
	THERMAL VIOLATIONS	NONE	NONE

Steady State Results Summary – Sensitivity Load Pre-Project Summer Peak

Contingency Category	Non-Convergence	Low Voltage Limit Violations	Thermal
Normal (P0)	NO	NO	NO
P1, P2-1	NO	NO	YES
P7	YES	YES	NO
P2, P4, P5	NO	YES	YES
P3 (G-1+N-1)	YES	YES	YES
P6 (X-1+N-1)	NO	YES	NO
P6 (P1 + P1/P7)	YES	YES	YES
P6 (P7 + P1/P7)	YES	YES	YES

Performance Comparison for CTT System – Sensitivity Load Summer Peak

VIOLATION CATEGORY		OPTION 1	OPTION 2	OPTION 3	OPTION 4
NON-CONVERGENCE ISSUES		NONE	NONE	NONE	NONE
VOLTAGE LIMIT VIOLATIONS	*P0*	NONE	NONE	NONE	NONE
	P1, P2-1, P7	NONE	NONE	NONE	NONE
	P2, P4, P5	NONE	NONE	NONE	NONE
	P3 (G-1 +N-1)	NONE	NONE	NONE	NONE
	P6 (X-1 + N-1)	NONE	NONE	NONE	NONE
	P6 (P1 + P1/P7)	YES	NONE	NONE	NONE
	P6 (P7 + P1/P7)	YES	NONE	NONE	NONE
THERMAL VIOLATIONS		YES; Low voltages under P6 (P1 + P7)	YES; Low voltages under P6 (P1 + P7)	NONE	NONE

Performance Comparison for other TSP Regions – Sensitivity Load Summer Peak

VIOLATION CATEGORY		OPTION 1	OPTION 2	OPTION 3	OPTION 4
NON-CONVERGENCE ISSUES		NONE	NONE	NONE	NONE
VOLTAGE LIMIT VIOLATIONS	*P0*	NONE	NONE	NONE	NONE
	P1, P2-1, P7	NONE	NONE	NONE	NONE
	P2, P4, P5	NONE	NONE	NONE	NONE
	P3 (G-1 +N-1)	YES	NONE	YES	NONE
	P6 (X-1 + N-1)	YES	NONE	YES	NONE
	P6 (P1 + P1/P7)	YES	YES (performs better than Option 1 and 3; More reactive support needed)	YES	YES (performs best; More reactive support needed)
	P6 (P7 + P1/P7)	YES	YES (performs better than Option 1 and 3; More reactive support needed)	YES	YES (performs best; More reactive support needed)
THERMAL VIOLATIONS		NONE	NONE	NONE	NONE

Other Study Results

Short Circuit Analysis

- Three-phase faults simulated at all buses within three buses of the CTT system
- No CTT breakers exceed their interrupting capabilities

Dynamic Stability Analysis

- Evaluated Option 1 (preferred) under all P1–P7 contingencies
- All dynamic stability criteria were met — no violations observed.

SSO Screening

- CTT performed SSO screening assessment to identify new potential SSR vulnerabilities
- No large loads become radial to series capacitors before or after the project
- Option 1 does not create new or shorter paths for generators to become radial to series capacitors
- No detailed frequency scan or SSR assessment is required.

Shunt Reactor Sizing for 765 kV Lines

- Shunt reactors are required to manage the Ferranti effect (voltage rise) on long 765 kV lines, especially during energization and light-load operation.

Line	Length (mi)	Total Reactor Size (MVAr)
Gray to Celtic Green	40.2	30
Gray to Cross	99.6	216
Cross to Longshore	196.9	750
Celtic Green to Tesla	69.2	90

CTT Recommendation

Conclusions and Recommendation

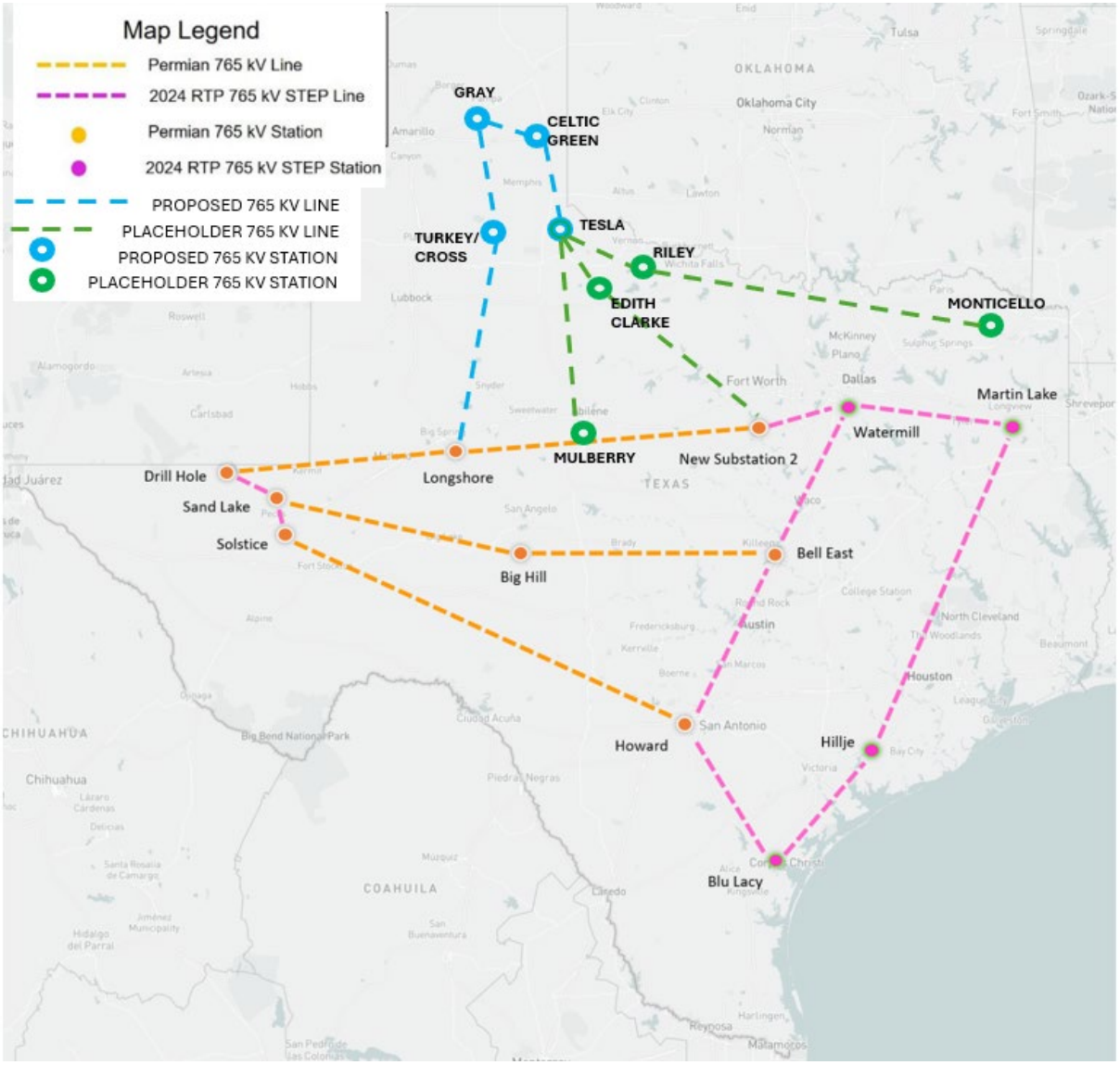
FINDINGS:

- The Panhandle region faces significant and growing reliability risks driven by large data center load additions
- Existing 345 kV infrastructure is fundamentally insufficient to serve these loads reliably
- All four 765 kV options resolve Base Load Scenario violations
- Options 3 and 4 are needed only if the additional 2,700 MW of near-FIRM loads materialize

RECOMMENDATION:

- CTT recommends Option 1 as the preferred solution for this RPG Tier 1 filing:
  - 3 new 765 kV stations + ~406 miles of new 765 kV lines
  - Estimated cost: $4.1 billion
  - Target in-service: 2031
  - Scalable to support future load growth

Recommended Project – Option 1



Recommended Project – Option 1

New Stations	
CTT Cross 765 kV Substation	
CTT Celtic Green 765 kV Substation	
CTT Gray 765 kV Substation	
New Transmission Line	
Description	**Circuit Length, in Miles (approx.)**
CTT Gray to CTT Celtic Green 765 kV Single Circuit Line	40.2
CTT Celtic Green to ETT Tesla 765 kV Single Circuit Line	69.2
CTT Gray to CTT Cross 765 kV Single Circuit Line	99.6
CTT Cross to ONCOR Long Shore 765 kV Single Circuit Line	196.9
New Transformers	
Location	**Count**
CTT Gray 765/345 kV	3
CTT Celtic Green 765/345 kV	3
CTT Cross 765/345 kV	3
Other Changes	
Tie ONCOR Alibates to CTT Gray 345 kV circuit to existing CTT Railhead 345 kV station	

END