



**Report on Existing and
Potential Electric System
Constraints and Needs**

December 2024

Key Takeaways

ERCOT developed the **Permian Basin Reliability Plan Study** and filed it with the Public Utility Commission of Texas (PUCT) in July 2024. The plan identified both local transmission needs and imports needs, which included 345-kV, 500-kV, and **765-kV** import path options. PUCT issued an order approving the plan in October 2024. The PUCT will make a decision on use of 765-kV on a statewide basis by May 1, 2025.

The 2024 Regional Transmission Plan (RTP) developed both the traditional 345-kV plan and the **765-kV** plan to facilitate the statewide decision on Permian Basin Reliability Plan import path voltage level at the PUCT. ERCOT plans to file the comparison between the 345-kV plan and the 765-kV plan with the PUCT in January 2025.

House Bill (HB) 5066 (88th Leg.) 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. The unprecedented load growth and this new requirement resulted in more than **50 GW of additional forecasted load** (including large loads) incorporated in the 2024 RTP. This new view shows unprecedented and rapid load growth, which is creating **new challenges and opportunities** for the ERCOT System.

The ERCOT System continues to evolve with significant **load growth**, increased thermal generation **retirement**, rapid growth in transmission-connected **wind, solar** and **energy storage** development, and distributed generation. ERCOT is critically evaluating planning processes and pursuing changes necessary to meet challenges associated with the **evolving grid**.



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About ERCOT Transmission Planning

ERCOT supervises and exercises comprehensive independent authority over the planning of transmission projects for the ERCOT System as outlined in the Public Utility Regulatory Act (PURA) and PUCT rules. PUCT rules further require ERCOT to evaluate and make a recommendation to the PUCT as to the need for any transmission facility over which ERCOT has comprehensive transmission planning authority.

ERCOT examines the need for proposed transmission projects based on ERCOT planning criteria and North American Electric Reliability Corporation (NERC) Reliability Standards. Once a project need has been identified, ERCOT evaluates project alternatives based on cost-effectiveness, long-term system needs, and other factors.

The ERCOT Protocols and Planning Guide describe the practices and procedures through which ERCOT meets its requirements related to system planning under PURA, PUCT rules, and NERC Reliability Standards.

ERCOT annually performs a planning assessment of the ERCOT Transmission Grid that is primarily based on two sets of studies:

- The Regional Transmission Plan (RTP) addresses region-wide reliability and economic transmission needs and includes the recommendation of specific planned improvements to meet those needs for the upcoming six years. The public version of the 2024 RTP report is posted on the ERCOT website at: <https://www.ercot.com/gridinfo/planning>.
- Stability studies are performed to assess the angular stability, voltage stability, and frequency response of the ERCOT System. Due to the security-related sensitive nature of the information contained in these study reports, they are not published on the ERCOT website.

ERCOT also conducts the biennial Long-Term System Assessment (LTSA) and the first biennial Grid Reliability and Resiliency Assessment (GRRR), which are completed in even-numbered years. The LTSA uses scenario-analysis techniques to assess the potential needs of the ERCOT System up to 15 years into the future. The role of the LTSA is to guide near-term planning decisions by providing a longer-term view of system reliability and economic needs. The GRRR assesses the system needs based on the resiliency criteria. The 2024 LTSA and GRRR reports are posted on the ERCOT website at: <https://www.ercot.com/gridinfo/planning>.

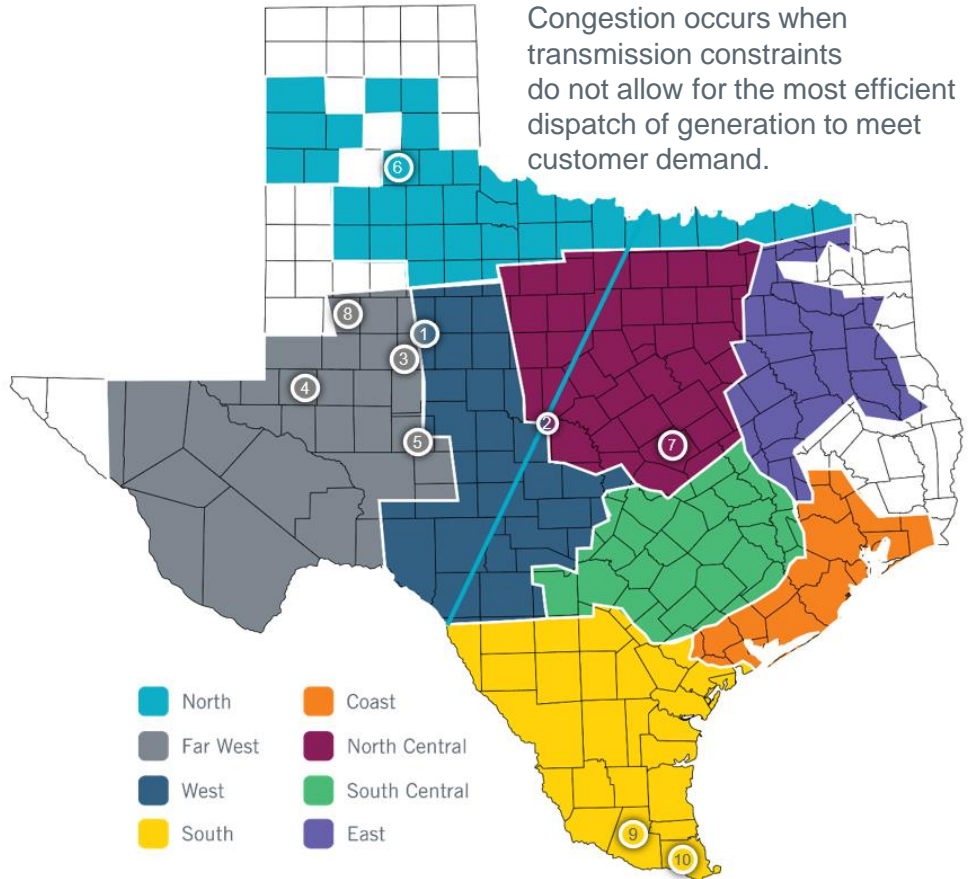
Map	Monitored Element of Constraint	Congestion Rent*	Outage Related ?
1	Tonkawa Switch - Morgan Creek SES 345kV	\$156M	
2	West Texas Export Interface	\$148M	
3	Morgan Creek SES - Navigation Sub 138kV	\$79M	
4	Odessa EHV Switch - Yarbrough Sub 138kV	\$57M	Planned Outages
5	Hargrove - Twin Buttes 138kV	\$55M	Planned and Forced Outages
6	Panhandle Interface	\$49M	
7	Bell County - Salado Switch 138kV	\$48M	
8	Lamesa - Jim Payne Poi 138kV	\$46M	Planned Outages
9	North Edinburg to Lobo interface	\$45M	
10	Burns Sub - Rio Hondo 138kV	\$33M	

*Congestion rent indicates areas of the system where economic transmission projects may be beneficial. It is not an indication of whether a project to reduce specific congestion would or would not meet the ERCOT economic planning criteria.

Recent Constraints

Top 10 constraints on the ERCOT System

Oct. 2023 to Nov. 2024, based on real-time data

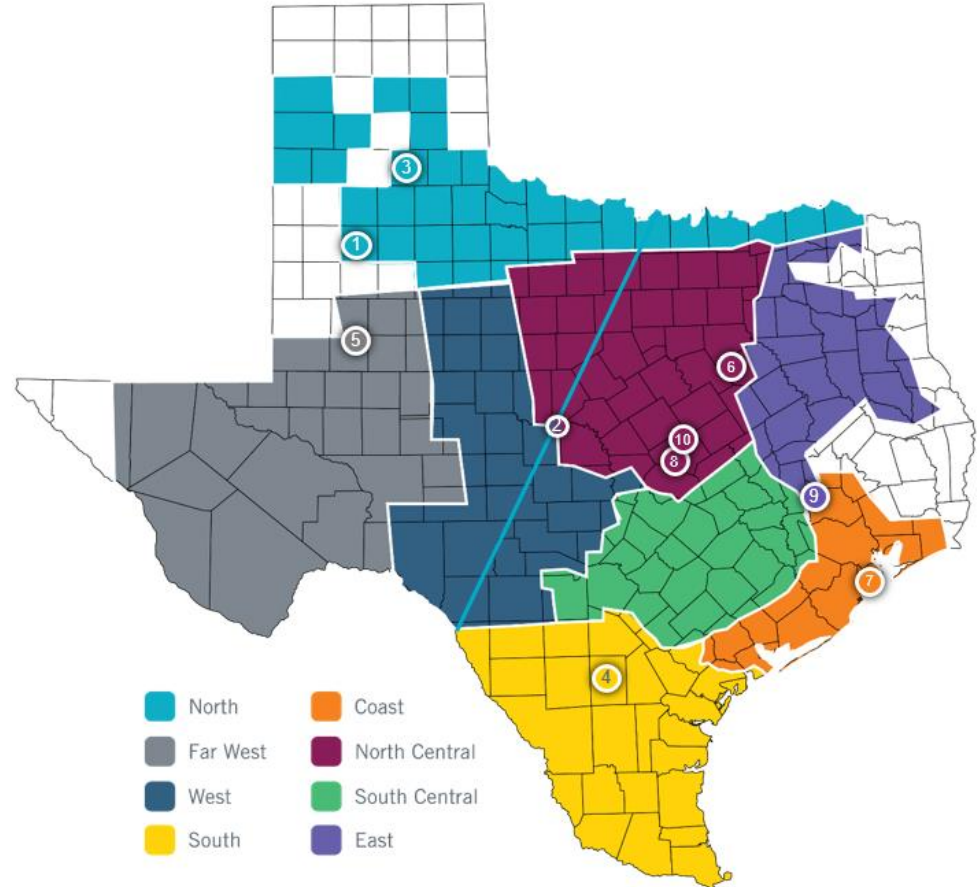


Map	Constraint	Congestion Rent*	
		2026	2029
1	MacKenzie Substation - Northeast Substation 115-kV Line	\$15M	\$181M
2	West Texas Export Interface	\$178M	\$49M
3	Panhandle Interface	\$139M	\$100M
4	Fowlerlon - Tilden 138 Sub 138-kV Line	\$108M	\$19M
5	Farmland - Wett Long Draw 345-kV Line	\$19M	\$64M
6	Navarro - Richland 69-kV Line**	\$62M	-
7	Meadow - PH Robinson 345-kV Line	\$54M	\$42M
8	Stagecoach - Killeen Elm 138-kV Line	\$49M	\$24M
9	North - Houston Interface	\$46M	\$34M
10	Temple North - Pepper Creek Switch 138-kV Line	-	\$40M

Projected Constraints

Top 10 projected constraints on the ERCOT System for 2026 and 2029

Based on economic analysis conducted for the 2024 RTP



*Congestion rent indicates areas of the system where economic transmission projects may be beneficial. It is not an indication of whether a project to reduce specific congestion would or would not meet the ERCOT economic planning criteria. Planned transmission outages were not included in the analysis.

**A placeholder RTP proposed project (2023-NC39) was recommended in 2023 RTP to resolve the reliability issue on Navarro - Richland 69-kV Line in 2028.

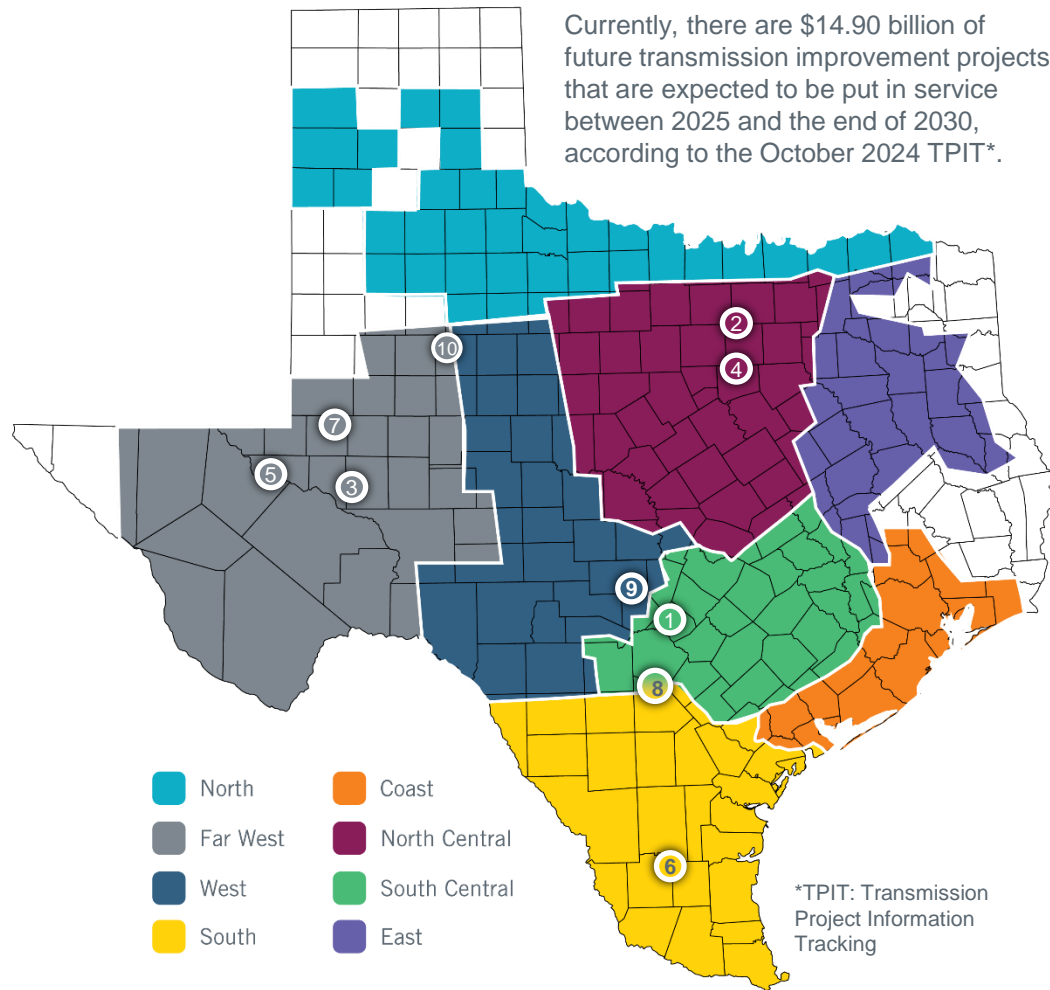
Map	Transmission Improvement	In-Service
1	Hays Energy - Kendall Corridor Transmission Line Rehabilitation Projects	2025
2	Roanoke Area Upgrades Project	2025
3	Bearkat - North McCamey - Sand Lake 345-kV Transmission Line Addition Project	2026
4	Arlington Reliability Enhancement Project	2026
5	Pecos County Transmission Improvement Project	2026
	Silverleaf and Cowpen 345/138-kV Stations Project	2027
6	Lower Rio Grande Valley System Enhancement Project	2027
7	Synchronous Condenser Project	2027
	West Texas Synchronous Condenser Project	2027
	Bakersfield Dynamic Reactive Substation Upgrade	2027
8	San Antonio South Reliability Project	2027
	San Antonio South Reliability II Project	2029
9	Temple Area Project	2028
10	West Texas 345-kV Infrastructure Rebuild Project	2028

Planned Improvements

Top 10 significant improvements on the ERCOT System

Projects planned for completion within the next six years

Currently, there are \$14.90 billion of future transmission improvement projects that are expected to be put in service between 2025 and the end of 2030, according to the October 2024 TPIT*.

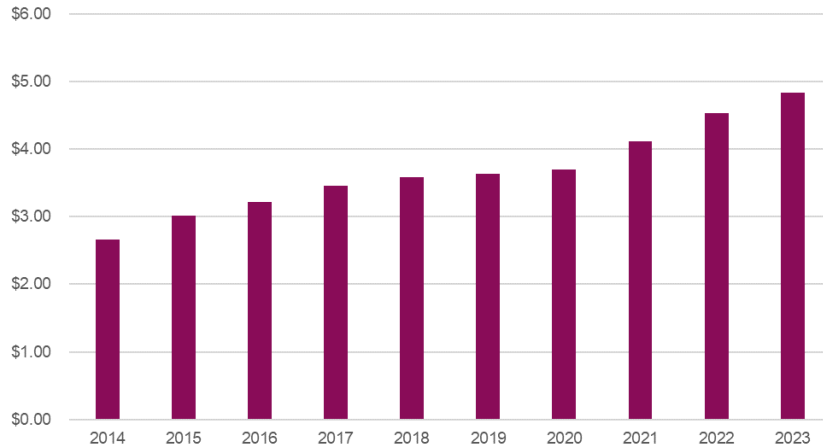


*TPIT: Transmission Project Information Tracking

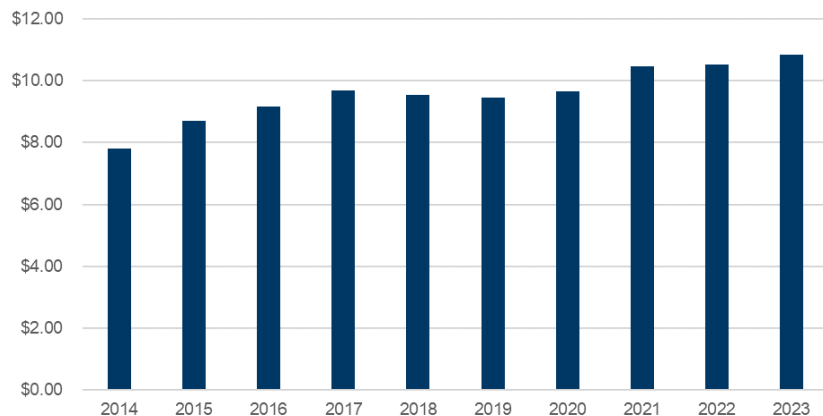


Transmission Investment Trend

ERCOT Annual Transmission Cost of Service
(\$ Billion)

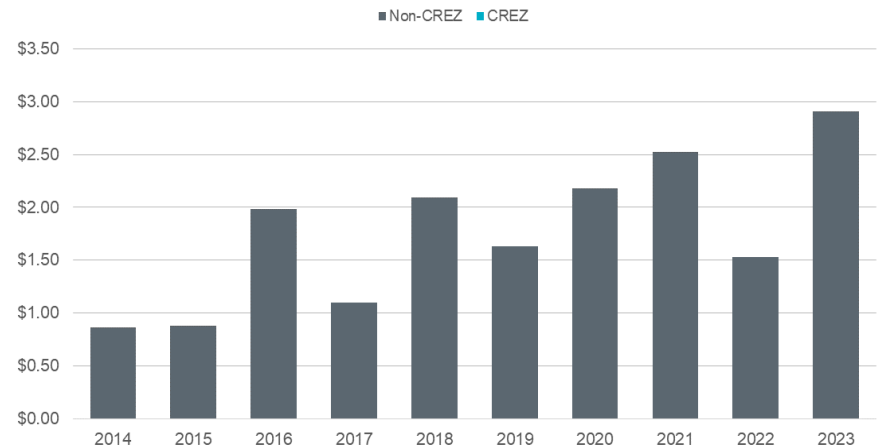


ERCOT Annual Transmission Cost of Service
per Total MWh Energy Use
(\$/MWh)



For the ERCOT Region, the total Transmission Cost of Service¹ (TCOS), which reflects investment in transmission improvements, has increased in the past several years along with TCOS per MWh.²

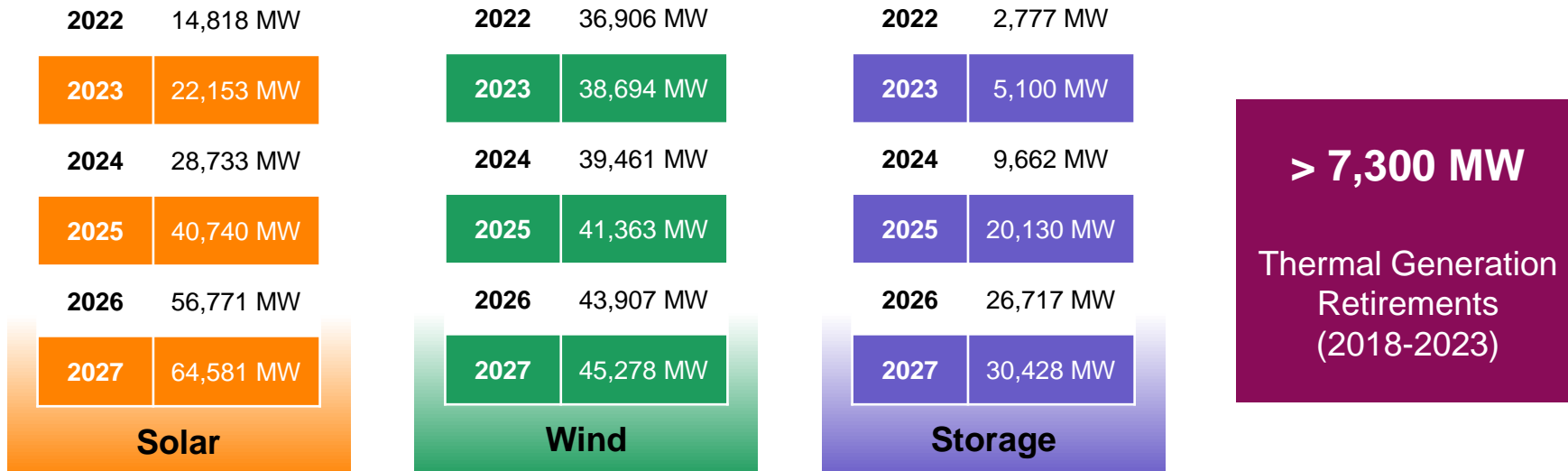
ERCOT Transmission Improvements by In-Service Year
(\$ Billion)



1. TCOS values are based on [ERCOT's Yearly Wholesale Transmission Service Charges](#) filed with PUCT
2. Total MWh Energy Use values are based on [ERCOT's Demand and Energy Report](#) published in ERCOT Market Information System (MIS)



The Changing Grid – Generation

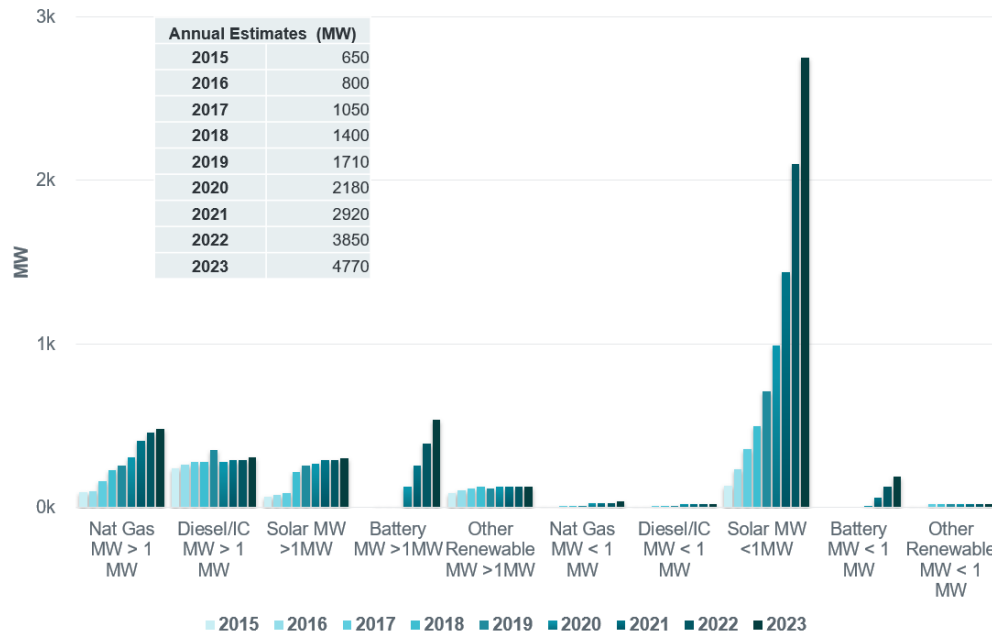


- ERCOT continues to experience a rapid shift in the type and location of generation available to serve demand.
- Robust growth of inverter-based resources (IBR) has continued. More than 102 GW of transmission-connected wind, solar, and battery energy storage capacity is expected to be installed by the end of 2025. Total IBR capacity has the potential to exceed 140 GW in 2027.
- Over 7,300 MW of coal and natural gas generation has retired since 2018.
- The change in generation mix has also resulted in increased distance between generation sites and demand centers. Retired coal and gas generation were closer to large cities, whereas the most abundant wind and solar resources tend to be in more distant locations.

The Changing Grid – Distributed Generation (DG)

- ERCOT continues to improve DG integration processes under increasing DG penetration.
 - Distribution Generation Resource (DGR) and Settlement Only Distribution Generator (SODG) modeling processes are largely finalized, and these facilities are explicitly included in the Steady State Working Group (SSWG) and Dynamics Working Group (DWG) cases.
 - HB3390 introduced a requirement for Transmission Distribution Service Providers (TDSPs) to provide unregistered DG information to ERCOT via their Transmission Service Providers (TSPs). ERCOT is currently working on a Nodal Protocol Revision Request (NPRR) and associated Revision Requests to establish processes for collecting data from TDSPs and explicitly modeling aggregated unregistered DG (e.g., residential rooftop solar).

ERCOT Estimated Total DG Growth 2015-2023 (MW)

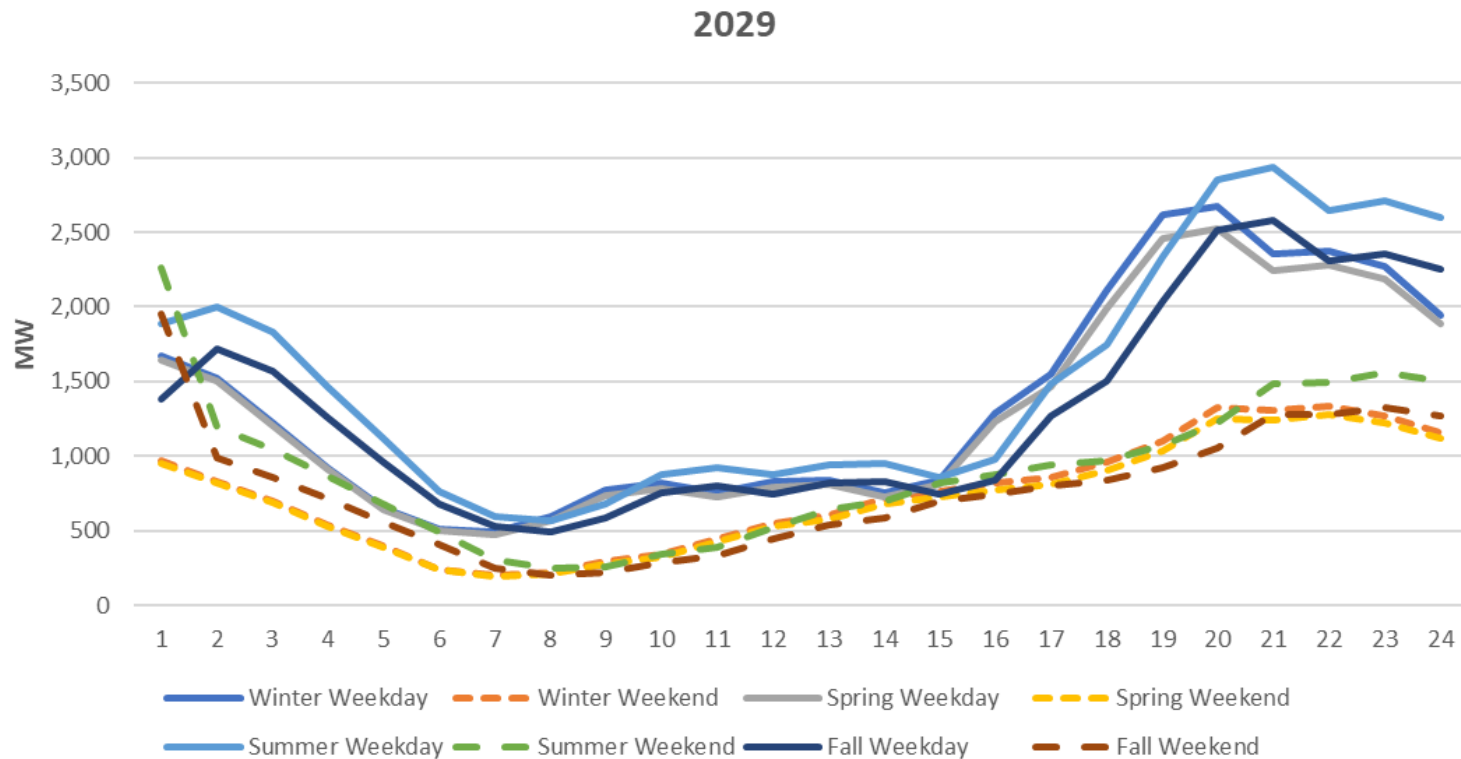


- Projects are in process at NERC to incorporate Distributed Energy Resources (DER) into relevant Reliability Standards (MOD-032, TPL-001, FAC-001/002, MOD-031) and SARs being proposed for others (PRC-006, EOP-004, EOP-005).
- ERCOT participates in the NERC System Planning Impacts from Distributed Energy Resources Working Group (SPIDERWG), which has published several Reliability Guidelines, White Papers, and Technical Reference documents to facilitate transmission planning, modeling, and analysis under increasing DER penetrations.



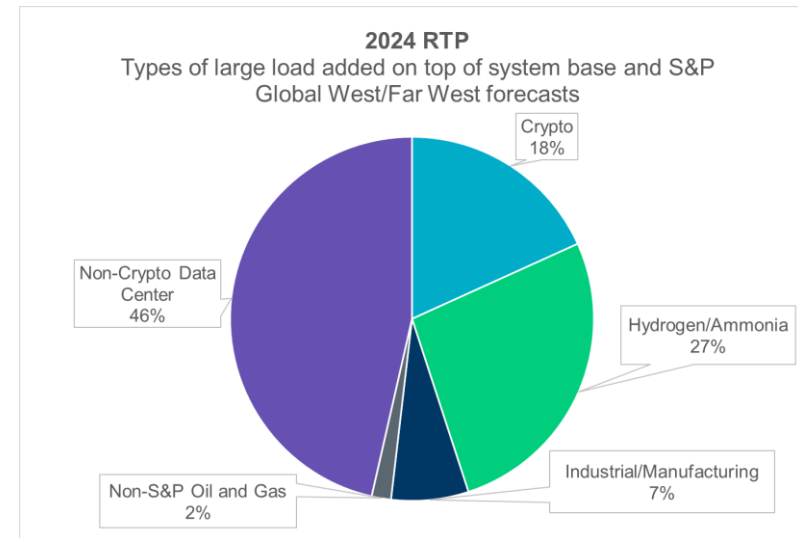
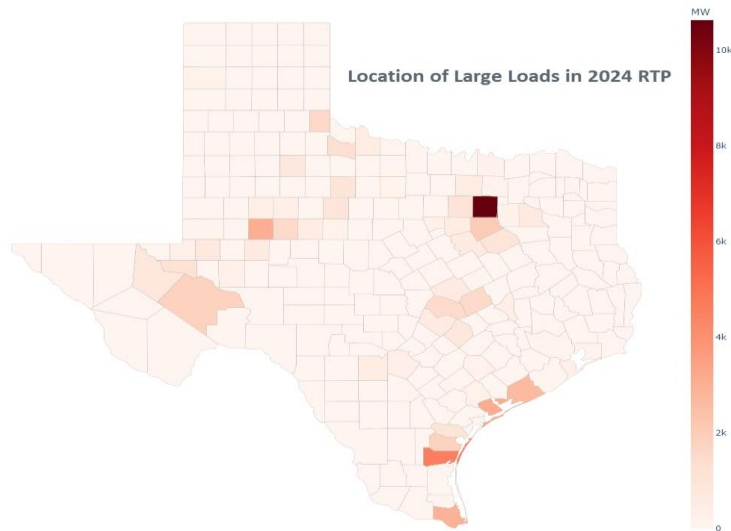
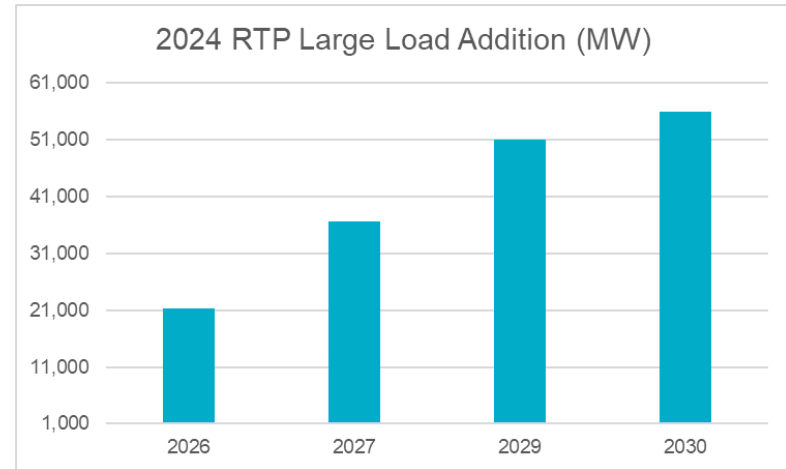
The Changing Grid – Electrical Vehicles (EV)

- The EV load impacts are incorporated into the ERCOT 2024 near-term and long-term Transmission Planning assessment (RTP and LTSA) using the methodology developed by the Brattle Group.
 - By 2039 the total number of EV is estimated to be 6.44 million with the total energy consumption of 46 terawatt hours (TWh).



The Changing Grid – Demand*

- HB5066 (88th Leg.) 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.
- This new requirement and the unprecedented economic growth in Texas resulted in more than 50 GW of additional forecasted load (including large loads) incorporated in the 2024 RTP.
- Most of the large loads are concentrated in certain areas of the system and are expected to maintain constant electricity consumptions regardless of season, day, or time.



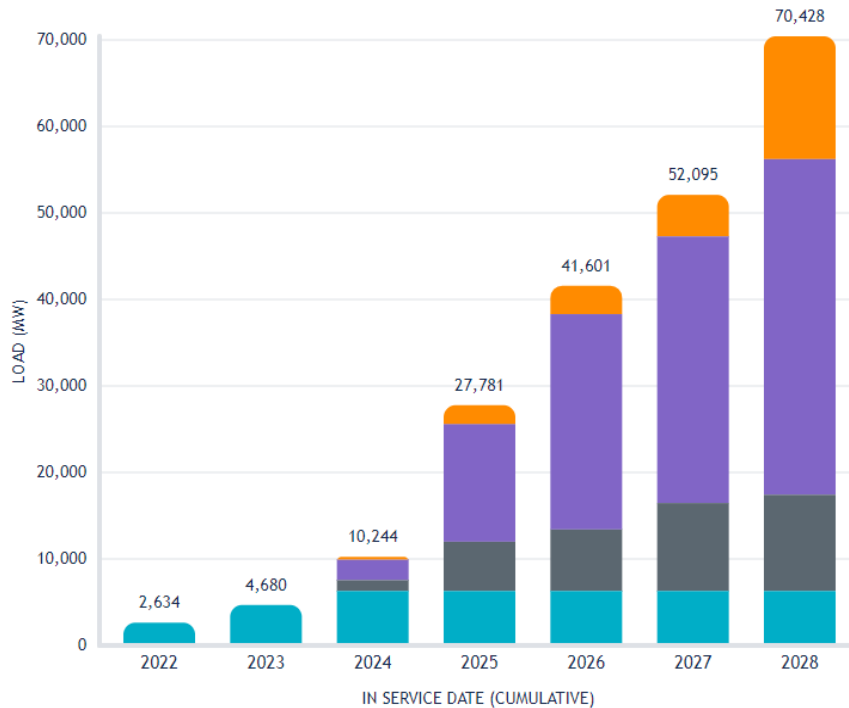
*All information is as of May 2024 and based on the 2024 RTP.

The Changing Grid – Interconnection of Large Loads*

- ERCOT continues to track nearly 70.5 GW of large load interconnection requests.
- 6,297 MW approved to energize since January 2022.
- The interim large load interconnection process, developed in 2022 to reliably integrate these load additions in a timely manner, continues to be used pending the approval of large load Revision Requests.
- ERCOT has proposed NPRR1234 and PGRR115 to formalize the interconnection process for large loads and establish operational standards to maintain reliability.
- ERCOT continues to work with stakeholders to address the challenges associated with the unprecedented volume and characteristics of the current large load interconnection request.

Project Status	2022	2023	2024	2025	2026	2027	2028
No Studies Submitted	-	-	300	2,170	3,295	4,805	14,202
Under ERCOT Review	-	-	2,391	13,620	24,901	30,825	38,802
Planning Studies Approved	-	-	1,256	5,694	7,108	10,168	11,127
Approved to Energize	2,634	4,680	6,297	6,297	6,297	6,297	6,297
Total (MW)	2,634	4,680	10,244	27,781	41,601	52,095	70,428

Actual and Projected Large Load Growth 2022-2028



- Approved to Energize** – Projects that have received Approval to Energize from ERCOT Operations. NOTE: not all MWs in this category have been observed to be operational.
- Planning Studies Approved** – Projects that have received ERCOT approval of required interconnection studies. Any MWs that were not approved are reclassified as No Studies Submitted.
- Under ERCOT Review** – Projects that have studies under review by ERCOT.
- No Studies Submitted** – Projects that are tracked by ERCOT but that have not yet provided sufficient information for ERCOT to begin review. Additionally, MWs that were not approved by ERCOT after review of planning studies are included in this category until a path to interconnect these MWs is identified, or the customer cancels the interconnection request.

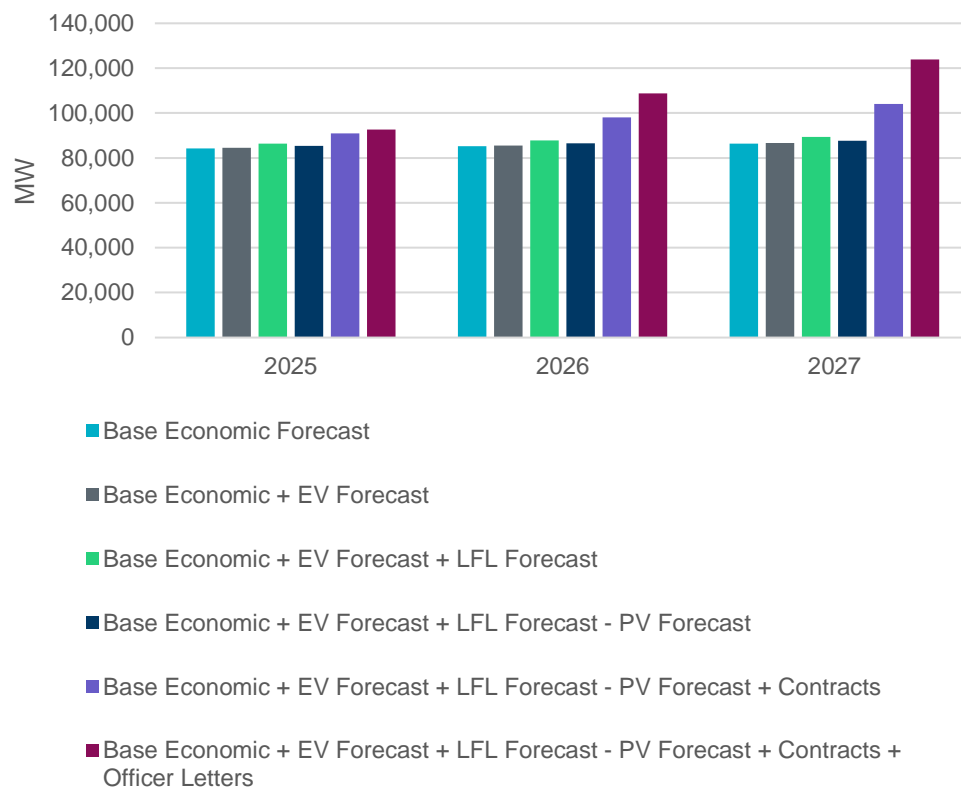


*All information is as of December 11, 2024.

2024 Long-Term Load Forecast

- ERCOT expanded the scope of the 2024 Long-Term Load Forecast (LTLF) to incorporate additional new large loads without a signed contract with their TSP or DSP, but with a TSP or DSP officer letter.
- ERCOT adopted the waterfall methodology in the 2024 (LTLF):
 - To expand ERCOT’s ability to provide forecasts for more scenarios.
 - To avoid double counting load by reconstitution.
 - To allow more visibility of peak load shifts.
 - To increase transparency.
- The waterfall methodology is comprised of:
 - Base (econometric model) forecast.
 - Roof-top PV forecast.
 - EV forecast, Large Flexible Load (LFL) forecast.
 - Large loads substantiated by signed contract or TSP officer letters.

Example of Long-Term Load Forecast Waterfall



$$\text{LTLF} = \text{Base Economic Forecast} + \text{EV Forecast} + \text{LFL Forecast} - \text{PV Forecast} + \text{Contracted Loads} + \text{Officer Letter Loads}$$

Permian Basin Reliability Plan

- In May 2023, the HB5066 was adopted requiring the PUCT to direct ERCOT to develop a reliability plan identifying the transmission upgrades which are needed to serve the existing and future load in the Permian Basin region.
- On December 14, 2023, the PUCT issued an order directing ERCOT to develop the Permian Basin Reliability Plan and to file the reliability plan with the PUCT by July 2024.
- ERCOT began development of the Permian Basin Reliability Plan in January 2024 for year of 2030 and 2038 (peak load of 2039 was studied) with substantial review and input from TDSPs and other stakeholders in the ERCOT Region through the Regional Planning Group (RPG).

	2019 Delaware Basin Study	2021 Permian Basin Study 2030 Case	2023 RTP Study 2029 Case	Permian Basin Reliability Plan 2030 Case	Permian Basin Reliability Plan 2038 Case
Permian Basin Total Load (MW)	9,771	10,527	16,577	23,659	26,400
Permian Basin Oil & Gas Load* (MW)	9,771	10,527	12,341	11,964	14,705
Additional Non-oil & Gas Load (MW)	0	0	4,236	11,695	11,695

* The Permian Basin oil & gas load from the S&P Global Permian Basin study includes residential and commercial load.

- In identifying the transmission needs, ERCOT divided the proposed transmission upgrades into two categories: local transmission upgrades and import paths. For the import paths, ERCOT evaluated three mutually exclusive options: 345-kV, 500-kV, and 765-kV.
- Cost Estimates: Total cost estimates are approximately \$12.95 billion for 345-kV option and \$13.77 billion for 765-kV option in 2038.

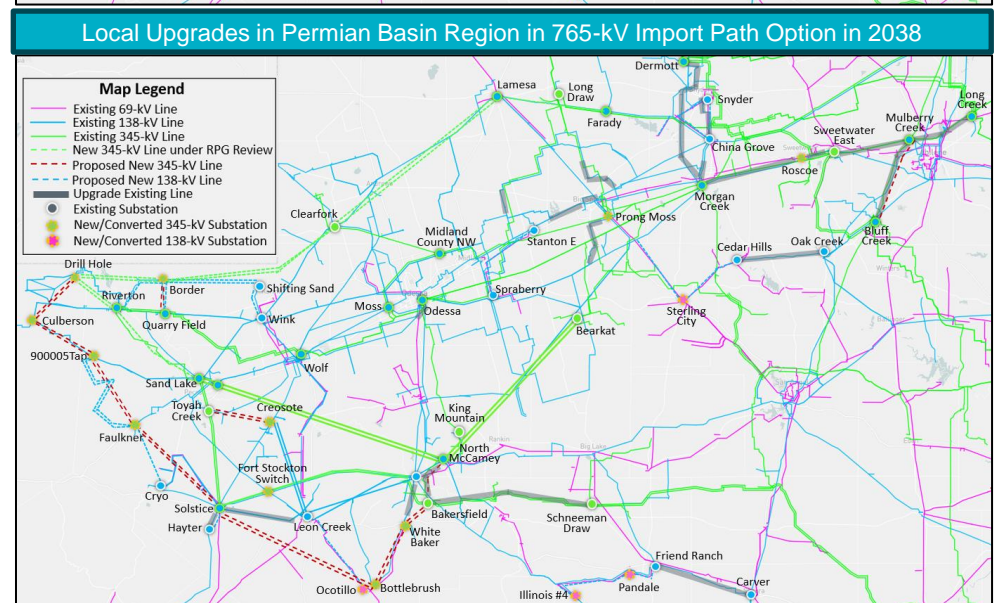
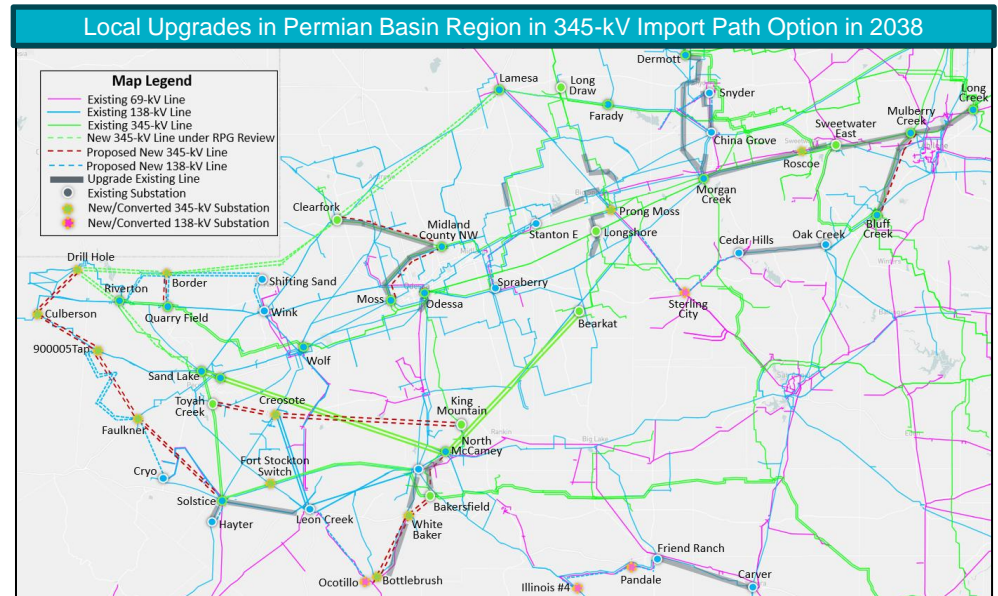
- PUCT approved the Permian Basin Reliability Plan in September 2024.

- Approval of all the common local projects that are required to serve the ERCOT Region through 2038, irrespective of the voltage level that the PUCT approves for the import paths.
- Authorization for TSPs to prepare Certificate of Convenience and Necessity (CCN) applications for all eight import paths, which include three 765-kV import paths and five 345-kV import paths.
- ERCOT must work with the TSPs preparing the CCN applications for the eight import paths to identify the import paths that will be needed to serve load in 2030 so that the preparation of those CCN applications is prioritized by the applicable TSPs.
- Authorization to file the CCN applications for the eight import paths is subject to the PUCT's decision on import path voltage level on a statewide basis by May 1, 2025.

	2038	
	345-kV Option	765-kV Option
Common Local Upgrades	4.02	4.02
Import Paths	7.69	9.06
Incremental Local Upgrades	1.23	0.69
Total	12.95	13.77

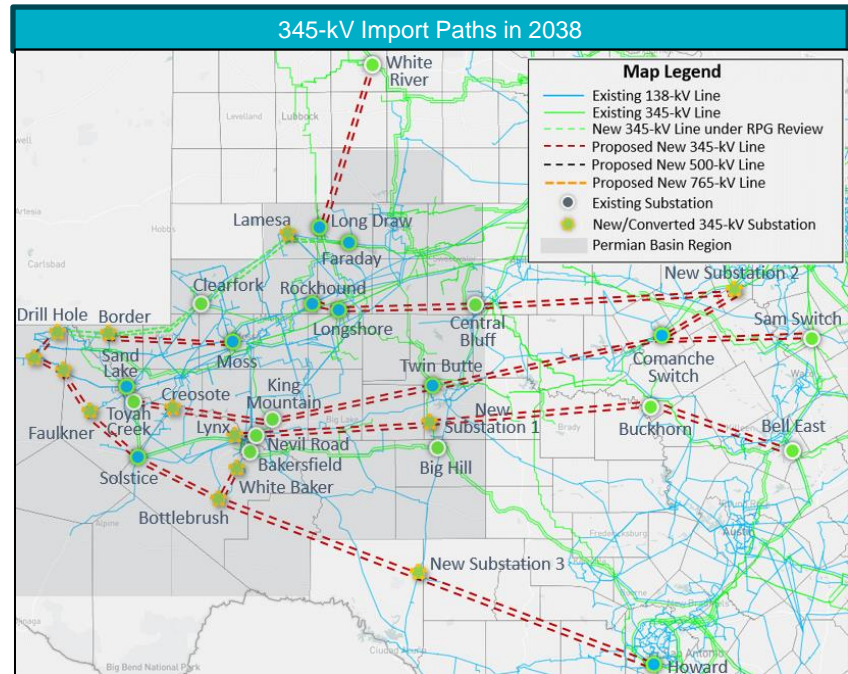
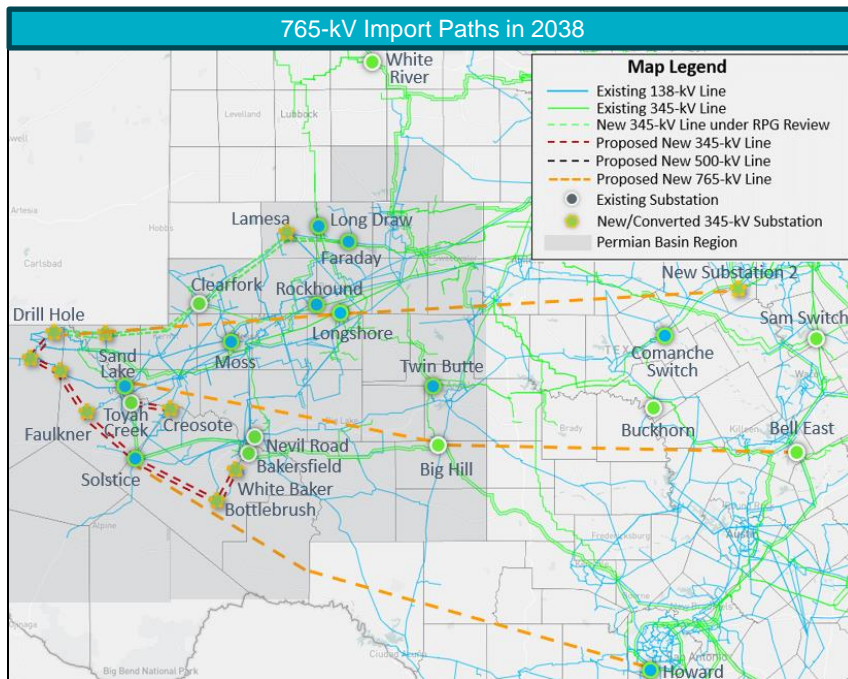
Permian Basin Reliability Plan – Local Transmission Upgrades

- Local transmission upgrades are transmission projects that are needed to interconnect and serve the projected load in the Permian Basin region assuming that power can be imported into the region.
- Common local transmission upgrades would be needed irrespective of the forecast horizon or the import path chosen, and include, among others:
 - The addition of approximately 174 miles of new 345-kV double-circuit transmission lines;
 - The upgrade of approximately 43 miles of existing 345-kV transmission lines and the addition of second circuits;
 - The upgrade of approximately 98 miles of existing 345-kV double-circuit transmission lines;
 - The addition of 8 new 345-kV/138-kV substations with 17 new 345-kV/138-kV transformers;
 - The addition of approximately 186 miles of new 138-kV transmission lines;
 - The upgrade of approximately 221 miles of existing 138-kV transmission lines;
 - The conversion of approximately 230 miles of existing 69-kV transmission lines to 138-kV; and,
 - The addition of approximately 3,600 MVar of reactive power devices.



Permian Basin Reliability Plan – Import Paths

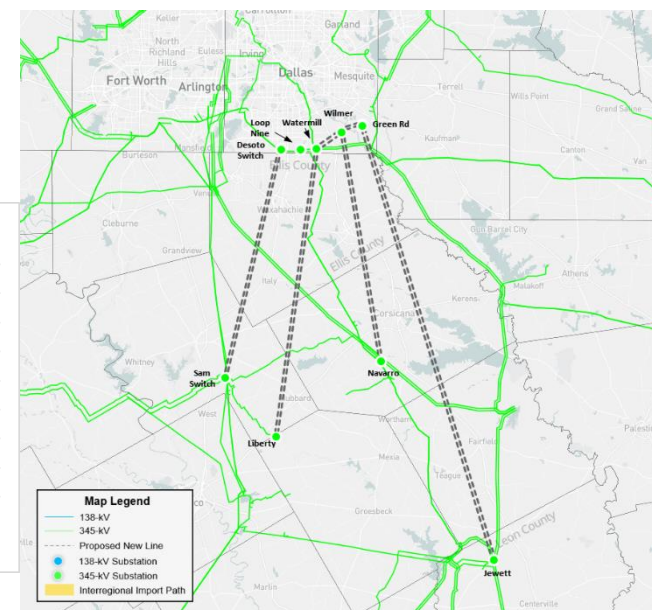
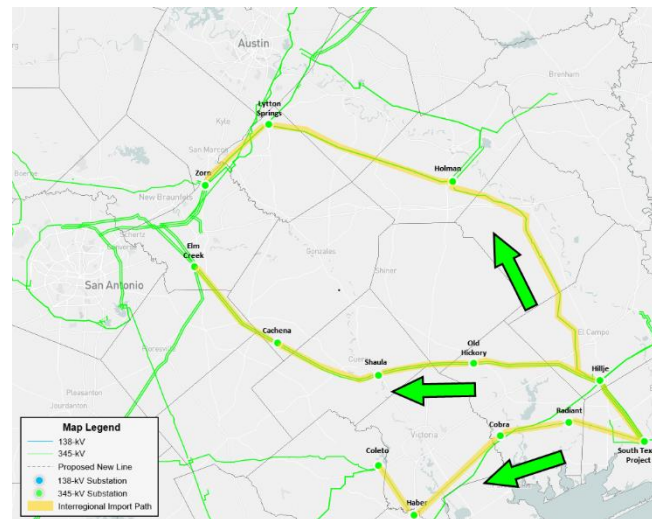
- Import paths are those transmission projects needed to transfer power from other regions into the Permian Basin region to serve the projected demand.
- For the import paths, ERCOT evaluated three mutually exclusive options for 2038: 345-kV, 500-kV, and 765-kV. The 765-kV option will be part of a systemwide 765-kV study to be completed in December 2024.



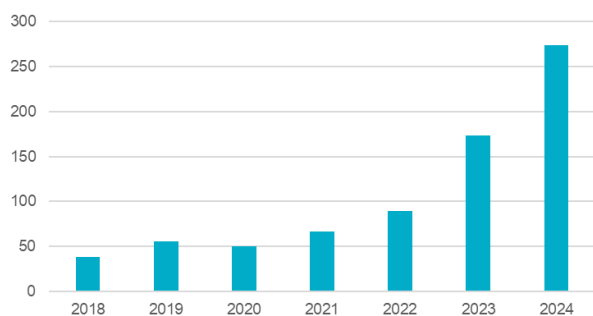
- **345-kV Option:**
 - Four new 345-kV double-circuit import paths plus a short path from the Panhandle, total five 345-kV import paths
 - Approximately 1,676 miles of new 345-kV double-circuit transmission lines in total
 - Additional new dynamic reactive devices required
- **765-kV Option:**
 - Three new 765-kV import paths
 - Approximately 1,255 miles of new 765-kV single-circuit transmission lines in total
 - Additional new dynamic reactive devices required

2024 RTP Highlights

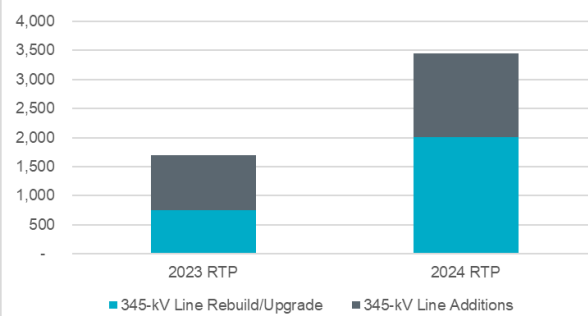
- The unprecedented increase in forecasted load growth resulted in significant reliability needs in the ERCOT System.
- The significant increase in forecasted load resulted in a generation shortage in the 2024 RTP planning models which required adding generation beyond the normal planning guide assumptions.
- The 2024 RTP identified the needs of 274 transmission projects to reliably serve the forecasted load growth in the traditional 345-kV plan (in comparison 173 transmission projects identified in 2023 RTP).
- The reliability projects included both the new inter-regional pathways, enhancement of existing inter-regional pathways, and local transmission upgrades inside each region.
- While Central Texas remains as the area needing significant import capability, new flow patterns have emerged, with imports to Central Texas coming from north of Austin and the Coast Weather Zone due to the significant generation growth in the Coast Weather Zone and generation in the South Weather Zone now serving the large load additions in and around Corpus Christi.
- In total, approximately 580 circuit miles of new 345-kV import paths south of the Dallas-Fort Worth (DFW) metroplex, along with hundreds of miles of reinforcement to the existing 345-kV import pathways into DFW and 5,000 MVar of reactive power support, were needed to reliably serve the projected load growth in the area.



RTP Total Number of Projects

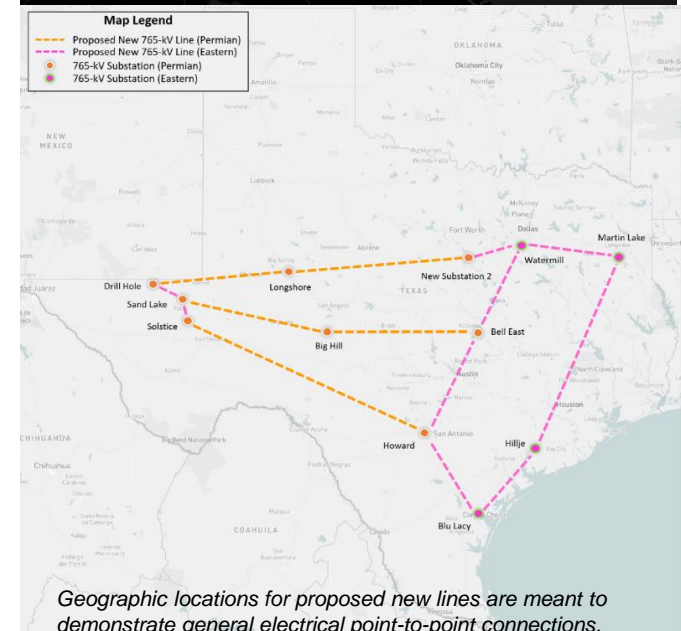
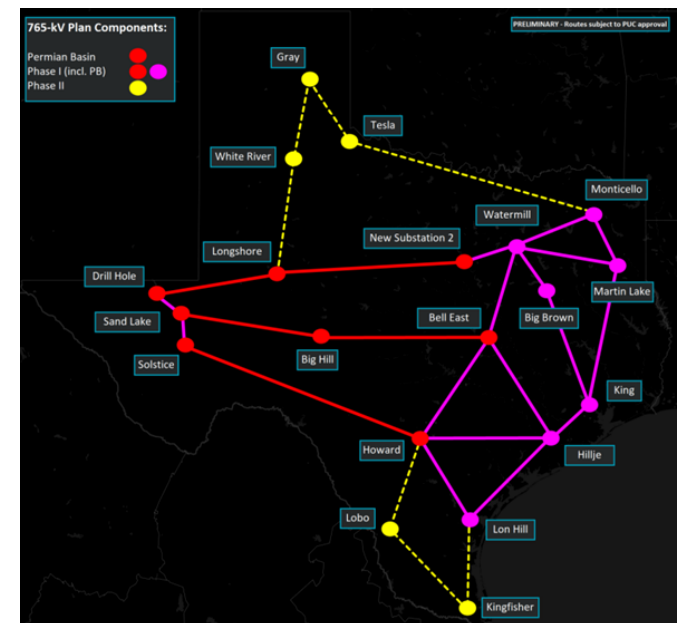


RTP 345-kV Line Projects (Circuit Miles)



2024 RTP - 765-kV Plan

- The unprecedented 2024 RTP load growth prompted ERCOT to consider a 765-kV plan as an alternative to the traditional 345-kV plan to meet the future ERCOT System growth, reliability, and need for large power transfer between major generation locations and load centers.
- ERCOT began by developing a holistic 765-kV plan including two phases for future growth and then identified the critical components (core plan) needed by 2030.
- PUCT approved the Permian Basin Reliability Plan in October 2024, irrespective of the voltage level, and will make a decision on import path voltage level (765-kV or 345-kV) by May 1, 2025.
- ERCOT intends to file the 345-kV vs. 765-kV comparison plan based on the 2024 RTP together with the dynamic analysis and congestion analysis with PUCT in January 2025.



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.

Recent Planning Criteria and Rule Revisions

- Congestion cost savings test development for economic project evaluation
 - ERCOT Board of Directors recommended approval of NPRR1247 in December 2024 to incorporate the congestion cost savings test as recommended by Energy and Environmental Economics (E3).
- Resiliency
 - ERCOT submitted PGRR117 to define the resiliency criteria.
 - ERCOT intends to propose an NPRR to address the process for determining whether an upgrade that meets the proposed resiliency criteria provides sufficient benefit balanced with economic savings and/or reliability benefits, in accordance with 16 TAC § 25.101(b)(3)(A)(iii). This NPRR is currently under development and will be brought to the stakeholder process in 2025.
- HB5066
 - HB5066 requires consideration of load for which the electric utility has yet to sign an interconnection agreement, as determined by the electric utility with the responsibility for serving the load.
 - To facilitate the PUCT's consideration of projects that may be needed to serve this load, NPRR1180 and PGRR107 propose to incorporate this additional load into ERCOT's planning processes.
- Generation addition in planning models
 - While the new rules allow for the consideration of more load in the planning processes, the policy governing the inclusion of planned Generation Resources in the planning models remains unchanged.
 - Additional steps outside of the current planning practices were needed to create planning models capable of accommodating the unprecedented load growth in the 2024 RTP.
 - ERCOT is currently developing a PGRR to adjust the criteria for adding Generation Resources to the planning models and will initiate stakeholder discussions in 2025.

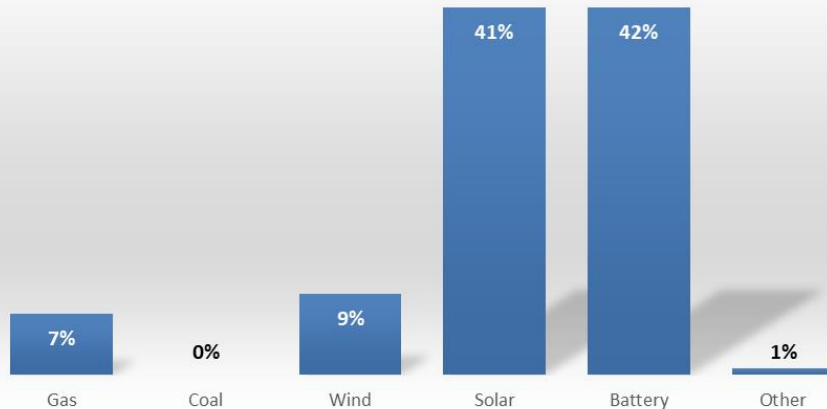
High Voltage Direct Current (HVDC) Transmission

- ERCOT currently has four asynchronous ties to other grids: two connections to the Eastern Interconnection with a total capacity of 820 MW, and two ties to the Mexican system with a total capacity of 400 MW. These ties allow ERCOT and the connecting grids to exchange power in emergencies and for entities to trade power between grids on a commercial basis.
- [Southern Spirit Transmission](#) has proposed building a 3,000 MW, 324-mile, 525-kV DC Tie project connecting ERCOT to MISO South in Eastern Mississippi with an expected energization in 2029.
- This was formerly the 2,000 MW Southern Cross Transmission Project. ERCOT has materially completed its work on the directives assigned to ERCOT by the PUC in Project No. 46304. These include Directive 6 (determination regarding any needed transmission upgrades) and Directive 8 (determination regarding Primary Frequency Response and Voltage Support).
- Pattern Energy has requested that ERCOT conduct a transmission interconnection study of the revised Southern Spirit Transmission project to evaluate system constraints under the latest project parameters.
 - Project previously studied at maximum capacity of 2,000 MW; project capacity is now 3,000 MW
 - Project previously studied using line-commutated converter (LCC) technology; Southern Spirit now plans to use voltage-source converter (VSC) technology
 - Studies expected to be completed by end of Q1 2025



Advanced Grid Support (AGS) Inverter-based Energy Storage (ESR) Adoption Effort

Generation Interconnection Requests by Fuel Type:
Total 372 GW (as of September 2024)



- Increasing challenges in reliably operating the ERCOT System with rising IBR integration and fewer online conventional units underscores the importance of proactive measures for grid stability
- Approximately 92% of new interconnection requests are IBRs, with nearly 42% specifically for inverter-based ESRs (i.e., batteries).

Source: ERCOT [GIS Report](#) posted on 10/1/2024 for September 2024

- With minimal impact to the hardware, AGS-ESR can enhance grid stability, reduce generation curtailment due to stability constraints, and lessen the severity of grid disturbance.
- The ERCOT AGS-ESR Test Requirement [report](#) has been posted on [the IBRWG website](#).
- The Planning and Operating Guides revision requests ([NOGRR272](#) and [PGRR121](#)) are currently under the stakeholder review process.



ERCOT AGS-ESR test requirement [report](#)

Recent PUC Rule Changes and Initiatives

- **Reliability Standard:** The PUC adopted a Reliability Standard for the ERCOT Region in August 2024. The Standard comprises three probabilistic reliability measures and associated compliance criteria. For a system simulation, the metrics assess characteristics of loss-of-load (LOL) events—when there are insufficient resources to meet load and maintain required minimum operating reserves. The metrics and criteria include the following:
 - The expected average frequency of LOL events must not exceed 0.1 events per year
 - The maximum magnitude of LOL events must be less than the maximum number of megawatts of load shed that can be safely rotated during a LOL event (with a 1% exceedance tolerance)
 - The maximum duration of LOL events must be less than 12 hours (with a 1% exceedance tolerance)
- **Capacity, Demand and Reserve (CDR) Report:** The PUC approved NPRR1219 to extensively modify ERCOT's CDR reports. The main modifications include (1) reporting of both peak load hour and peak net load hour capacity reserve margins, (2) incorporating capacity contributions from battery energy storage resources, (3) revising the capacity contribution methodology for IBRs to account for their reliability impacts on the system, and (4) expanding the eligibility criteria for planned resources to include posting of financial security for interconnection construction.

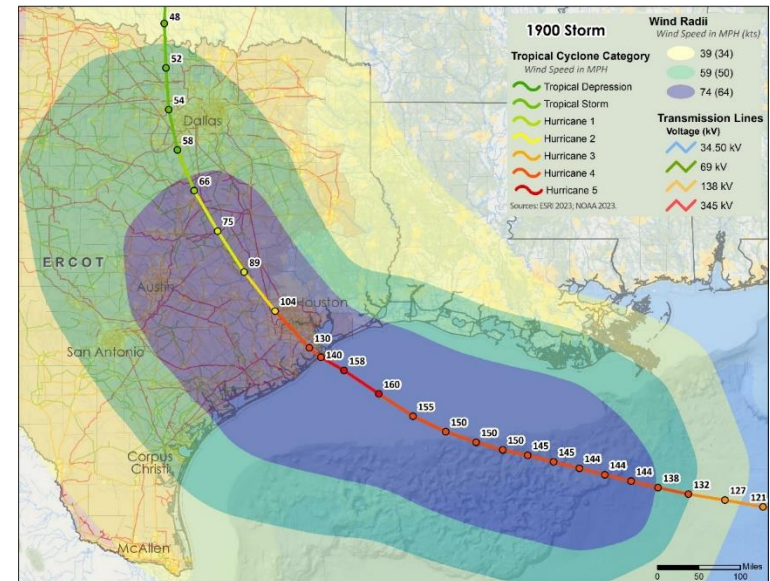
The ERCOT Region is considered deficient if any one of the criteria is not met, thereby

2024 Grid Reliability and Resiliency Assessment (GRRRA)

- The 2024 GRRRA was performed to meet the requirements established in 16 TAC § 25.101(b)(3)(E).
- The 2024 GRRRA identified projects that are necessary to prevent cascading, instability, or uncontrolled islanding and/or to reduce the impact of outages on customers under the following two extreme weather scenarios:
 - An extreme winter peak scenario that considered a weather condition similar to the 2021 Winter Storm Uri event but with the impacts of the weatherization rules effective since then factored in.
 - A hurricane scenario representing a worst-case scenario Category 5 hurricane with Houston area landfall using information provided in the Argonne National Laboratory's 2024 Hurricane Study for ERCOT.

Key takeaways:

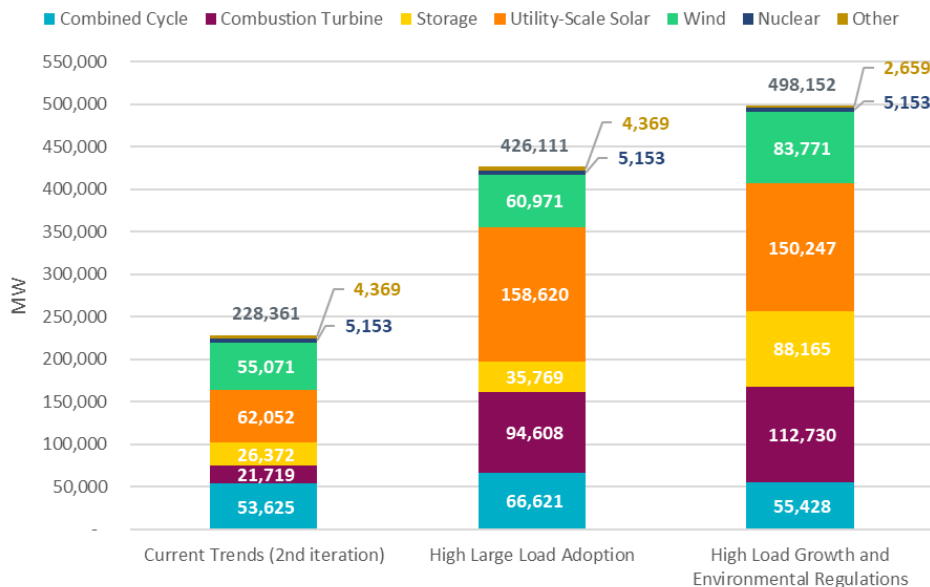
- Additional transmission enhancements were found to be beneficial to increase the resiliency of the ERCOT Transmission Grid under both scenarios.
- Substation hardening was found to have a critical role in increasing system resiliency under the hurricane scenario.
- Though distribution hardening was out of the scope of this assessment, a more resilient distribution system was deemed as crucial to increase the overall system resiliency under the hurricane scenario.



2024 Long-Term System Assessment (LTSA)

- ERCOT’s 2024 LTSA analyzed potential system needs through 2039.
- ERCOT analyzed different future scenarios in its long-term planning process to account for the inherent uncertainty of planning the transmission system beyond six years.

Total Net Nameplate Capacities in 2039



Across all scenarios, significant growth in wind, solar, natural gas, and battery energy storage was projected to replace retired coal capacity and meet rising demand.

		Congestion Rent	
Index	Constraint	2034	2039
1	West Texas Export Interface	\$556M	\$821M
2	Farmland - Wett Long Draw 345-kV Line	\$134M	\$233M
3	Meadow - PH Robinson 345-kV Line	\$162M	\$155M
4	Bell County East Switch - Sandow Switch 345-kV Line	\$121M	\$153M
5	South Texas Project - Jones Creek 345-kV Line	\$55M	\$143M
6	Panhandle Interface	\$142M	\$140M
7	Refuge - Jones Creek 345-kV Line	\$49M	\$112M
8	North - Houston Interface	\$60M	\$108M
9	Kendall - Welfare 138-kV Line	\$15M	\$81M
10	MacKenzie Substation - Northeast Substation 115-kV Line	\$55M	\$79M

Transmission challenges were identified for both the export from the renewable resource-rich regions and the import into the demand centers.



NERC & DOE Studies of Interregional Transfer Capability

NERC Interregional Transfer Capability Study (ITCS)

- Fiscal Responsibility Act of 2023: NERC must conduct study of “total transfer capability” to recommend “prudent additions . . . that would demonstrably strengthen reliability within and among . . . neighboring transmission planning regions.”
- Based on the identified resource deficiencies under several instances including the most severe of which was observed during Winter Storm Uri event, study recommends 14,100 MW of transfer capability as “prudent additions” to connect ERCOT with other planning regions:
 - 5,700 MW to the “Front Range” area of the Western Interconnection
 - 4,300 MW to MISO South
 - 4,100 MW to SPP South
- ITCS report notes that alternative approaches other than transmission can also mitigate these future energy risks, such as local generation, or demand-side solutions.
- ERCOT’s advisory group member submitted comments noting that study does not account for ~8,500 MW of generation under Texas Energy Fund that is expected to be available to help mitigate energy deficiencies.
- NERC filed the ITCS final document with the Federal Energy Regulatory Commission (FERC) on November 19, 2024.
 - Public comments allowed once FERC publishes study in the Federal Register.
 - FERC must provide report to Congress within 12 months after end of public comment period.
 - FERC may provide recommendations for statutory changes.

DOE National Transmission Planning Study (NTPS)

- Extends on 2023 National Transmission Needs Study to provide more robust recommendations of interregional transfer capability based on analysis of overall reliability and economic impacts and facility costs.
- On October 3, 2024, the Department of Energy (DOE) released its National Transmission Planning Study.
- Primary purpose of study was to identify regional and interregional transmission additions needed under a wide array of different future scenarios of emissions restrictions and demand growth.
- Some of the key study conclusions:
 - Increasing regional and interregional transmission buildout to 2.4–3.5 times 2020 capacity by 2050 decreases system costs by \$270–490 billion (NPV) due to increased generation-sharing and use of low-marginal-cost wind and solar power, assuming medium growth and emissions reduction policies.
 - Greater reliance on wind and solar power reduces CO2 emissions by 10.2-11.2 billion metric tons (43% to 48%).
 - Under high demand growth assumption (2.7%), estimated net savings from accelerated transmission range from \$710–970 billion (NPV).
 - 2035 nodal multi-terminal (MT) HVDC analysis identifies a need for up to 28 GW of additional transfer capability between ERCOT and other regions (MISO-South, SPP, and Western Interconnection).

ERCOT Interregional Transfer Study Proposal

- ERCOT is currently seeking via a request for proposal (RFP) a contractor to perform a study of the costs and benefits of increasing synchronous and/or asynchronous connections between ERCOT and other regions.
- Summary of the study objectives and scope:
 - full assessment of costs and benefits of increasing connections to other regions from the perspective of Texas consumers.
 - advantages/disadvantages of synchronous vs. asynchronous connections.
 - alternatives to synchronous and asynchronous connections, such as switchable generation and demand response.
- Key milestones:
 - November 2024: issuance of RFP
 - January 2025: proposals due
 - March 2025: draft outline of final report due
 - August 2025: report completion

Contacts and Links

Contacts and Information

For general communications and queries, please submit an information request to: <https://www.ercot.com/about/contact/inforequest>

Media

Media@ercot.com

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Links

ERCOT website: <https://www.ercot.com/>

Market Participants can access additional planning information on the Market Information System (MIS), which can be accessed through the “MIS LOG IN” link located at the top of the ERCOT website. A digital certificate is required to access to this area. Information available on the MIS includes a variety of data, procedures, reports, and maps for both operations and planning purposes, including the following planning-related information:

- Generation project interconnection information
- RPG information
- Steady-state base cases