Energy Systems Integration Group (ESIG)

Grid Challenges in ERCOT and Opportunities with 765-kV Transmission

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ERCOT Facts

85,508 MW

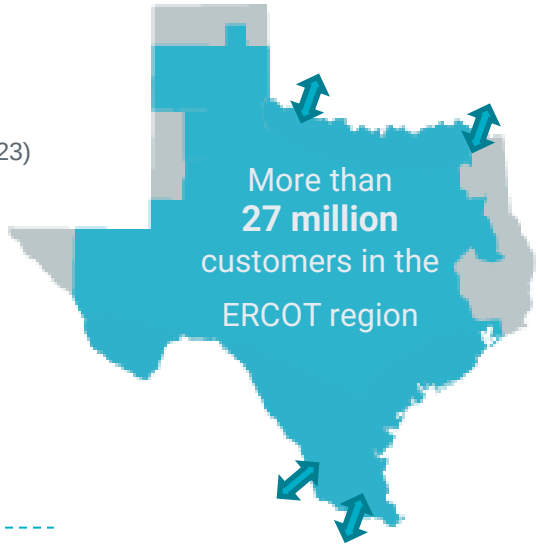
Record peak demand (August 10, 2023)

115,596+ MW

Expected capacity for summer 2025 peak demand (May 2024 CDR)

$3.8 billion

Transmission projects endorsed in 2024

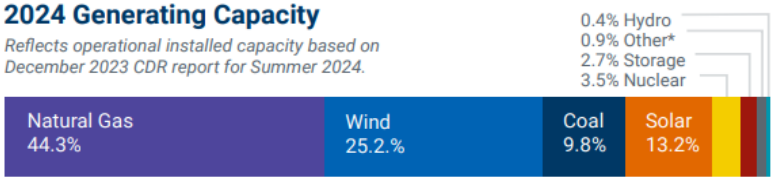


Note: The total capacity of the DC tie is 1,220 MW

1 MW of electricity is enough to serve about 250 residential customers during ERCOT peak hours.

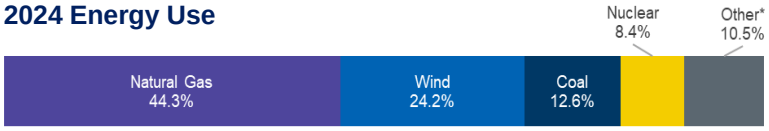
2024 Generating Capacity

Reflects operational installed capacity based on December 2023 CDR report for Summer 2024.



The sum of the percentages may not equal 100% due to rounding.
**Other includes biomass and DC Tie capacity.*

2024 Energy Use



* Other includes solar, hydro, petroleum coke (pet coke), biomass, landfill gas, distillate fuel oil, net DC-tie and Block Load Transfer important/exports and an adjustment for wholesale storage load.

39,546 MW

Wind

of installed wind capacity as of February 2025, the most of any state in the nation

28,550 MW
Generation Record
(March 3, 2025)

69.15 %
Penetration Record
(April 10, 2022)

28,817 MW

Solar

of utility-scale installed solar capacity as of February 2025

24,865 MW
Generation Record
(March 1, 2025)

54.23 %
Penetration Record
(February 24, 2025)

~75 % (~34,900 MW)

Preliminary **Wind + Solar** Penetration Record (March 29, 2024)

10,017 MW

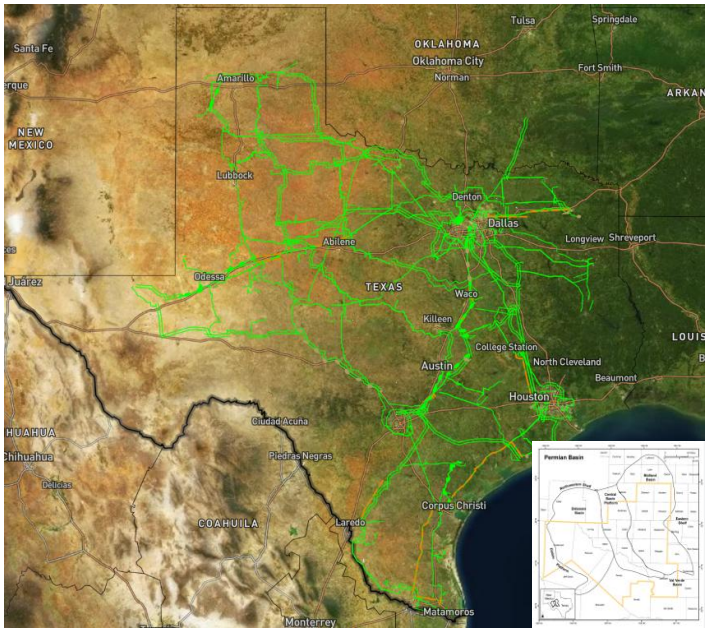
Battery Storage

of installed battery storage as of December 2024

4,578 MW
Storage Discharge Record
(February 25, 2025)

Challenges in Demand Forecast and Transmission Planning

- Challenges in planning due to lack of long-term load commitment and identifying near-term and long-term transmission upgrades in time



- New Load Notification (1-2 years)

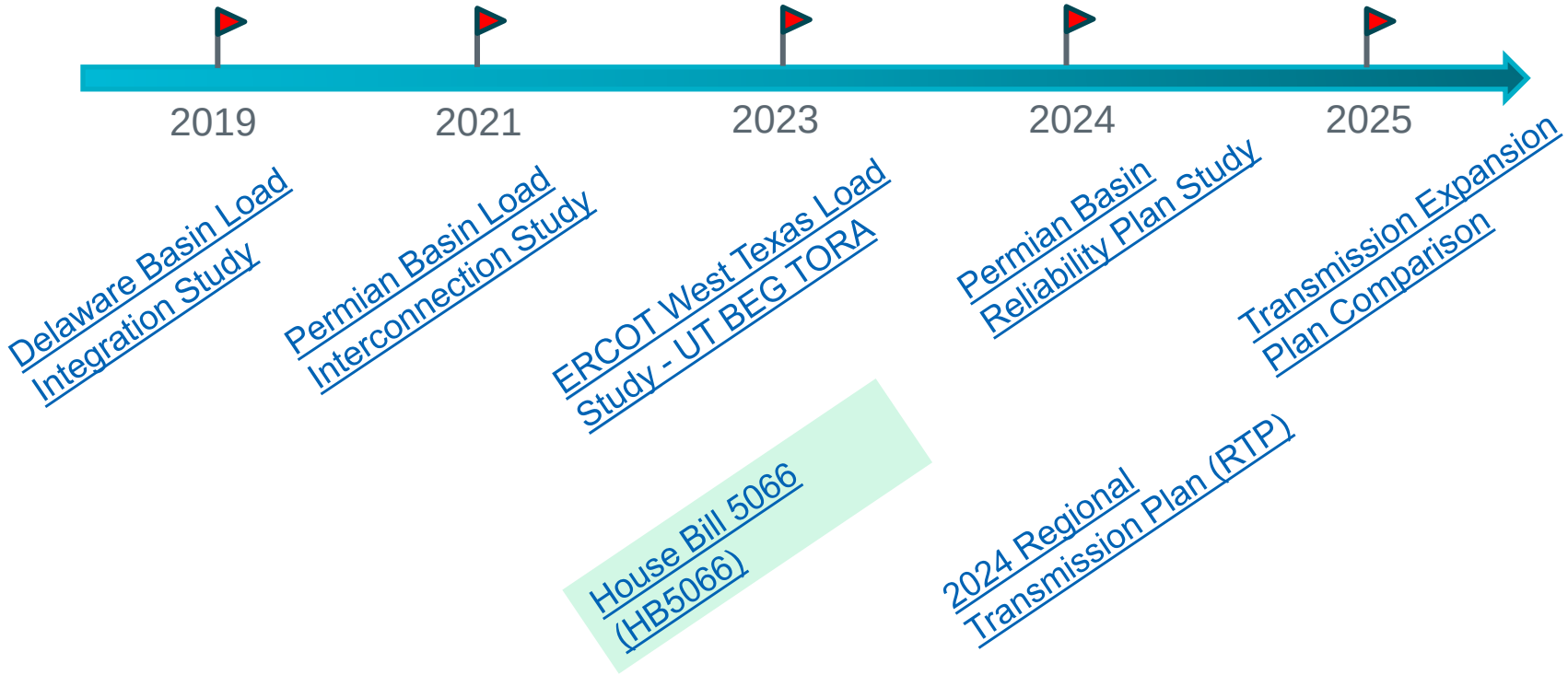
Commitment for New Load

- Time to Construct New Transmission (4-6 years)

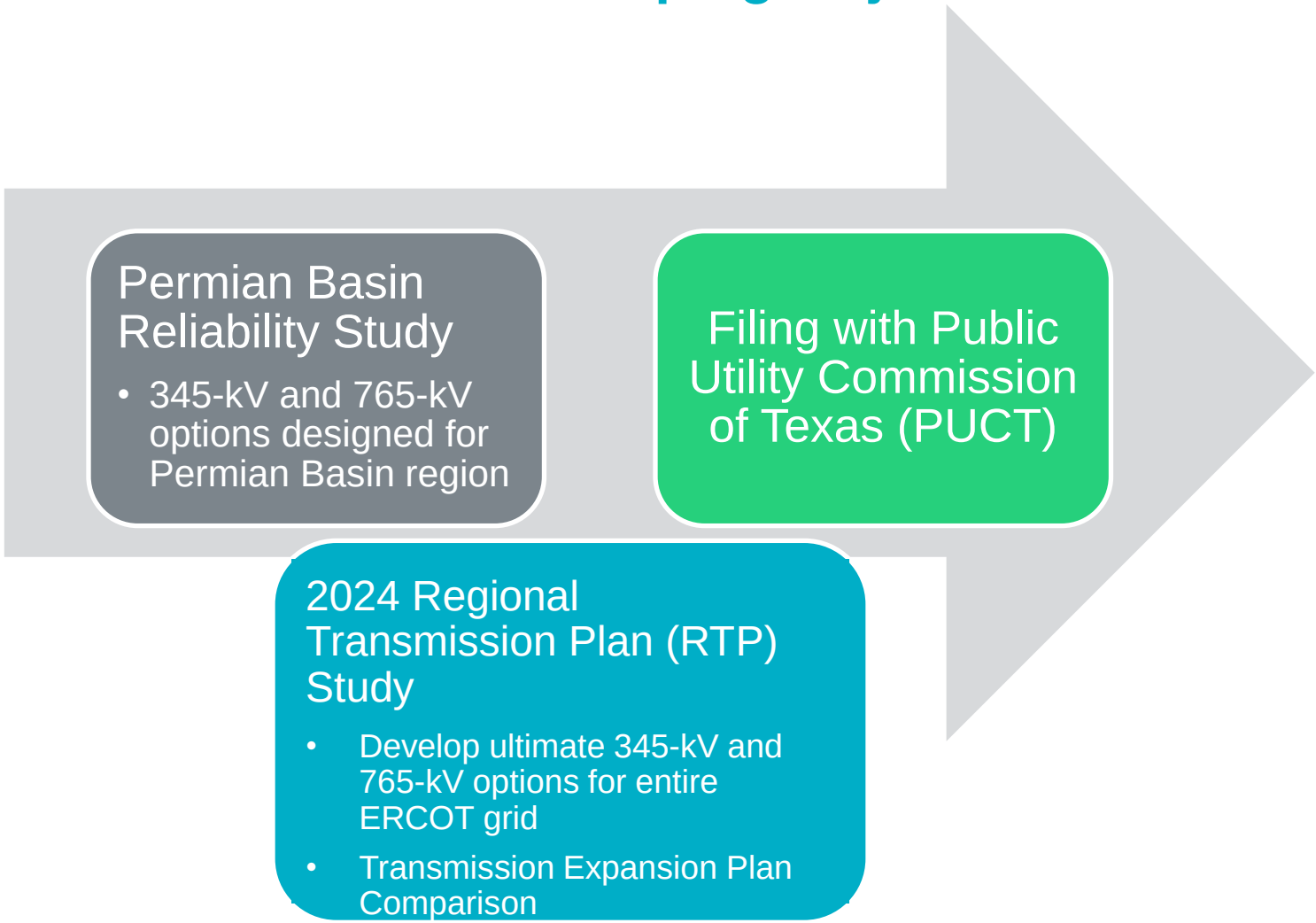
Identify Need → ERCOT Endorsement → CCN Preparation → CCN Approval → Final Engineering → Construction → Modeling and Operations

Transmission Planning Efforts for the Permian Basin Region

- ERCOT and Transmission Service Providers (TSPs) have been working to address challenges to accommodate significant and rapid load growth in the area



High-Level Process for Developing Major Transmission Plan



- PUCT approved the 345-kV and 765-kV options from the Permian Basin Study in October 2024; voltage level decision expected in May 2025

Demand Assumptions – Permian Basin Study

- As directed by House Bill (HB) 5066 (2023), the PUCT required ERCOT to develop a reliability plan for the Permian Basin region.
- HB5066 introduced a new requirement to consider loads for which the electric utility has yet to sign an interconnection agreement, as determined by the electric utility responsible for serving the load
- Using load forecasts from TSPs, ERCOT projected 2030 Permian Basin load at 23,659 MW (11,964 MW oil & gas, 11,695 MW non-oil & gas) and evaluated transmission needs for 2030 and 2038

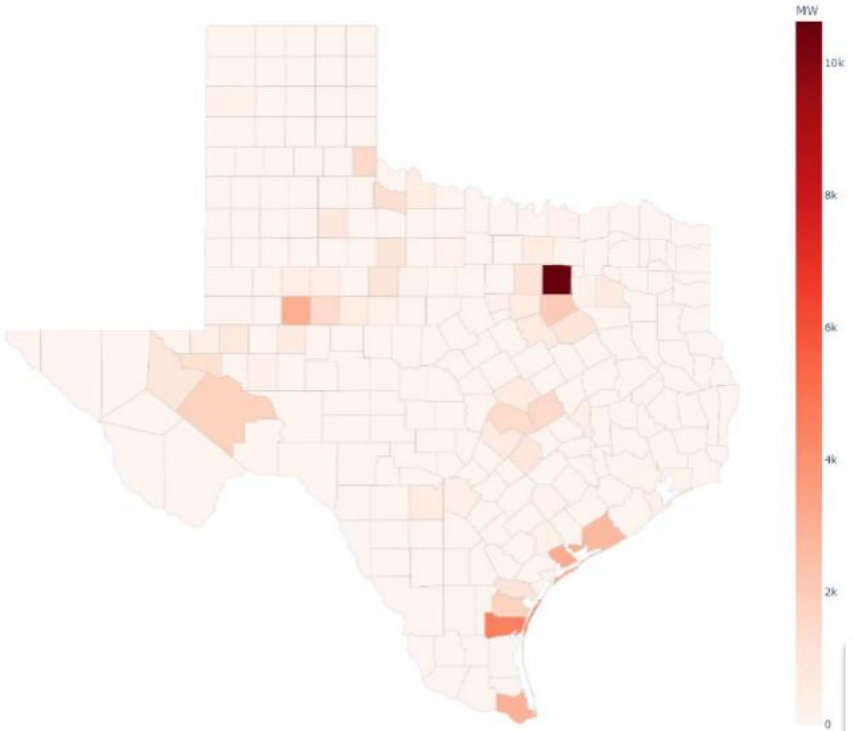
	Permian Basin Load Interconnection 2030 Case (Study in 2021)	Permian Basin Reliability Plan 2030 Case (Study in 2024)	Permian Basin Reliability Plan 2038 Case (Study in 2024)
Permian Basin Total Load	10,527	23,659	26,400

- A 124% increase in the Permian region load forecast by 2030 compared to the previous study
- Of the 23.6 GW forecasted for 2030, nearly half is tied to specific sectors: 65% from Crypto/Data Centers, 22% from Hydrogen Production, and 13% from Commercial/Industrial loads

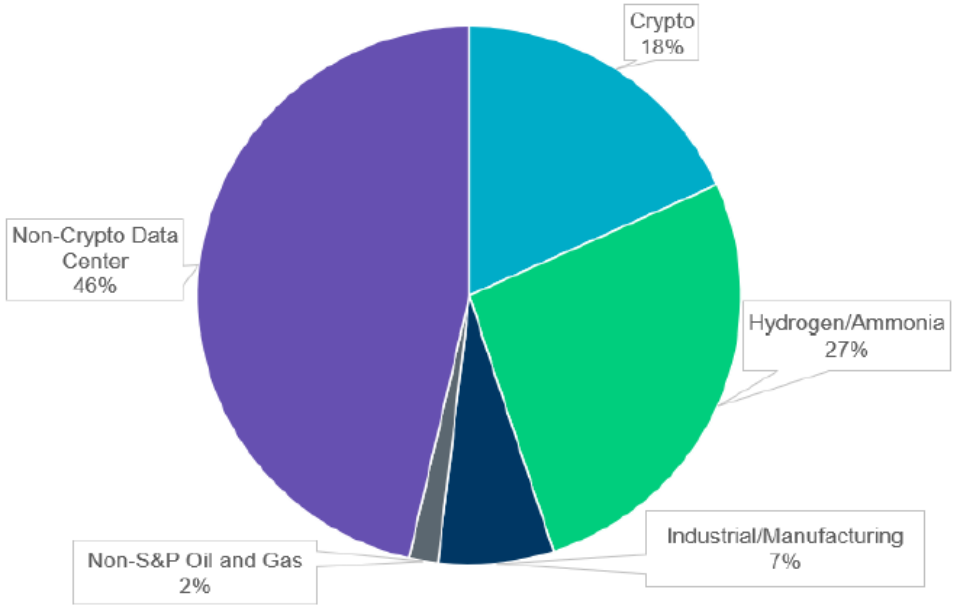
Demand Assumptions – 2024 Annual Planning Assessment

- The new requirement of HB5066 and the unprecedented economic growth in Texas resulted in the forecasted summer peak demand for 2030 exceeding 150 GW, of which approximately 50 GW is large load

Location of Large Load in 2024 RTP



Types of Large Loads in 2024 RTP

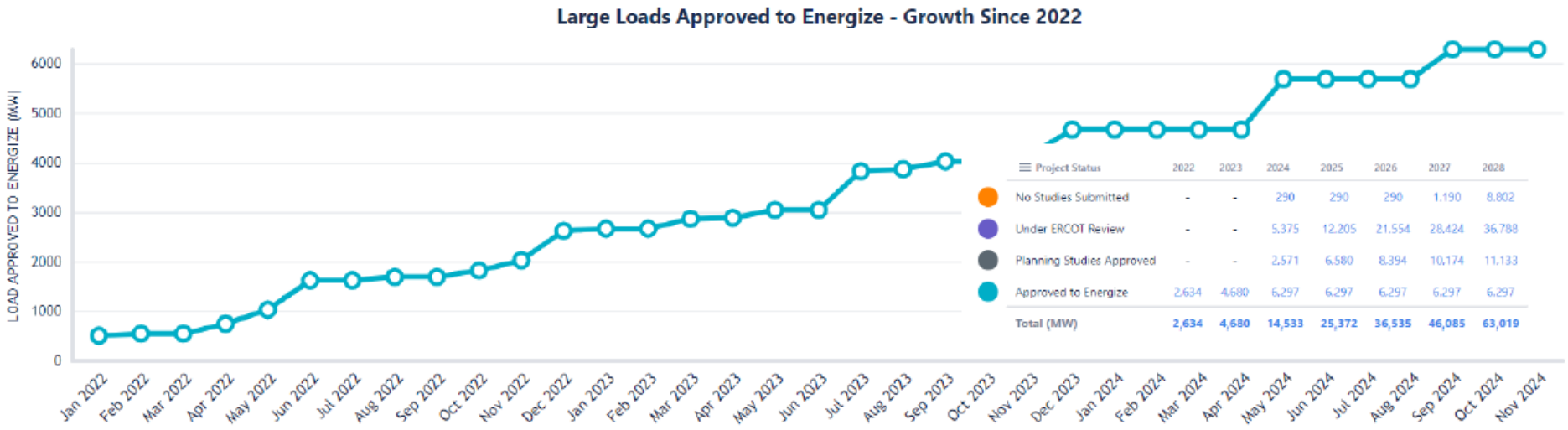


86 GW (Historical Peak) in 2023 vs. 150 GW for year 2030 assumed in the 2024 RTP

Equivalent to 8.2%

Annual Average Load Growth Rate

Challenges in Large Load Interconnection

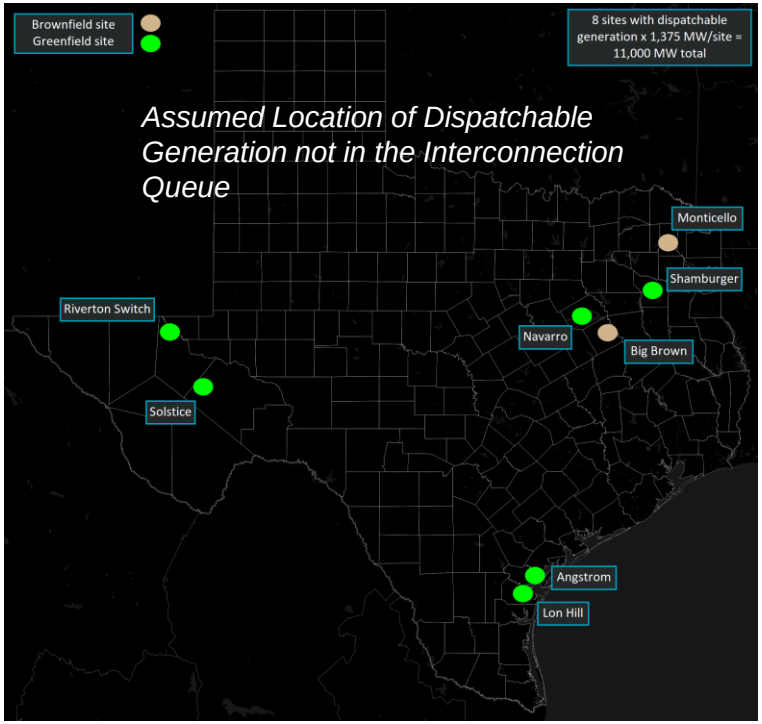


Project Status	2022	2023	2024	2025	2026	2027	2028
No Studies Submitted	-	-	290	290	290	1,190	8,802
Under ERCOT Review	-	-	5,375	12,205	21,554	28,424	36,788
Planning Studies Approved	-	-	2,571	6,580	8,394	10,174	11,133
Approved to Energize	2,634	4,680	6,297	6,297	6,297	6,297	6,297
Total (MW)	**2,634**	**4,680**	**14,533**	**25,372**	**36,535**	**46,085**	**63,019**

- Approximately 63+ GW of load in queue, seeking interconnection
- Types: crypto mining, data centers, hydrogen production
- Some individual load > 1 GW
- Potential reliability risk (e.g., frequency instability)

Generation Assumptions – 2024 Annual Planning Study

- To address the supply deficit needed to meet the forecasted demand before formal planning rules are established, ERCOT incorporated additional generation outside of the normal planning process. It includes approximately 11 GW of dispatchable generation that are not in the queue to resolve remaining generation shortfall and to address the 24/7 nature of new load

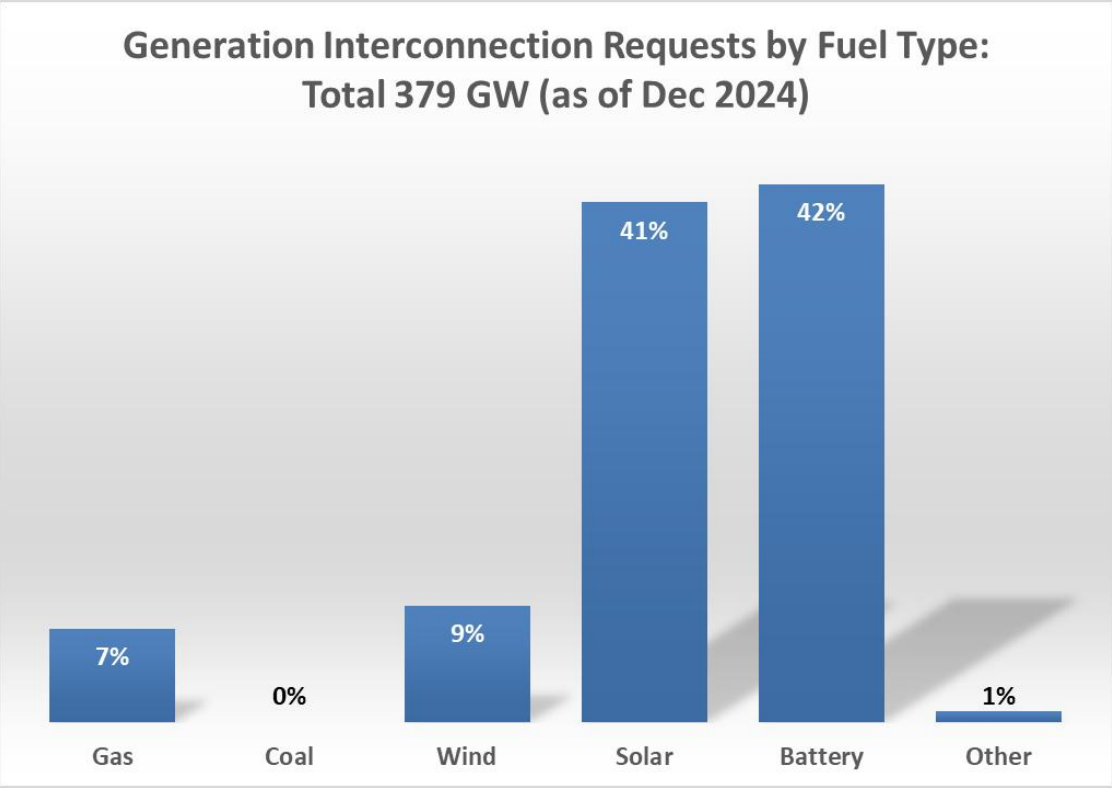


Source: *2024 Regional Transmission Plan Report*

Challenges in Generation Interconnections

Key Data:

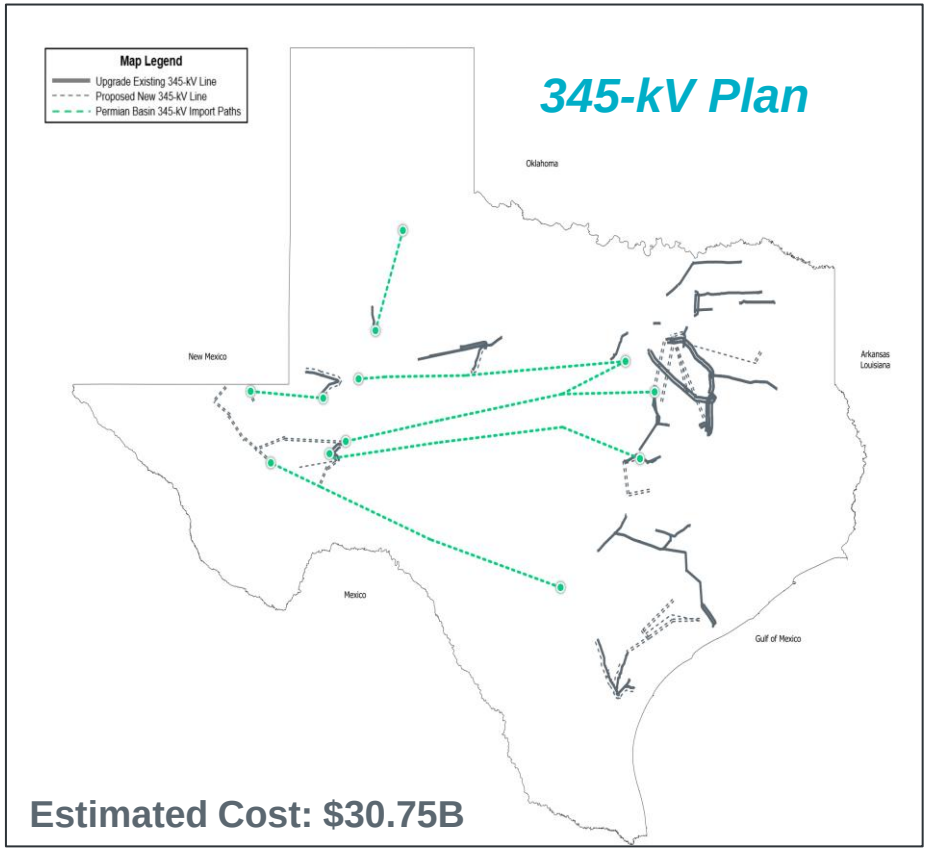
- 379+ GW generation projects in queue
- 90%+ are IBRs (solar, battery, wind)
- 42% are battery projects
- Potential risk of system weakening, leading to possible instability

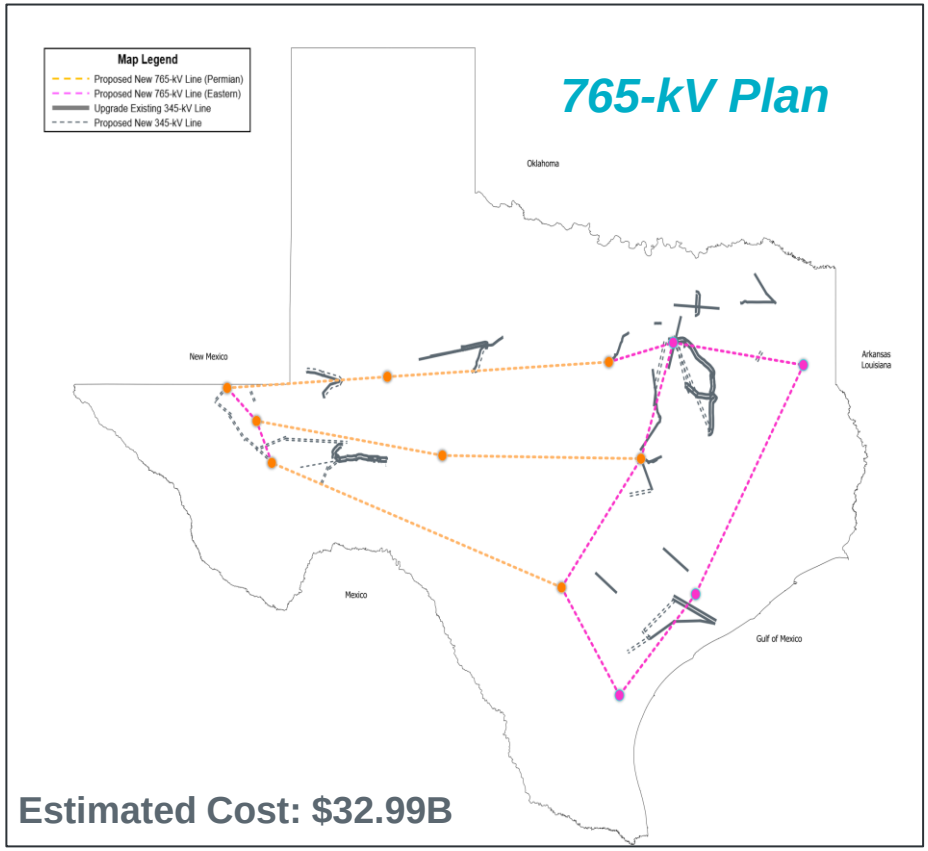


Source: ERCOT GIS Report posted on January 2, 2025

Comparison of 345-kV Plan and 765-kV Strategic Transmission Expansion Plan (STEP)

- The last voltage change in Texas transmission planning was in the 1960s (345-kV)
- 765 kV would be new to ERCOT but is available in some parts of the U.S. and other countries.



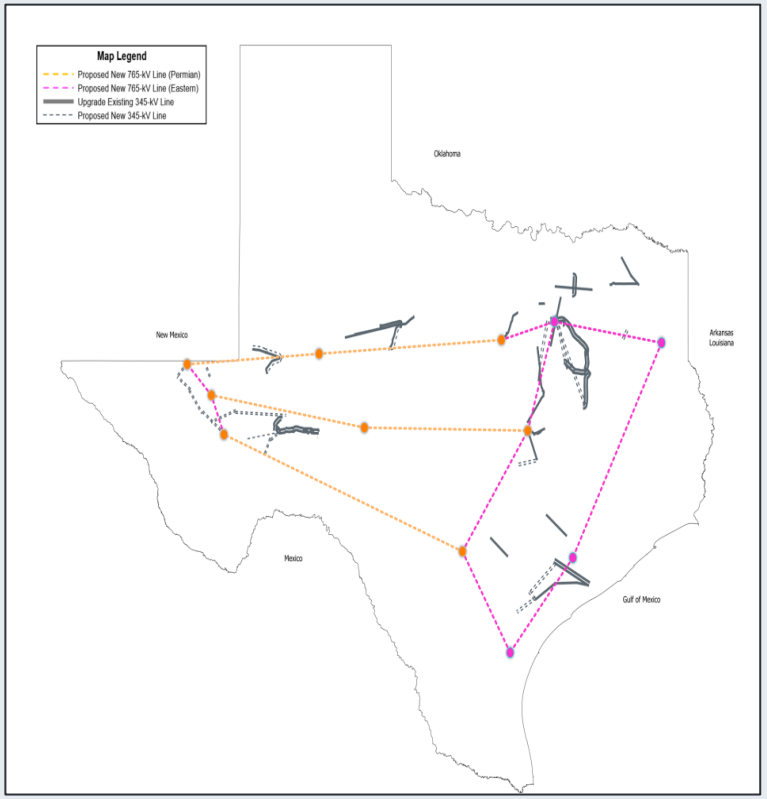


TX 765-kV STEP

- No changes to 765-kV option in Permian Basin study
- # of 765-kV Substations
  - Permian Basin = 8
  - Eastern = 4
- New 765-kV ROW Line Miles*
  - Permian Basin = 1,255
  - Eastern = 1,213
- # of 765/345-kV Transformers
  - Watermill, Hillje, Blu Lacy = 3
  - All others = 2
- Existing Line Upgrade Miles*
  - 2,831

Texas 765-kV Strategic Transmission Expansion Plan (TX 765-kV STEP)

Critical components needed by 2030



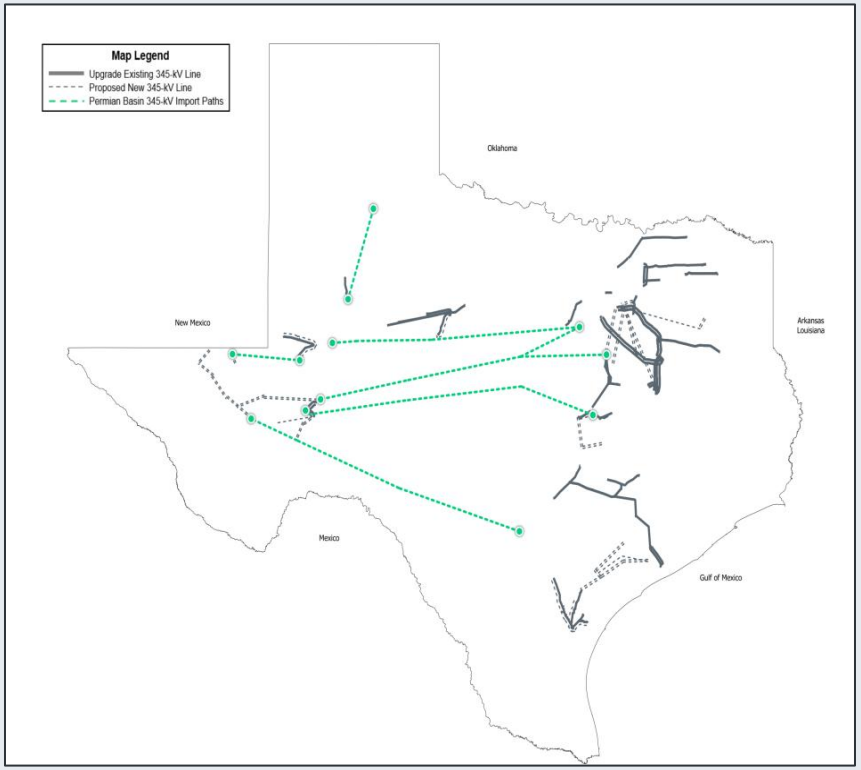
**All mileage numbers include 20% routing adder on top of point-to-point distance.*

***NOTE**: Geographic locations for proposed new lines are meant to demonstrate general electrical point-to-point connections. Specific routing of any new transmission infrastructure is determined by the PUCT as part of the CCN process with Transmission Service Providers.*

345-kV Plan

- No changes to 345-kV option in Permian Basin study
- New ROW Line Miles*
  - 3,007
- Existing Line Upgrade Miles*
  - 4,274

345-kV Plan
Critical components needed by 2030



**All mileage numbers include 20% routing adder on top of point-to-point distance.*
***NOTE**: Geographic locations for proposed new lines are meant to demonstrate general electrical point-to-point connections. Specific routing of any new transmission infrastructure is determined by the Public Utility Commission as part of the CCN process with Transmission Service Providers.*

Cost-Benefit Comparison

TX 765-kV STEP	vs	345-kV Plan
1,443 fewer miles *of existing system work*	**Existing System Upgrades**	-
-	**New ROW**	**434 fewer miles** *of new ROW*
-	**Estimated New Construction Costs**	**$2.24B less** construction cost
$890M *less in outage-related construction costs*	**Live/Hot Construction to Facilitate Existing Upgrades**	-
$229M/year *more consumer energy cost savings (annually)*	**Estimated Consumer Energy Cost Savings**	-
$28M/year *more production* cost savings *for energy (annually)*	**Estimated Production Cost Savings**	-
560 GWh/year *less energy losses ($16.2M annual savings)*	**Estimated System Loss Reduction**	-
600 to 3,000 MW *increases in power transfer capability*	**Incremental Transfer Capability**	-

Closing Remarks

- Addressing Future Challenges:
  - Rapid and significant demand growth, rising IBRs, and increasing transmission constraints demand major transmission reinforcements.
  - The 765-kV option appears to be the better option moving forward, offering superior capacity, resiliency, and flexibility.

- Collaboration is Key:
  - ERCOT will continue engaging with regulators, stakeholders, and Transmission Service Providers to address the challenges.

- Next Milestone
  - A PUCT decision on the voltage level is expected in May 2025.

- Let’s pave the way for a stronger, more resilient ERCOT grid.

Questions?

Comments are welcome to:
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Appendix: Permian Basin Reliability Plan