MARCH 2025

2025 ERCOT ELECTRICITY MARKET OUTLOOK 2ND EDITION

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Introduction

As part of an ongoing series, LCG Consulting produces the ERCOT Outlook, which outlines our findings from modeling the ERCOT electricity market based on the most likely transmission, generation, and market conditions. The nodal market simulations for our 2025 studies were performed using LCG's UPLAN Network Power Model (NPM)™ and PLATO-ERCOT™ Data Model with hourly dispatch. We used the most updated data available, as of February 2025, which includes several notable developments and projections.

Texas has undergone dramatic changes in its fuel mix and transmission infrastructure in the last fifteen years, and that rate of change is not slowing. According to Q4 2024 data, ERCOT's annual renewable output increased by 14% during the year 2024, averaging 440.25 GWh per day. ERCOT leads in added total renewable generation capacity and achieved a record solar output of 24.3 GW at 2:35 p.m. CT on February 28, 2024. The 2022 Inflation Reduction Act (IRA) has been a significant driver in promoting investment in these technologies.

Both residential and commercial demand in Texas continues to grow. As of this report's publication date, ERCOT's peak demand for 2023 was 85.7 GW, approximately 7% higher than the 80.0 GW peak demand recorded in 2022. In 2024 due to mild summer weather the demand levels did not reach the peaks set in 2023 despite which the recorded peak was just 309 MW short of the record demand.

Industrial load growth along the coast and in West Texas, along with increased oil and gas production activity in the Permian Basin, has contributed to above-normal growth. Growth continues in major load centers such as the Dallas-Fort Worth area and Houston. According to the U.S. Census, Texas has the fastest-growing population of any state. UPLAN projects a peak demand of 92.7 GW and a total energy demand of 498 TWh for 2025.

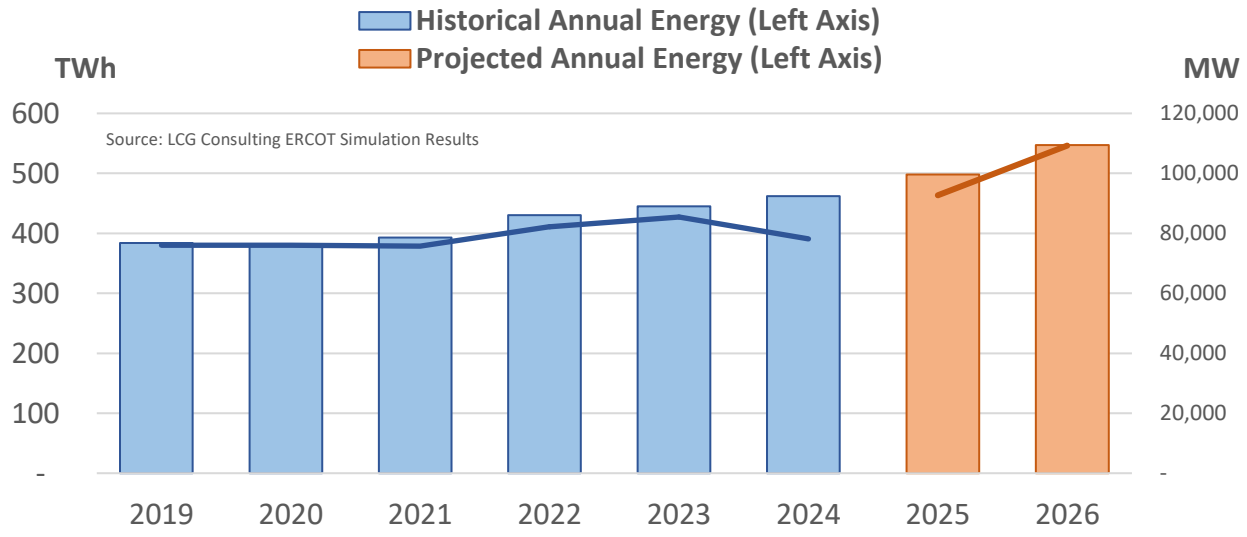


Figure 1 Peak load and energy demand from 2018 to 2026

Figure 1 shows the historical peak load and energy demand for ERCOT from 2018 to 2024, along with forecasted UPLAN simulation data for 2025 and 2026. The simulation data is based on ERCOT's Monthly

Peak Demand & Energy Forecast and the Weather Zone Coincident Peak Forecast, both published in July 2024. The annual average growth rate for peak load from 2019 to 2026 is 5.32%, while the growth rate for energy demand is 5.18%.

In 2025, LCG anticipates that cryptocurrency mining activities will add as much as 3.5 GW to demand, accounting for a remarkable 3.8% of the forecasted ERCOT-wide peak demand of 92.7 GW. This additional demand presents challenges to the transmission system and is expected to impact prices as it grows. Cryptocurrency mining operations act as controllable loads that are price-responsive and can adjust their demand based on orders from the grid operator. While ERCOT remains open and welcoming to miners, in March 2022 it began requiring that they obtain approval before connecting to the grid. In November 2024 a law came into effect requiring existing facilities using more than 75 MW to register with the state, and to disclose their electricity use, as well as to project their expected energy demand for the next five years.

Concurrently, AI ventures have led to substantial investments in building new data centers, hundreds of which have already been built in Texas, particularly in the Dallas-Fort Worth area. Investment in this area is expected to grow rapidly. Unlike cryptocurrency, data centers cannot typically participate in demand response. Recent data suggests Texas has 386 data centers, while the U.S. has 5,381, although only a portion of this capacity is dedicated to AI, perhaps around 10%.

Transmission continues to be a critical issue in Texas, with the timing and location of upgrades being crucial for predicting economic patterns. Several transmission upgrades have been completed and are under construction to enhance the reliability of the electrical grid.

To upgrade the state's power grid to catch up with this growth, the Texas legislature approved the $5 billion Texas Energy Fund (TEF) to provide grants and loans for the enhancement of existing generating facilities or the construction of new ones within the ERCOT region. To qualify for this funding for the fiscal years 2024-2025, a generation facility must have a capacity of at least 100 MW.

In the South load zone of ERCOT, a key region for solar, wind, and storage development, congestion issues have been prominent, particularly involving the Spruce to Pawnee 345kV circuit. This circuit serves as the sole, southern-facing 345kV import path to the 345kV ring around San Antonio, often congested due to the contingent loss of the Elm Creek to San Miguel 345kV Circuits 1 and 2. To address the severe congestion observed during the summers of 2022 and 2023, ERCOT has initiated upgrades to this double circuit. The CPS San Antonio South Reliability project aims to enhance the network by adding a double-circuit 345kV import path to the San Antonio ring network, with completion targeted for mid-2027.

ERCOT's Permian Basin reliability study considers growing transmission needs due to significant load growth, driven by the oil and gas sector and other industrial activities. According to ERCOT’s historical data, the peak demand of Far West Weather Zone, which includes a significant portion of the Permian Basin, has grown approximately by 255% over the last decade. Moreover, S&P Global developed a 2022 load forecast, where projected growth in peak oil-and-gas related demand as 11,964 MW in 2030 and 14,705 MW in 2039, reflecting an expectation of a transmission expansion in the Permian Basin region.. ERCOT has proposed the addition of approximately 162 miles of new 138-kV transmission lines to enhance the reliability of the local grid, and the construction of new 345-kV double-circuit transmission lines to form a loop in the Delaware Basin area.

The Corpus Christi North Shore Project is designed to enhance the reliability and capacity of the electrical grid in the Corpus Christi area. The project involves several critical upgrades, including adding a 345 kV bus and two 345/138 kV transformers at the Resnick substation, building approximately 44 miles of double-circuit 345 kV transmission lines, and reconductoring roughly 1.5 miles of 138 kV transmission lines. The project has recently been completed.

LCRA Transmission Services Corporation is upgrading the Hays Energy to Kendall Corridor transmission line. Expected to be completed this year, this project rebuilds an approximately 60-mile transmission line corridor from the Hays Energy Substation near Interstate 35 in San Marcos to the Kendall Substation.

The number of Generic Transmission Constraints (GTC) continues to grow, particularly in West Texas and South Texas, as a temporary measure to address the stability constraints related to the long-distance transfer of power from these areas to urban centers. ERCOT has identified a reliability need to limit power transfers in areas south of San Antonio. Therefore, as of March 2024, ERCOT has added four new GTCs to manage these transfers, bringing the total to twelve GTCs in effect by 2025.

The generation capacity mix is expected to remain similar to that of 2024, with no significant changes anticipated between 2025 and 2026. In 2025, natural gas-powered generators are projected to remain the majority of installed capacity, followed by wind and solar resources. Wind and solar energy will play an important role in the capacity mix, with a total nameplate capacity of 40,957 MW and 37,462 MW, respectively, not adjusted for Effective Load Carrying Capability (ELCC). The planning reserve margin for summer 2025 is forecasted to be 21.56%, based on resource updates provided to ERCOT from generation developers and an updated peak demand forecast.

Figure 2 shows installed capacity by fuel type, as modeled in UPLAN.

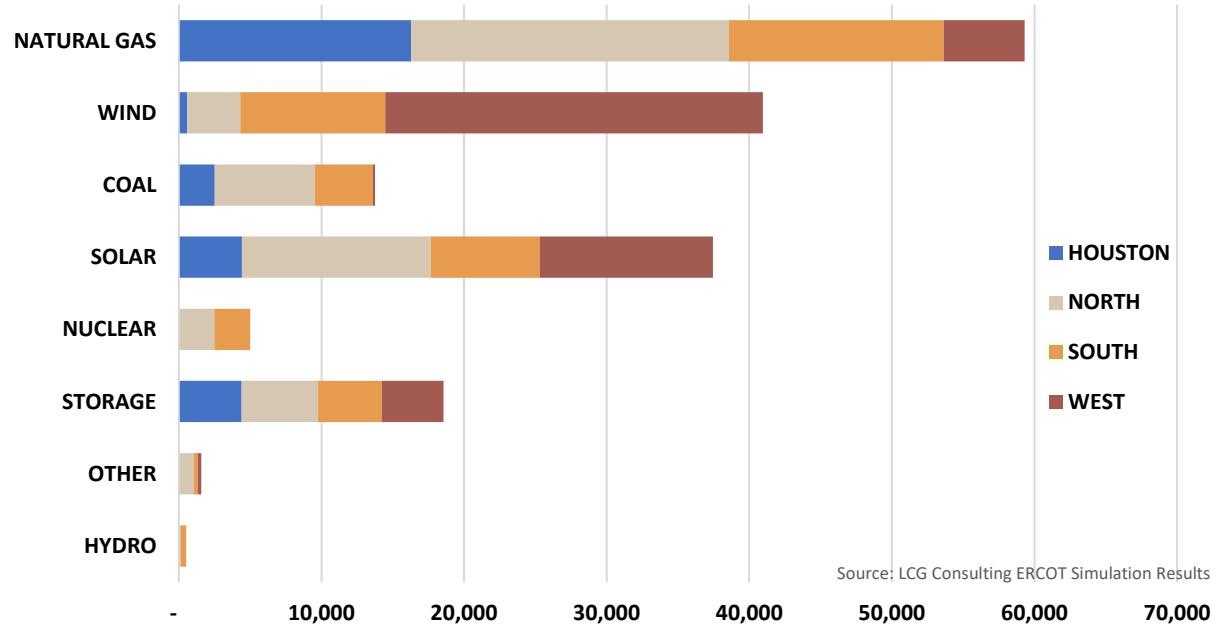


Figure 2 ERCOT installed capacity by fuel type in 2025 (MW)

In this study, we based the generation expansion for 2025 on the ERCOT Generation Interconnection Study (GIS) Report, published in May 2024. Units with Signed Interconnection Agreements (SGIA) and Financial Security (FS), and notice to proceed posted with the transmission owners have been modeled in UPLAN.

LCG's statistical analysis of the GIS indicates an average delay of 500 days between the expected commercial operation date reported in the CDR and the actual date when the plant comes into service. Persistent pressure on supply chains has been the primary reason for the delay. For this reason, simulations exclude 11,863 MW of solar, 6,918 MW of storage, and 2,157 MW of wind units, even though their expected Commercial Operation Date (COD) falls between Q3 and Q4 2025 and they meet the SGIA and FS criteria.

Approximately 22.4 GW of new capacity is expected to be added to the ERCOT market from Q1 2025 to Q4 2025. The new capacity by 2025 is outlined in Table 1.

Table 1 Capacity expansion by fuel type and zone by 2025 (MW)

Zone	STORAGE	SOLAR	WIND	NATURAL GAS	TOTAL
HOUSTON	2,777	1,608	441	174	4,999
NORTH	3,221	5,052	-	-	8,273
SOUTH	2,146	2,106	235	188	4,675
WEST	1,290	2,541	577	-	4,407
TOTAL	**9,433**	**11,306**	**1,252**	**362**	**22,353**

Source: LCG Consulting ERCOT Simulation Results

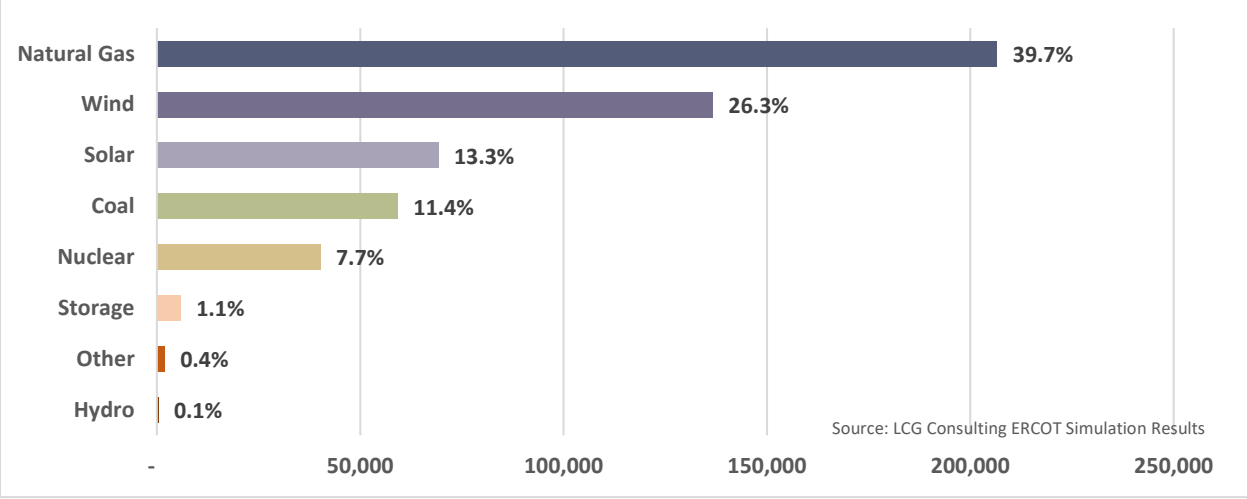


Figure 3 Annual energy production by fuel type (GWh) [1]

[1] Contributions from other fuel types are considered under "Other" fuel type.

Half of energy in ERCOT continues to come primarily from fossil fuels but is increasingly being replaced by wind and solar. Fossil fuels are expected to generate 51% of the electricity, which is similar to the 2024 outlook but represents a sharp decrease of 8% from 2023. Solar generation has been growing rapidly, increasing from 1.0% in 2019 to 2.3% in 2020, nearly doubling again to 4% in 2021, 5.6% in 2022, and 8.7% in 2023. It is expected to grow to 13.3% by 2025. Wind generation is projected to be around 26.3% in 2025. Coal generation continues to decline due to planned retirements. Figure 3 shows the annual production by fuel in LCG's 2025 simulation.

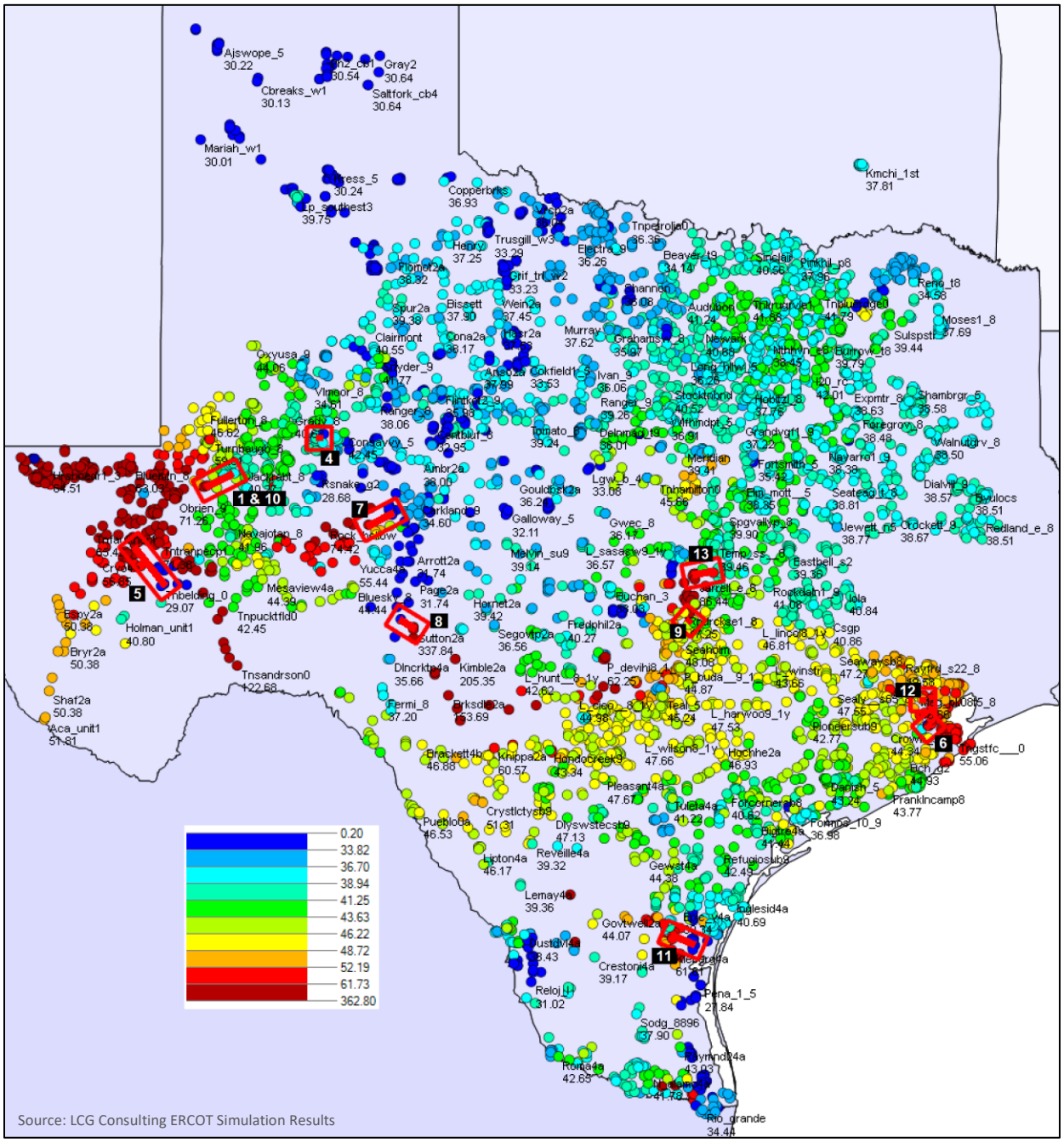


Figure 4 Annual average nodal price heat map and top 15 transmission constraints

Figure 4 shows a heat map of annual average bus LMPs and the top constraints in the ERCOT region for 2025. The figure displays the top 15 constraints with the highest congestion rent for 2025:

1. Odessa EHV Switch to Yarbrough Substation 138kV line
2. North to Houston GTC
3. West Texas GTC
4. Longshore_5 Prairilnd_5 345kV line
5. Fort Stockton Plant to Leon Creek TNP 138kV line
6. Magnolia TNP To Seminole TNP 138kV line
7. Hargrove To Twin Buttes 138kV line
8. Sonora To Bondroad 69kV line
9. Wells Branch to Howard Lane 138kV line
10. Odessa EHV Switch to Yarbrough Substation 138kV line
11. Celanese Bishop to Nelson Sharpe 138kV line
12. Tanker to Galena Park 138kV line
13. Bell County to Salado Switch 138kV line
14. North Edinburg to Lobo GTC
15. South Texas Export Pawnee-Spruce GTC

The annual average prices tend to be highest in the Houston zone, followed by the South, West, and North zones.

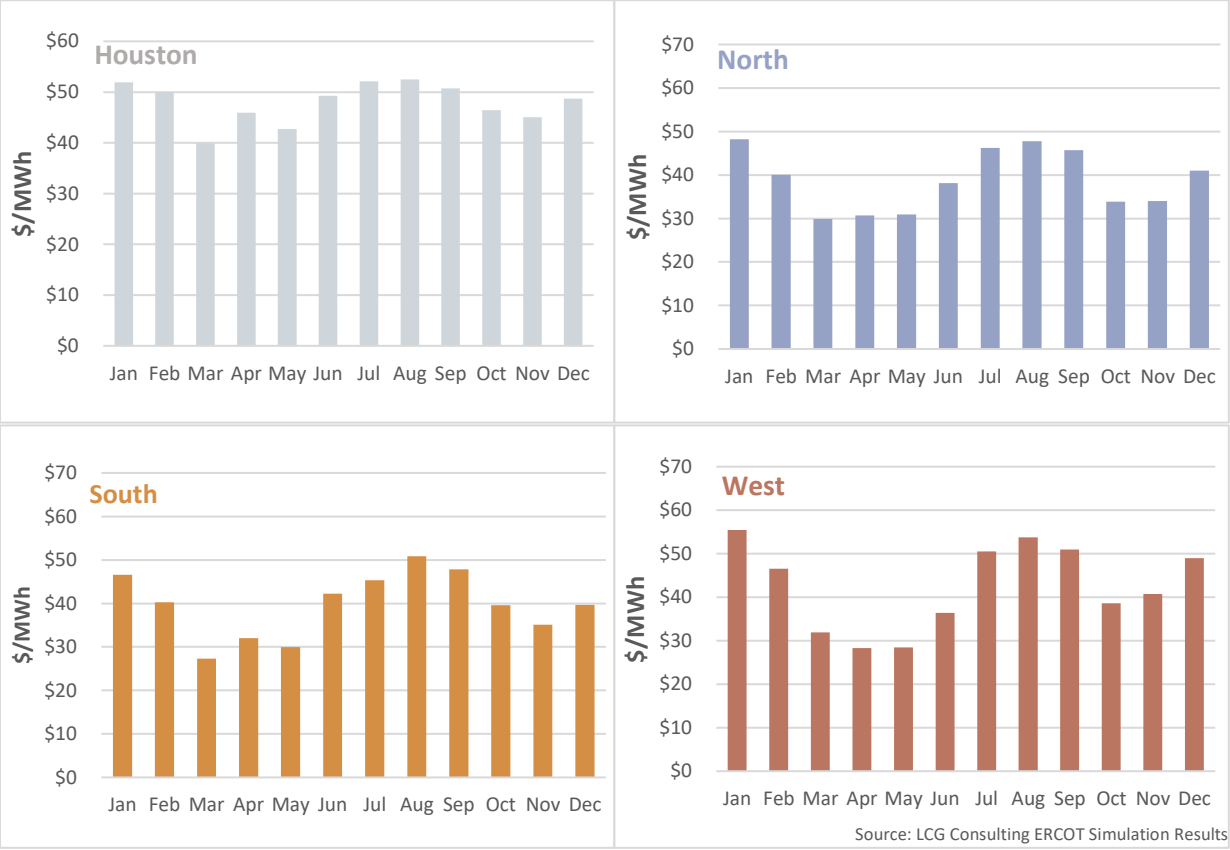


Figure 5 Monthly load-weighted average prices ($/MWh) by load zone – 2025

Figure 5 shows the load-weighted, monthly average prices by load zone. Prices are typically higher during the summer (June–September) and winter (December–February) months. The highest zonal price from the simulation is around $774/MWh, which is well below the newly reduced System-Wide Offer Cap (SWOC) of $5,000/MWh.

Historical real-time market prices for load zones monthly are shown in Figure 6. Note that the extreme weather events of February 2021 have been removed for better comparison.

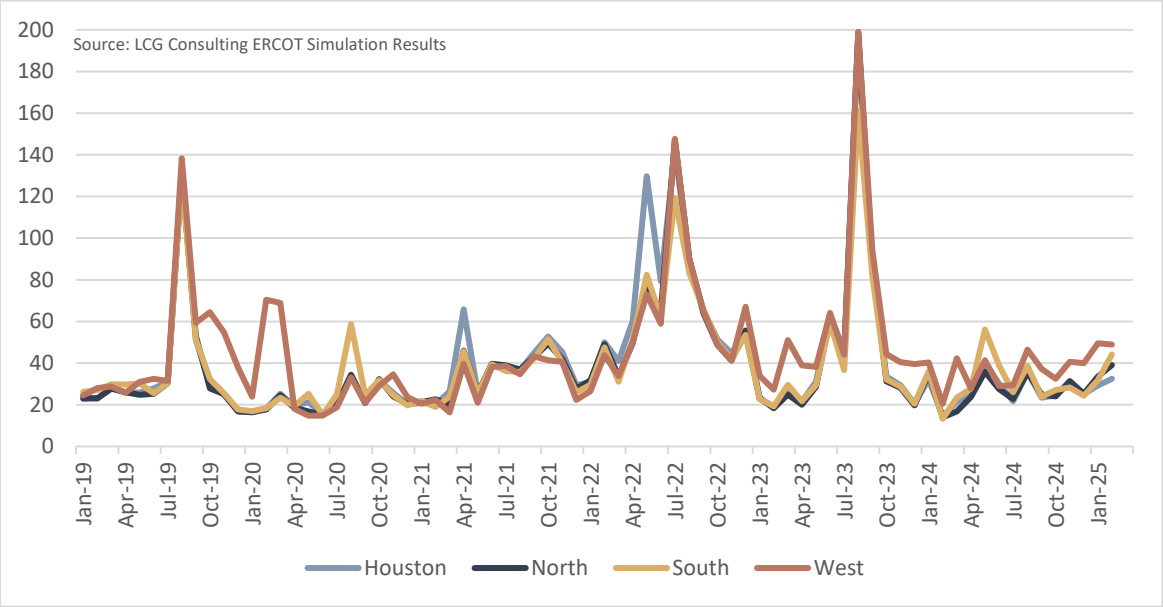
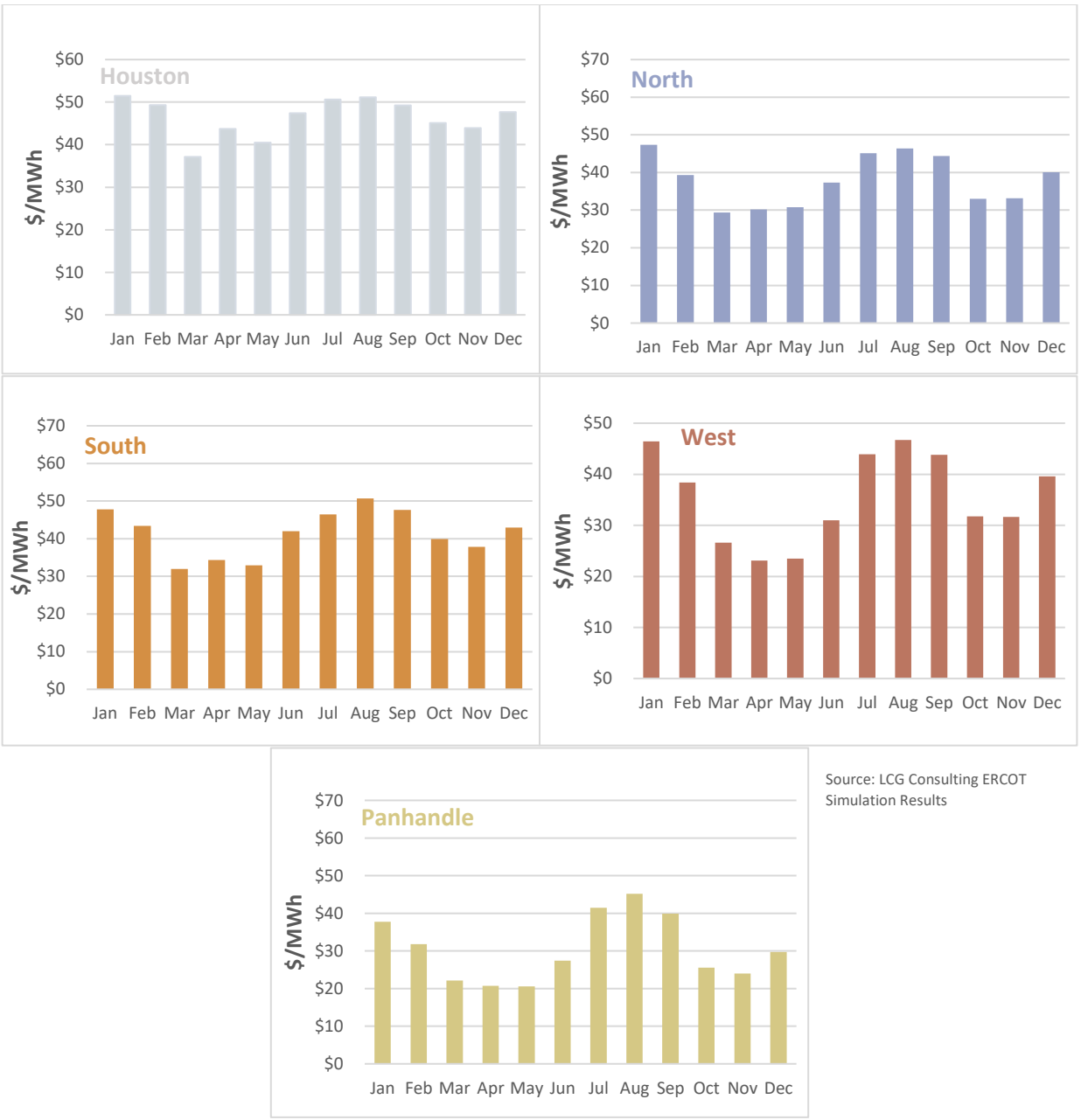


Figure 6 Historical monthly load-weighted average prices ($/MWh) by load zone

ERCOT has defined seven hubs for calculating average LMPs and assisting transactions between hubs, zones, and individual buses: Houston with 20 buses, North with 75 buses, South with 31 buses, and West with 17 buses. A Panhandle Hub was created in 2019 and includes 12 buses.

Under expected conditions, the most competitive average hub price is observed in the Panhandle Hub, with progressively more expensive prices experienced in the North, West, South, and Houston Hubs. The hub price averages are higher during the summer and winter months, a trend similar to load zone prices. Monthly average prices in 2025 at the Houston, North, South, West, and Panhandle Hubs are shown in Figure 7.



Source: LCG Consulting ERCOT Simulation Results

Figure 7 Monthly average prices ($/MWh) by trading hub – 2025

The implied Heat Rate (IHR) is the cost of fuel needed to generate one megawatt-hour of electricity. It is calculated by dividing the electricity price ($/MWh) by the natural gas price ($/MMBtu). Only a natural gas generator with an operating heat rate—a measure of unit efficiency—below the implied heat rate value can be profitable. In-house natural gas price predictions show that the average natural gas price ranges from $1.56/MMBtu to $3.62/MMBtu across the four ERCOT load zones. Based on UPLAN projections, the lowest implied heat rate occurs in March in the North load zone. During the summer months, the implied heat rate averages around 16-22 MMBtu/MWh, while in non-summer months, it averages around 11-16 MMBtu/MWh. Monthly implied heat rates by load zone are shown in Figure 8.

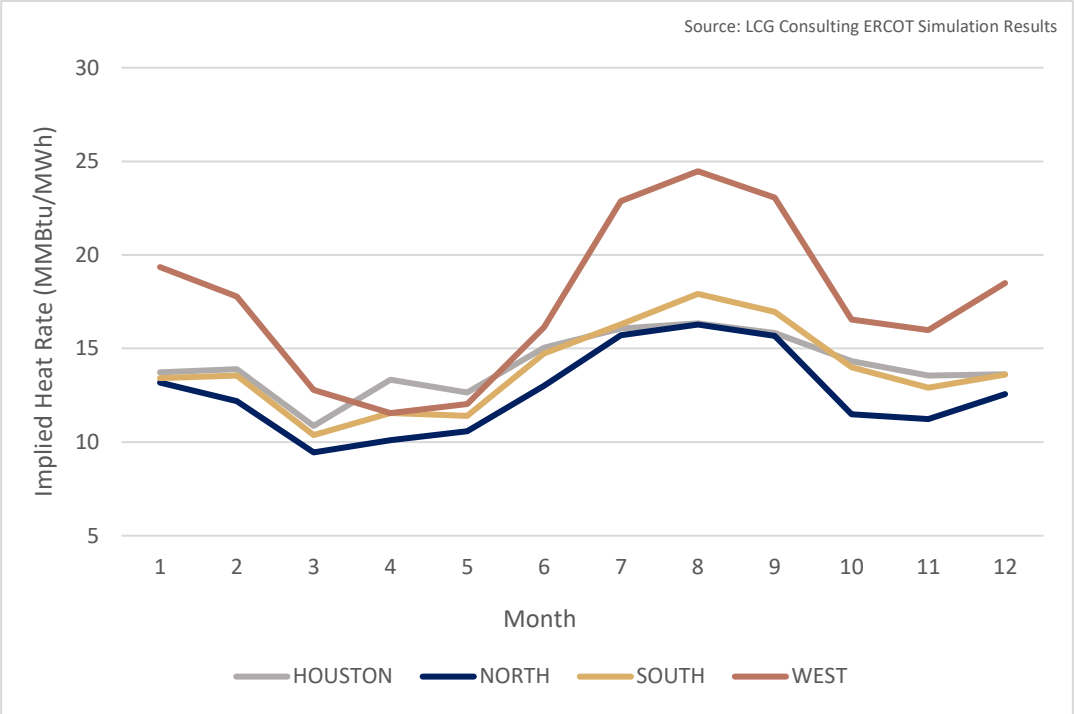


Figure 8 Monthly implied heat rate by load zone - 2025 (MMBtu/MWh)

The ERCOT region is poised for a rapid transition toward increased reliance on renewable energy resources. Battery storage is expected to play a crucial role in maintaining system reliability and ensuring resource adequacy amid high levels of renewable penetration, helping to balance supply and demand. Additionally, the anticipated load growth driven by artificial intelligence, crypto-currency mining operations, and oil & gas production in the ERCOT region may spur investments in new generation capacity. However, this rapid transition also presents several challenges, including the need for increased transmission capacity to support the rising demand, addressing intermittency issues associated with renewable energy sources, and accurately forecasting large load growth.

Study methods

UPLAN-NPM is a full network model designed for electricity market simulation. It replicates the engineering protocols and market procedures of the electric system operator and captures commercial activities such as bidding, trading, hedging, and contracting. The model performs coordinated marginal (opportunity) cost-based energy and ancillary service procurement, congestion management, and contingency analysis with Security Constrained Unit Commitment (SCUC) and Security Constrained Economic Dispatch (SCED), replicating the processes used by the ERCOT ISO.

PLATO data models are relational databases. The PLATO-ERCOT regional data model contains data for electric **P**lants, **L**oads, **A**ssets, **T**ransmission, and **O**perations for all the utilities and independent power producers (IPPs) in the ERCOT electric grid. The data models have been developed from private and public sources and augmented by studies and analyses, as well as direct communication with stakeholders. LCG

has been collecting and incorporating this data for the models for decades, and PLATO has been vetted in thousands of studies in Texas.

LCG Consulting, based in Los Altos, California, is a widely-recognized leader in the electricity industry and a pioneer in modeling energy markets. Since its founding in 1983, LCG has been at the forefront of providing the utility industry with specialized software and consulting services related to electric and gas deregulation. Our clients include numerous public and private electric utilities, independent system operators, electricity traders, power marketers, federal and state agencies, and several energy research institutes across the United States and internationally. LCG has a long history of modeling the Texas energy market and serves many regional clients, including ERCOT ISO.