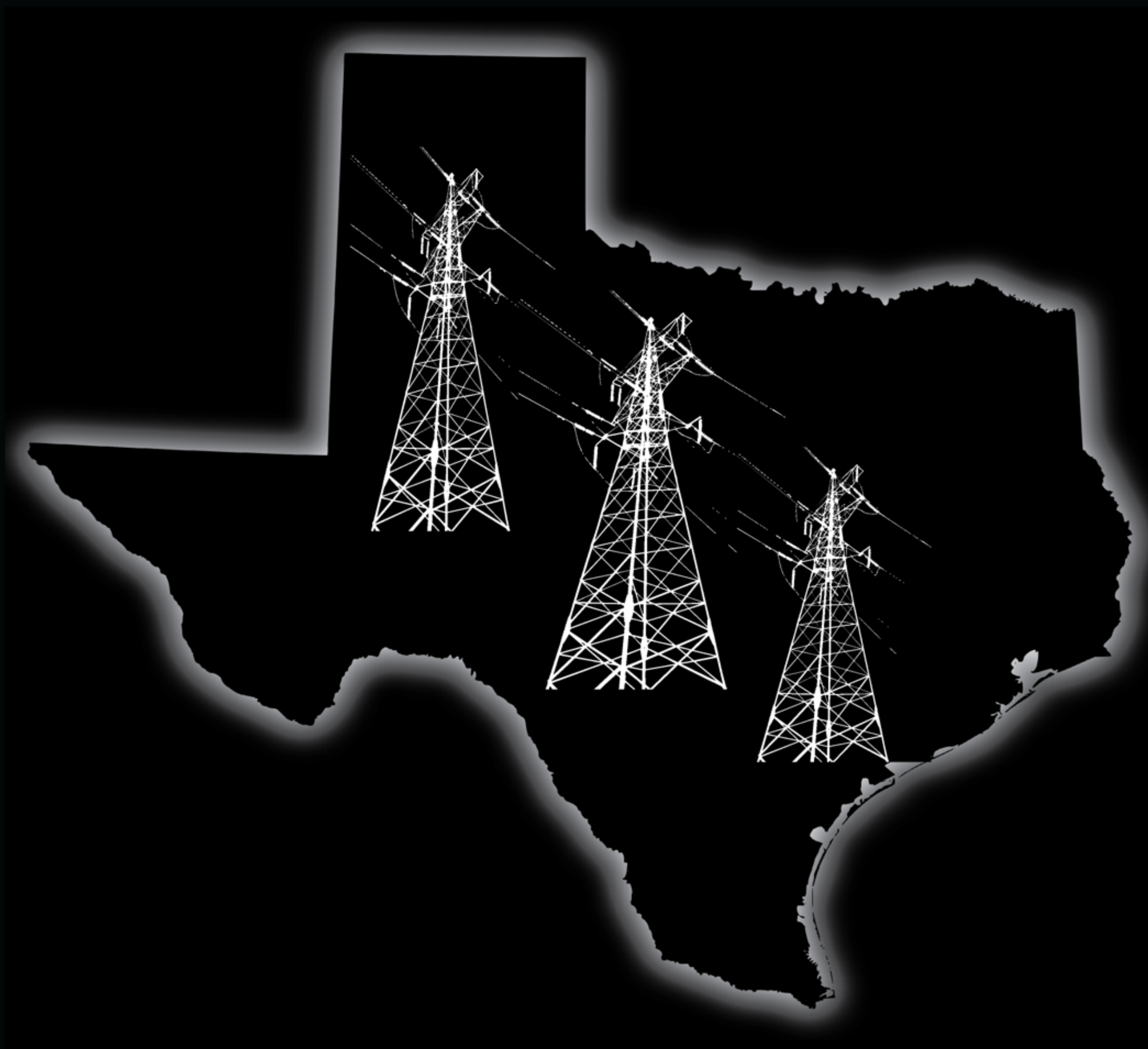

The Future of the Electric Grid in Texas: Opportunities and Challenges in the Next Decade

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Research White Paper • Summer 2025

About

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Acknowledgments

The authors are grateful to Jeannie Kever for her feedback and support of the project.

Notes

The Supplementary Material is available online at: https://uh.edu/energy/_docs/_papers-reports/the-future-of-the-electric-grid-in-texas_supplementary-material_uh.pdf

Executive Summary

The unique electric grid of Texas faces an unprecedented next decade with a confluence of supply, demand, and transmission issues that will require a comprehensive and clear planning process to ensure the continued vibrant economic growth of the state and its robust contribution to the nation and the world.

Historic consumption of electricity in Texas has strongly correlated with population and economic activity (as measured through per capita GDP), while the availability of transmission infrastructure and price of delivered electricity are somewhat weaker correlators of electricity consumption. The unprecedented rise of data centers (including cryptocurrency miners and artificial intelligence (AI) centers), along with the rapid growth of electric vehicles and a strong push to add electrified processes as part of the state's industrial base, will drive a major increase in electricity demand over the next decade.

Rural locations in West and Northwest Texas, along with the Dallas and Houston metro areas, will be home to much of the data center expansion. West and Northwest Texas, while close to significant wind and solar resources as well as natural gas resources, lack sufficient electricity transmission and dedicated natural gas pipelines. Similarly, the urban markets of Dallas and Houston lack generation and transmission capacity to address the large demands emerging from the potential growth of data and AI centers, as well as the growth of electric vehicles and the rapid charging infrastructure being contemplated.

We find that without significant investment in new generation and transmission infrastructure, Texas will experience an annual grid capacity shortfall of up to 40 GW, and more likely to be 27 GW, over the next decade. Along with the electricity shortage, the lack of infrastructure will also be a significant logistical, supply chain, socioeconomic, and regulatory bottleneck and could slow the growth of the digital economy in Texas.

To circumvent these challenges, many data centers are now pursuing (behind the meter) on-site electricity generation through co-located generation facilities. However, these facilities are exacerbating system planning challenges, upsetting already strained supply chains for generation and storage equipment, and aggravating market, regulatory, and policy uncertainties.

Satisfying the state's growing demand for electricity will be tightly coupled with natural gas supply and price. With the expansion of LNG permitting, we anticipate a rough doubling of LNG exports from Texas over the next five years and a further doubling by 2035. At the same time, the demand for natural gas to meet new electricity demand could reach up to three times, and more likely two times, the current in-state consumption by 2035. While wind and solar generation are expected to continue to grow, the pace remains in question. Changes in state and federal policy towards renewable electricity, supply chain, and cost barriers from a shifting landscape of trade policies, and backlogs in deployment of interconnection and infrastructure are significant headwinds. Should both the anticipated, robust growth in LNG exports and electricity demand occur, natural gas production will have to increase more than threefold (from 6.4 to over 20 TCF), and more likely 2.5X (from 6.4 to 15 TCF), in Texas. This would also mean that natural gas and LNG prices will rise in response to tighter domestic supply, higher feedstock costs, and increased market volatility. This could cause major economic challenges to the downstream chemical and plastics industry along the Gulf Coast.

While Texas currently produces much more natural gas than it consumes, focusing on increasing natural gas production will be key over the next decade. Even the most optimistic outlook from the U.S. Energy Information Administration expects production to increase by 1.5 times over this period. There are some additional challenges to this massive projected growth of the natural gas sector. The procurement of gas turbines, compressors, pipelines, and other key equipment to support new electricity generation is constrained by mounting lead times, global supply chain delays, tariffs, and the growing fears of economic standoffs between the U.S. and suppliers including China and Italy.

Texas already faces intensifying challenges to the water supply needed to meet growing energy and industrial needs. Meeting electricity demand through natural gas, accompanied by decarbonization technologies like carbon capture, utilization, and storage (CCUS) to provide the low carbon intensity electricity desired by data and AI centers, poses additional threats to water resources. The water required for new electricity capacity additions, combined with increased municipal and industrial needs, could result in an annual water deficit of up to 3,600 million cubic meters (~3 million acre-feet) in the next decade.

In the current 89th Legislative session, the Texas Senate unanimously passed Senate Bill 6 (SB6) proposing substantial reforms to transmission planning and interconnection processes, reporting requirements for data centers, and mandating demand response capabilities for load management. In addition, the geographic mismatch between emerging growth centers for large loads and existing energy infrastructure, along with the momentum mismatch between demographic and market shifts and current policy and regulatory processes, will require more thoughtful, responsive, and expeditious reforms. Doing nothing is not an option, and moving slowly will jeopardize grid reliability, infrastructure resilience, including that for the digital economy, water availability, and the state's global leadership in energy, commerce, and market competence.

1. Introduction

Electricity consumption in Texas over the last 25 years has grown at a year-over-year rate of 2.5% (U.S. EIA, 2025). This stands in stark contrast to the U.S. overall, where electricity demand has remained flat over the last 10 years and only recently shown a slight uptick.

The largest growth in demand has occurred in the state's commercial sector (~3%), followed by the residential (~2.5%) and industrial sectors (~2%). Population growth, urbanization, industrial expansion, energy market deregulation resulting in increased competition and lower prices, increased cooling needs, and new electricity-intensive technologies have combined to result in increased electricity consumption.

Based on historical data, we quantitively evaluate the dependencies of total electricity consumption on various demographic and socioeconomic drivers in Texas. In this research white paper, we consider the future of electrical energy demand in Texas over the next 10 years, based on the quantitative models and additional loads with no historical precedents, such as the growth of electric vehicles and large data centers. We discuss the constraints on the growth of electricity supply, potential bottlenecks in transmission infrastructure, and the consequences for infrastructure including water supply, land use, and natural gas supply and pipelines.

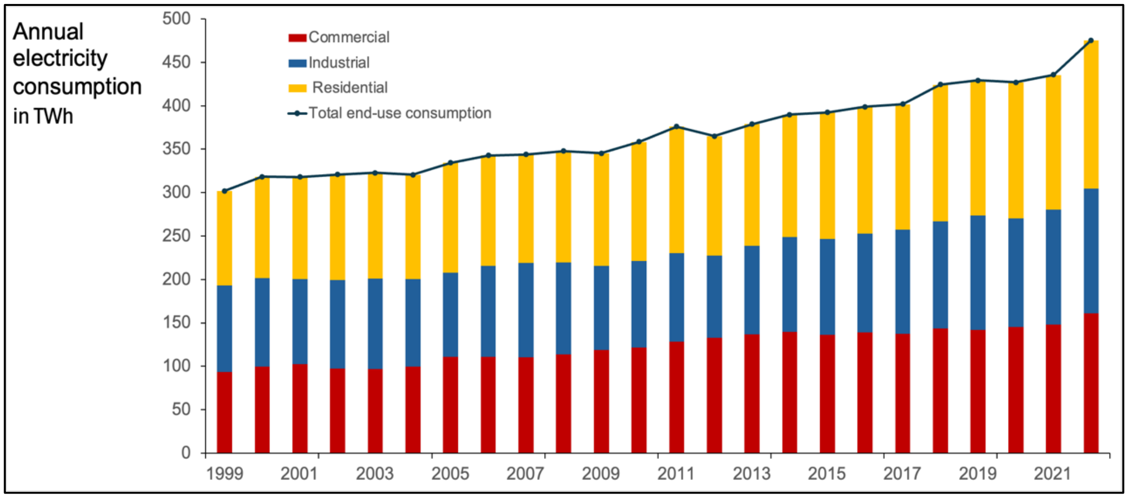

Figure 1. Annual total electricity consumption and sectoral basis of consumption in TWh in Texas. Data source: U.S. EIA.

1.1 The Energy Landscape in Texas

Texas leads energy production and electricity production in the nation. About 25% of all domestically produced **primary energy** in the U.S. and 13% of the nation's net **generation of electricity** occurs in the state (U.S. EIA, 2025). For purposes of comparison, we note that about 9% of the U.S. population lives in the state, which covers 7% of the country's landmass (Texas Comptroller of Public Accounts, 2024a). Texas is the top oil and gas-producing state, accounting for 42% of crude oil and 27% of natural gas production, and the leader in refining and petrochemicals production, with 32 refineries responsible for 33% of U.S. refining capacity or nearly 6 million barrels of crude oil per day (U.S. EIA, 2025). The state is also the leading producer of wind-generated electricity, accounting for about 26% of the wind electricity generated in the U.S. (U.S. EIA, 2025). While California has the most installed solar PV and battery storage capacity in the nation, Texas is the fastest-growing market for both technologies and second in the country for solar electricity generation.

In terms of consumption, Texas leads the country in total energy consumption, accounting for about one-seventh of the nation's total energy use. The industrial sector represents more than half of end-use energy consumption in the state and 24% of the nation's industrial energy use. Overall, the state consumed over 500 TWh of electricity in 2024, with the average Texas household using over 14,000 kWh per year (U.S. EIA, 2025).

The electricity demand profiles across the state's 268,820 square mile land expanse are disparate. The Electric Reliability Council of Texas (ERCOT), the state's independent system operator, has divided Texas into eight distinct weather zones to manage demand and generation, forecast regional electricity demand and peak loads, and plan grid infrastructure and transmission line repairs and expansions based on regional weather patterns, climate conditions, population centers, and types of energy resources (Figure 2).[i] As of 2023, ERCOT had oversight over 1,250 generation units and 54,100 miles of transmission lines across the weather zones (Figure 2) (ERCOT, 2025a).

In 1999, the Texas Legislature passed Senate Bill 7 to deregulate the electricity market overseen by ERCOT (Texas Legislature Online, 1999). The bill went into effect in 2002, allowing for electricity generation and distribution to be controlled by separate entities, allowing for more competition among businesses, lower prices, and more choices for consumers.

The state's electricity mix is diverse, with natural gas being the largest contributor. In 2024, the top five sources for (cumulative) electricity generation were natural gas (40.3%), wind (29.0%), coal and lignite (12.3%), nuclear (10.2%), and solar (7.7%) (U.S. EIA, 2025). The summer capacity of the electricity grid in Texas has grown at the rate of 4% (year-over-year growth rate) between 1999 and 2022 (Figure 3), and yet the overall contribution of natural gas has remained roughly constant while that of coal has diminished; the contribution from wind has increased substantially.

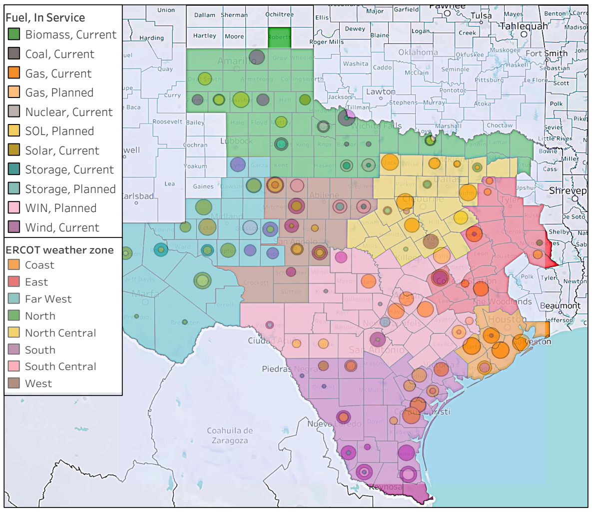

Figure 2. Current and planned projects across ERCOT Weather zones, by fuel type. Data source: U.S. EIA, ERCOT, Texas Comptroller of Public Accounts.

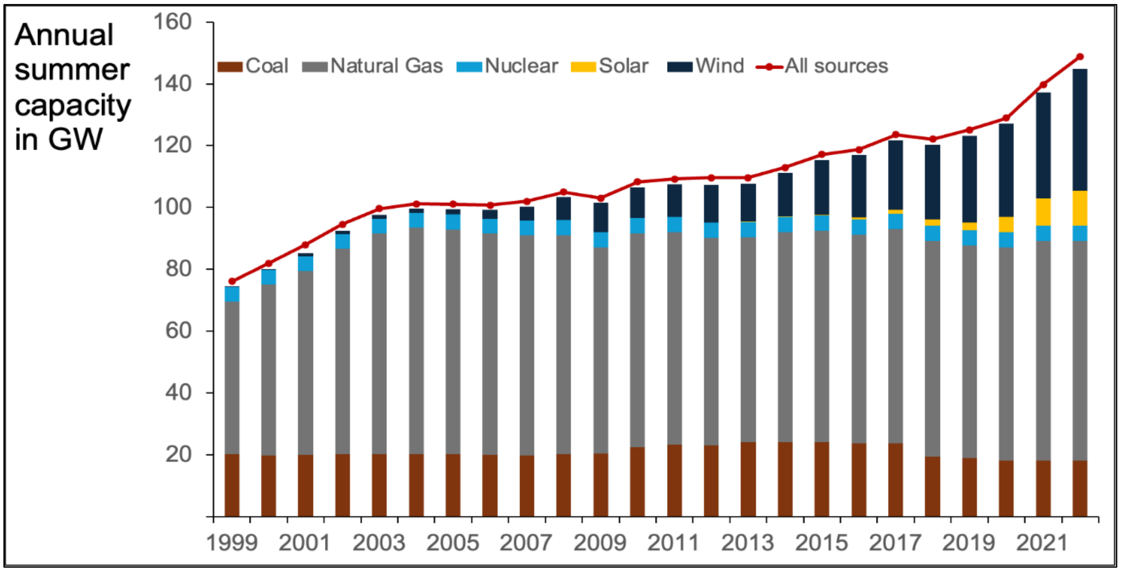

Figure 3. Annual summer capacity in GW, 1999-2022. Data source: U.S. EIA.

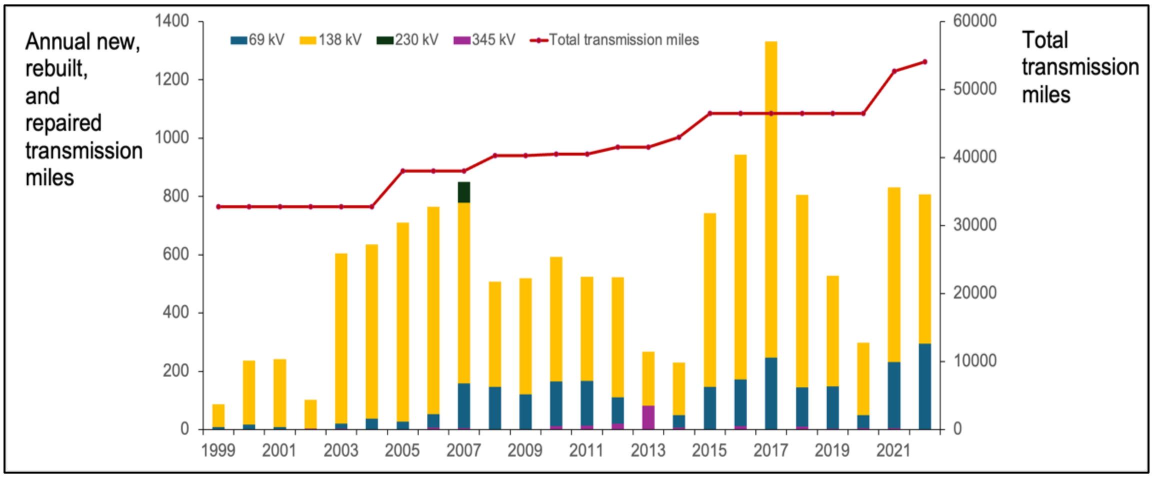

Figure 4. New, rebuilt, and repaired transmission miles by capacity in kV and total circuit miles of transmission in ERCOT-served Texas. Data source: U.S. EIA.

In 2023, Texas reached an all-time high of 12.4 trillion cubic feet (TCF) in gross annual withdrawals of natural gas. Its extensive pipeline network (Section 3.6, Figure 18) facilitates natural gas exports across the U.S. and into Mexico, while two liquefied natural gas (LNG) terminals on the Gulf Coast contribute to global exports. Although much of the natural gas is used for electricity generation and industrial purposes in the state, Texas consistently produces more natural gas than it consumes. However, this surplus will be at risk as electricity demand grows over the next decade.

Both oil and gas production in Texas have shown only a weak correlation with their respective commodity prices (Figure 5 and Figure 6) (U.S. EIA, 2025), which are determined by global oil and gas trade and geopolitical, economic, and policy factors. From Figures 5 and 6, production does not immediately react to changes in commodity prices, and lagging effects are typically moderated by

investment decisions for production, technology changes, and hedging.

Any notable contribution from renewables to the electricity supply can only be observed starting in the 2000s for wind and 2010s for solar (Figure 7a). Biomass and hydroelectricity generation also make smaller contributions to the grid, while geothermal energy is an emerging resource in the state.

The share of coal-based electricity generation continues to drop, down by 6,000 MW from its peak in 2013 to 2022. Coal's share of total summer capacity declined from 27% in 1999 to 12% in 2022. Even though Texas is the second-largest producer of lignite coal, with reserves used almost exclusively for power generation near mining sites, coal's share in electricity generation has significantly declined due to recent plant retirements (U.S. EIA, 2024b; Texas Comptroller of Public Accounts, 2023c).

Since 1990, almost 24,500 MW of installed generation capacity has been retired (Public Utility Commission of Texas, 2022; ERCOT, 2024) (Figure 7b). While most of these retirements have come from natural gas facilities, new capacity additions based on natural gas have far exceeded the retired capacity. This has allowed natural gas to continue to substantially contribute to power generation in Texas.

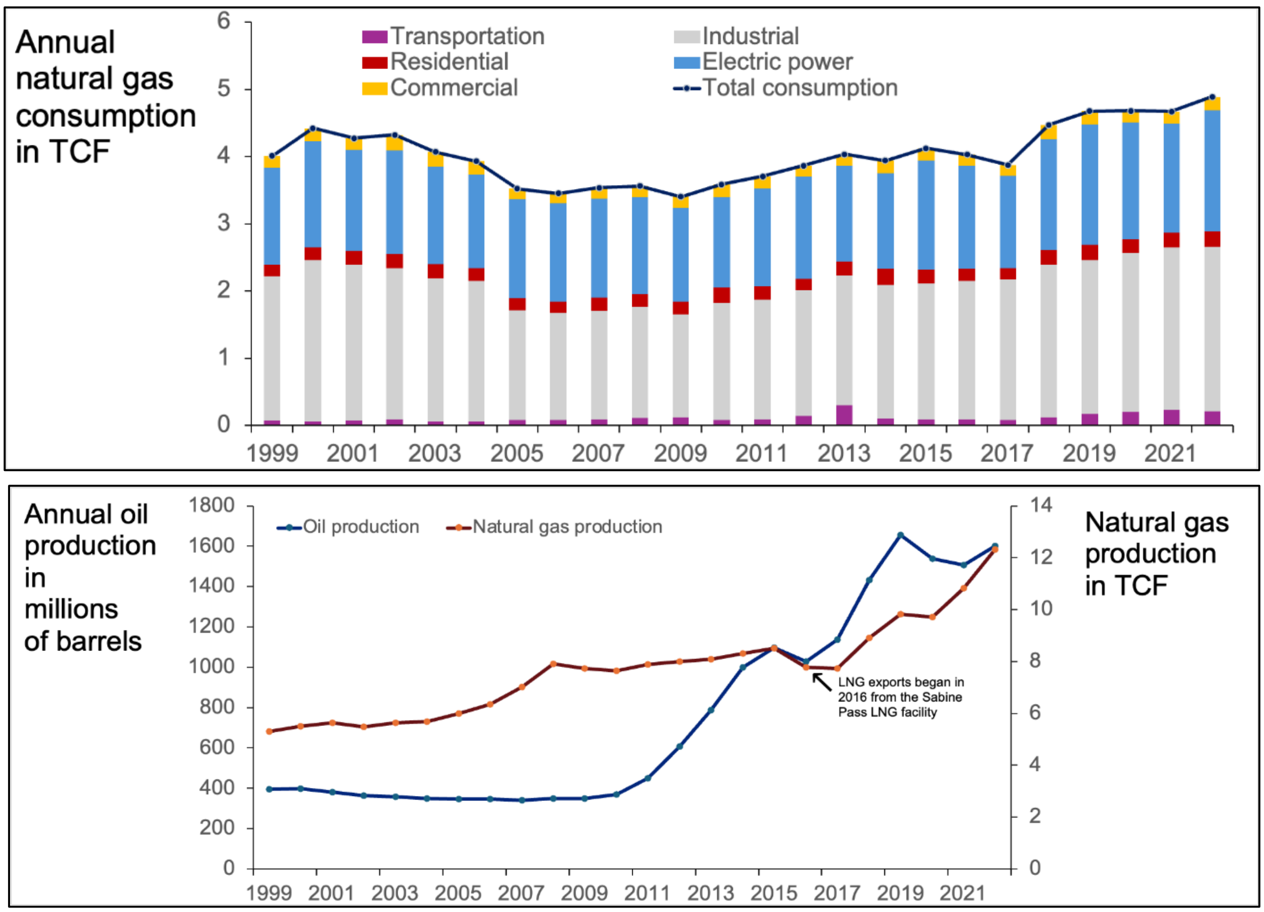

Figure 5. Sectoral annual natural gas consumption in trillion cubic feet, 1999-2022 (top); historical annual oil production in millions of barrels, and natural gas production in TCF in Texas, 1999-2022 (bottom). Data source: U.S. EIA.

Texas has two nuclear power plants, Comanche Peak Nuclear Power Plant and the South Texas Project Electric Generating Station, each with two reactors. Combined, these plants have an installed capacity of about 5000 MW and produce over 4100 GWh of electricity annually (Texas Comptroller of Public Accounts, 2023a).

For energy storage, Texas has also made significant investments in battery projects (Table 1), across all segments – standalone, and coupled with wind, and solar – adding to the traditional storage alternative of pumped hydro. In 2022, the combined storage capacity of these sources was 2.12 GW. The current installed hydro capacity is marginal, and pumped hydro is not expected to be a significant contributor to energy storage options in the state for the foreseeable future (Texas Comptroller of Public Accounts, 2023b).

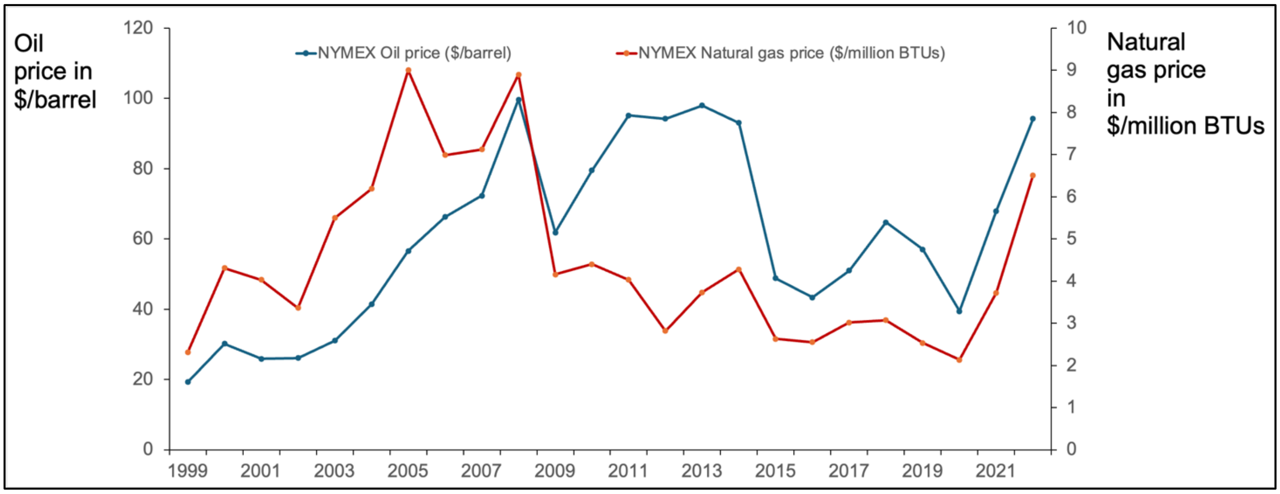

Figure 6. Historical price of oil in dollars per barrel (NYMEX) and of natural gas in dollars per million BTU (NYMEX), 1999-2022, with oil price on the left y-axis and natural gas price on the right y-axis. Data source: Texas Comptroller of Public Accounts.

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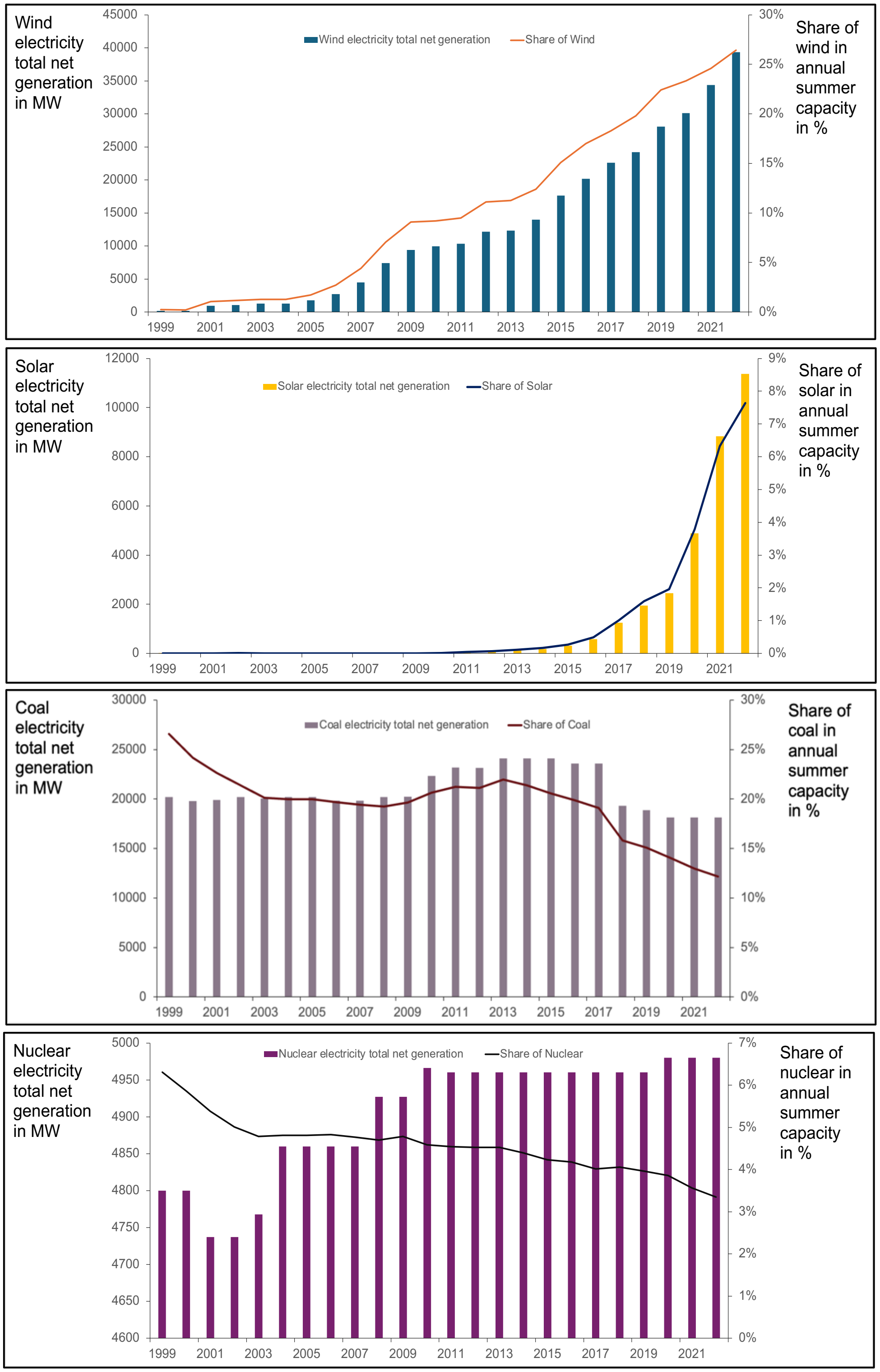

Figure 7a. Wind (top), solar (second), coal (third), and nuclear (bottom) summer capacity in MW and their share of total annual summer capacity, 1999-2022. Data source: U.S. EIA, ERCOT.

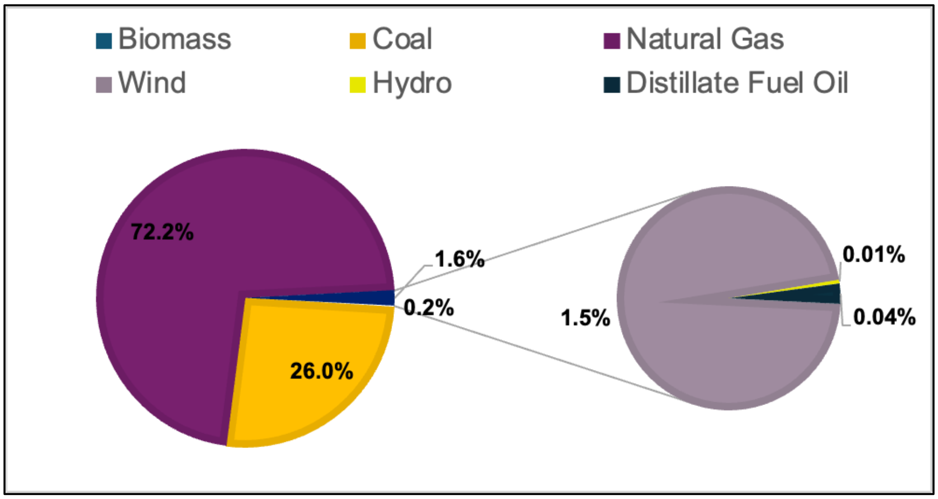

Figure 7b. Share of retired generation capacity, 1990 to 2024.[ii] A total of ~25 GW of generation capacity has been retired during that period. A list of retired plants by source of generation is included in Appendix B, available online. Data source: U.S. EIA, ERCOT.

Table 1. Battery energy storage in Texas, 2024. Data source: ERCOT.

Project Type	Number of Storage Projects	MW of Storage	% of Total Storage MW
Stand-Alone Battery Energy Storage	605	106,614	76%
Battery Energy Storage + Solar	274	32,966	23%
Battery Energy Storage + Wind	8	691	<1%
Battery Energy Storage + Other Tech	2	519	<1%
Total	**889**	**140,790**	**100%**

2. Data and Methods

2.1 Determinants of the Growth of Electricity Consumption

Historically, the growth of electricity consumption has been tightly coupled with growth in population and GDP, representative of economic productivity in the state. More people mean more households, businesses, and infrastructure requiring energy, resulting in a positive relationship between population growth and electricity consumption. Specifically, bigger urban demand centers in the state also have a higher per capita energy use due to dense residential areas, commercial hubs, and growing industries. The state's GDP is heavily influenced by energy-intensive industries such as oil and gas, petrochemicals, and manufacturing, leading to higher per capita electricity consumption compared to less industrialized states. Therefore, a higher GDP correlates with increased energy demand from both industrial and commercial sectors. However, shifts toward efficiency, greater production of renewable energy, and more transmission infrastructure may temper this effect. In the residential sector, household consumption is less responsive to changes in the price of electricity. The commercial sector exhibits moderate elasticity and adjusts operations, implements efficiency upgrades, and curtails non-essential electricity use during high-price periods, particularly in case of demand-response agreements with utilities. The industrial sector is highly price-elastic in the short term as the operations of large industrial centers are sensitive to electricity prices as a factor in the input cost. Over the long term, the generally low prices of electricity in the state have attracted more energy-intensive industries to Texas. An interplay of population, price, and GDP would suggest that the state's rapidly growing population will boost the residential sector's energy demand, while GDP growth will reflect industrial and commercial energy demand. Also, the relatively lower electricity prices will continue to attract energy-intensive industries. These factors will increase GDP and overall consumption. Therefore, we expect a positive relationship between electricity consumption, population, GDP, and prices over the long term.

In general, the growth in energy efficiency results in electricity consumption growing at a slower rate or even declining as efficiency increases. Similarly, expanding transmission infrastructure can reduce the losses that occur as electricity travels from generating facilities to consumers. With improved transmission networks, the pressure on the grid to generate excess power during times of high demand is reduced. Also, growing the transmission infrastructure has allowed for better integration of renewables into the grid and the ability to move electricity from remote supply centers in West Texas to urban demand centers in the eastern part of the state. This has helped mitigate supply and pricing challenges associated with peak summer demand. Hence, further reducing grid congestion will lead to lower electricity prices. Therefore, we generally expect a negative relationship between electricity consumption, efficiency, and the expansion of transmission infrastructure, as growth in the latter will prevent electricity consumption from growing too quickly in response to GDP growth.

2.2 Peak Electricity Demand

Electricity consumption in the state adheres to seasonal patterns, with the highest consumption in the summers for cooling and moderate peaks in the winters for heating needs. As summers become hotter and winters become more extreme, combined with population increase and growth in industrial and commercial sectors, summer and winter peak demand is increasing consistently. The high demand is predominantly met through 65 natural gas peaker power plants and peaking units within larger plants (Figure 8) and is increasingly supplemented by solar and battery storage. Spring and fall in Texas typically result in lower electricity demand due to milder temperatures.

Over the last two decades, the growth in Texas' commercial sector has been remarkable. Even though the power produced by the commercial sector in Texas is generally small compared to larger-scale power plants, growing on-site commercial generation in the form of distributed energy resources (DERs) has generally reduced the load on the grid during peak demand periods. At the same time, the growth in cogeneration and combined heat and power has allowed greater efficiency and reduced cost of operations, while allowing more commercial operations and economic growth. Therefore, electricity consumption is expected to have a positive relationship with the power produced by the commercial sector; however, the relationship might be moderated by improvements in energy efficiency, increased renewable energy adoption, and distributed generation technologies.

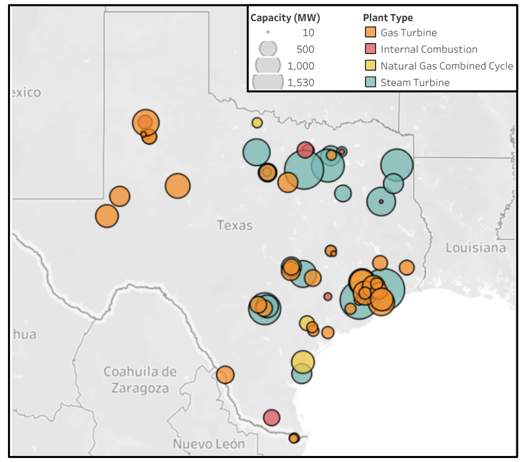

Figure 8. Peaker plants in Texas. Figure source: PSE for Healthy Energy.

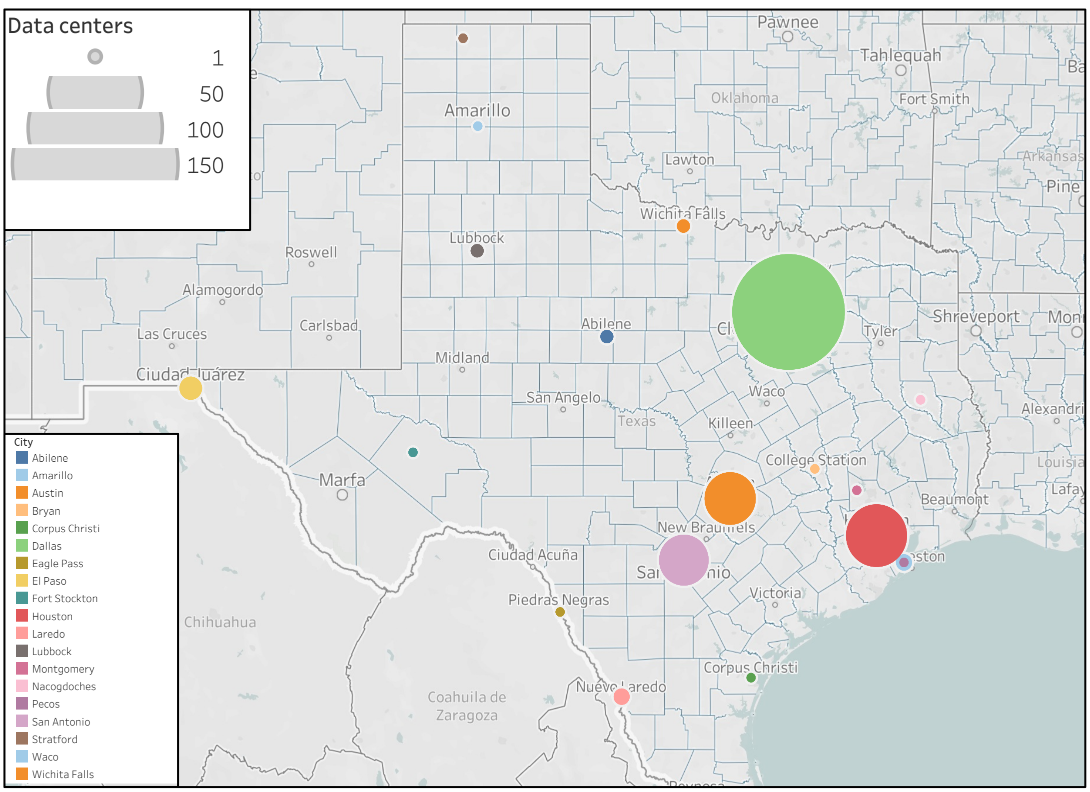

Figure 9. Current data centers in Texas. The marker size indicates the number of facilities in a location. Data source: Texas Comptroller of Public Accounts.

2.3 New Electricity Demand

A relatively new segment that is not a traditional determinant of consumption but is increasingly impacting Texas is the growth in electric vehicles. As EV ownership increases, it creates additional electricity demand, reshaping consumption patterns and influencing the state's energy infrastructure. Most EV charging happens at home, often during peak residential demand hours. Historically, the state has lacked public charging infrastructure commensurate with the exponential growth in EV registrations, especially in urban, high-demand centers like Austin, Houston, Dallas, and San Antonio (U.S. Department of Energy, 2023). With supportive policies, a growth in public charging infrastructure in these urban population centers is expected. However, these areas already have high electricity demand due to population density as well as commercial activity, and higher charging demand will further stress the grid. If local and state policies are unable to keep pace with the growth in EVs, consumers will continue to charge at home, creating unmanaged, high-demand charging loads—especially during peak hours—without coordinated planning for grid upgrades, demand response, or time-of-use pricing. This will strain local distribution networks and increase the risk of regional imbalances.

2.4 Regression Modeling

We utilized data from the U.S. Energy Information Administration, ERCOT, and the Texas Comptroller of Public Accounts to model the relationship between these determinants and the electricity consumption in the state. Data from 1999 to 2022 were used to understand the historical nature of the relationship.

For newer determinants, *i.e.*, commercial power production and the number of EVs, statewide data were available starting in 2011 and 2016, respectively. We assumed unit power production from commercial producers and EV penetration in the state for the log-transformed model for data before 2011. The additional demand from large load interconnections, which is representative of the ongoing and expected growth of data centers (and cryptocurrency mining facilities), was added to model the overall growth in electricity consumption under different scenarios. We discuss the details of the scenario modeling in Section 2.5.

We note that the efficiency of natural gas-based electricity generation has increased over the last two decades with the transition from gas turbines to combined cycle turbines. However, we found that this efficiency was not a significant predictor of consumption and was not included in the models. The simple model (Model 1) did not include the more recent determinants of electricity produced by commercial producers and the number of EVs, unlike the full model (Model 2). Lastly, all the variables were log-transformed (Model 3) to reduce the skewness in the data.

Table 2. Dependent and independent variables, and other model parameters.

Variable	Unit	Measurement and Other Notes
Electricity consumption	MWh	
Per capita GDP	$ per person	$\frac{Gross\ state\ product}{State\ population}$
Efficiency of natural gas electricity generation	MWh per MMcf	$\frac{Electricity\ produced\ from\ natural\ gas\ (MWh)}{Natural\ gas\ consumed\ to\ produce\ eletcricity\ (MMcf)}$
Transmission	Ratio	Transmission miles were weighted by capacity, 69, 138, 230, and 345 kV. $\frac{New+\ repaired, rebuilt, and\ reconstucted\ miles}{Total\ circuit\ miles}$
Price of electricity	$/ MWh	Price of delivered electricity across all sectors
Number of EVs		Statewide data available from 2016 onwards
Electricity produced by commercial producers	MW	Statewide data available from 2011 onwards
Total Degree Days	Number of days	Representative of weather conditions $Cooling\ Degree\ Days + Heating\ Degree\ Days$
Large load interconnection requests	MW	Representative of growing data centers. Not included in regression model since historical data is unavailable; added in projections

Table 3. The effect of per capita GDP, transmission infrastructure updates, the price of electricity, EVs, commercial electricity production, and heating and cooling degree days on electricity consumption.

	Model 1: Simple model	Model 2: Full model	Model 3: Log transformed model
Per capita GDP	3,700***	2,600***	0.34***
	(185)	(360)	(0.02)
Transmission	-1.6e+08	-1.8e+08	-0.01**
	(1.2e+08)	(1.1e+08)	(0.00)
Price of electricity	316,900**	172,000	0.03*
	(143,000)	(131,000)	(0.01)
Number of EVs		96.00	0.01***
		(72.00)	(0.00)
Electricity produced by commercial producers		71,500***	0.01***
		(20,500)	(0.00)
Total Degree Days	14,800**	14,700**	0.29***
	(6,900)	(6,900)	(0.04)
Constant	1.4e+08***	1.4e+08***	13.41***
	(3.9e+07)	(3.9e+07)	(0.41)
Observations	24	24	24
R-squared	0.981	0.981	0.995

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The most representative model (Model 3) resulted in the following regression equation:

$$
\begin{aligned}
\ln(Electricity\ consumption) \\
&= 0.34 \ln(Per\ capita\ GDP) - 0.01\ \ln(\ Transmission) \\
&+ 0.03 \ln(\ Price\ of\ electricity) + 0.01 \ln(Number\ of\ EVs) \\
&+ 0.01 \ln(\ Electricity\ produced\ by\ commercial\ power\ producers) \\
&+ 0.29 \ln(\ Total\ Degree\ Days) + 13.41
\end{aligned}
$$

2.5 Future Scenario Modeling

The regression equation provided the baseline to predict the growth in electricity consumption between now and 2035; we utilized projections from the Texas Comptroller of Public Accounts for population and GDP growth (Texas Comptroller of Public Accounts, 2022).

We considered three possible growth scenarios—**low (3%), moderate (5%), and high** (based on the highest value between the average annual growth since 2011 and 5%). These scenarios were applied to all factors except EVs and temperature trends (measured as total degree days).

We also compared these scenarios to historical trends and ERCOT's projections for transmission infrastructure (Appendix I, Figure I1, available online). Based on ERCOT's projections, we assumed the year-over-year increase for the high growth scenario would level after 2029.

For EVs, we used two growth scenarios. Since 2016, EV ownership in Texas has grown by about 44% each year. While this trend could continue, challenges like high vehicle costs, limited charging stations, supply chain delays, and shifting federal policies may slow that pace. Hence, we also included a more conservative growth rate of 25%, which aligns more closely with national trends. For total degree days, which were calculated as the sum of heating and cooling degree days in the state, we assumed the same average growth rate as observed since 2011. A summary of all these assumptions and the resulting projections through 2035 can be found in Appendix G, available online.

3. Results

3.1 Growth in Electricity Consumption

The regression model (baseline, with anticipated GDP and population data from the Texas Comptroller of Public Accounts) and the scenarios (low, moderate, and high growth) result in projections for end-use electricity consumption, as presented in Figure 10. This includes a comparison with the expected growth in consumption if ERCOT's projections for transmission infrastructure are utilized, included as a fourth scenario.

As a robustness check, we compared all scenario-based results with ERCOT's electricity demand projections up to 2030[iii]. The modeled results presented a ± 3-9% difference compared to ERCOT's analysis (ERCOT, 2025b). When the impact of large loads is accounted for, the modeled results presented a ± 10-12% difference compared to ERCOT's data. The confidence intervals presented in the figure account for these differences.

Compared to a 2022 baseline:

- The results from the baseline model indicate that electricity consumption will increase by 25% by 2035, growing from about 475 TWh in 2022 to between 580 TWh and 600 TWh, as presented in Figure 10a. (The confidence intervals, in this graph and the following scenarios, represent the difference between ERCOT's Long-Term Load Forecast and the baseline (or the appropriate model.)

- When the growth in data centers is accounted for in terms of the projects that are 'approved to energize', which are the projects that have received approval from ERCOT, electricity consumption will grow to between 670 TWh and 1,030 TWh by 2035, representing a 40%-115% increase, as presented in Figure 10b.

- Accounting for the total expected large load interconnections, electricity consumption is projected to grow to between 830 TWh and 1,900 TWh by 2035, representing a 75%-300% increase, as shown in Figure 10c. These projects include those that are approved by ERCOT, under review, have submitted planning studies, and those that have not. It is noteworthy that many of these projects that are in the queue for review and approval from ERCOT may never come online if sufficient power or energy infrastructure is not available to meet their electricity demand.

- Lastly, if the electricity demand from the industrial sector is met with the use of natural gas along with carbon capture, utilization, and storage (CCUS), then electricity consumption can grow to between 830 TWh and 2,180 TWh, representing an 80%-360% increase, as presented in Figure 10d.

- The peak demand for electricity (in GW) also exhibits similar growth to the cumulative electricity demand, as observed in Figure 10e.

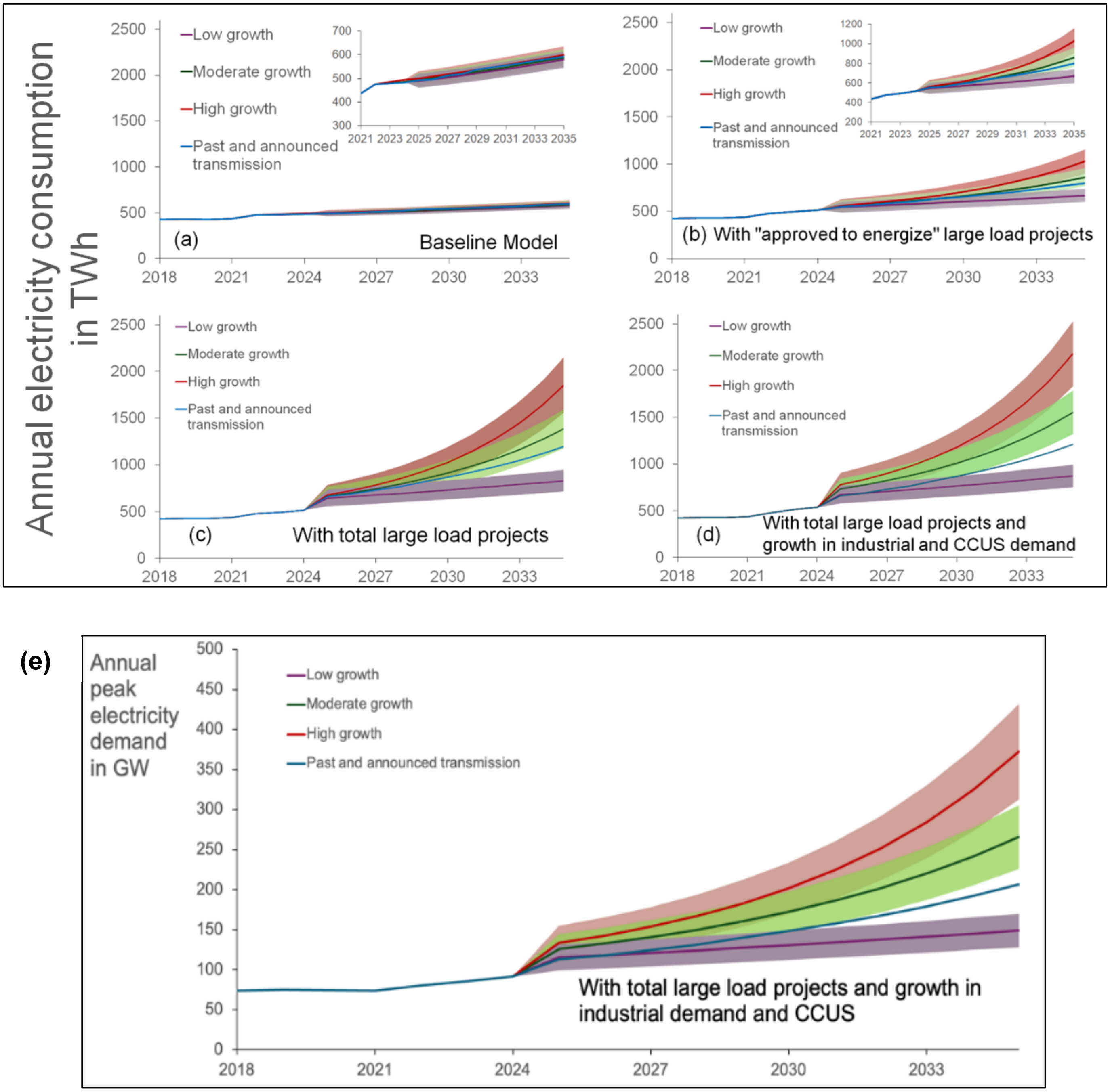

Figure 10. Results based on the regression and scenario modeling – baseline model (top), approved to energize (second), total large interconnection load (third), growth in industrial demand and CCUS (fourth) between 1999 and 2035, and projections for peak demand 2025 to 2035 (bottom).

3.2 Impacts of Data Centers

Data centers have led to a substantial and unprecedented increase in large-load interconnection requests for the ERCOT grid, wherein ERCOT defines large load as the aggregate peak demand greater than or equal to 75 MW at one or more facilities at a single site (ERCOT, 2023). The projects waiting to be connected to the grid are managed through the large load interconnection queue. Figure 11 presents the major upcoming data centers in Texas by county and their cumulative load in MW.[iv] These are in addition to the current data centers presented in Figure 9.

Based on data from ERCOT, Figure 12 highlights the cumulative load of the projects currently waiting to come online and be connected to the grid.[v] The interconnection load growth suggests that 'approved to energize' will grow from about 2,500 MW to almost 5,500 MW by 2028, while total projects will increase from about 2,500 MW to over 56,000 MW over the same time. In 2024, about 4,500 MW of interconnection requests received the approval to energize, i.e., connect to the grid in the next few years. For these projects, a non-simultaneous peak consumption of about 2,600 MW has been recorded. This peak consumption is calculated as the sum of the maximum values for each load regardless of when the maximum occurs and is used as an approximate measure of the operational load from the approved projects.

New standalone and co-located projects, as well as some cancellations, resulted in an increased large load interconnection queue capacity toward the end of 2024. Of the projects that received approval to energize, over 2,800 MW of load was observed in the west load zone of ERCOT, which roughly maps to the West, Far West, and North weather zones. We estimate that this trend will continue in the near term. The trend is corroborated by Figure 11, wherein most new major data centers are situated in the West, Far West, and North weather zones, especially Taylor County in West Texas.

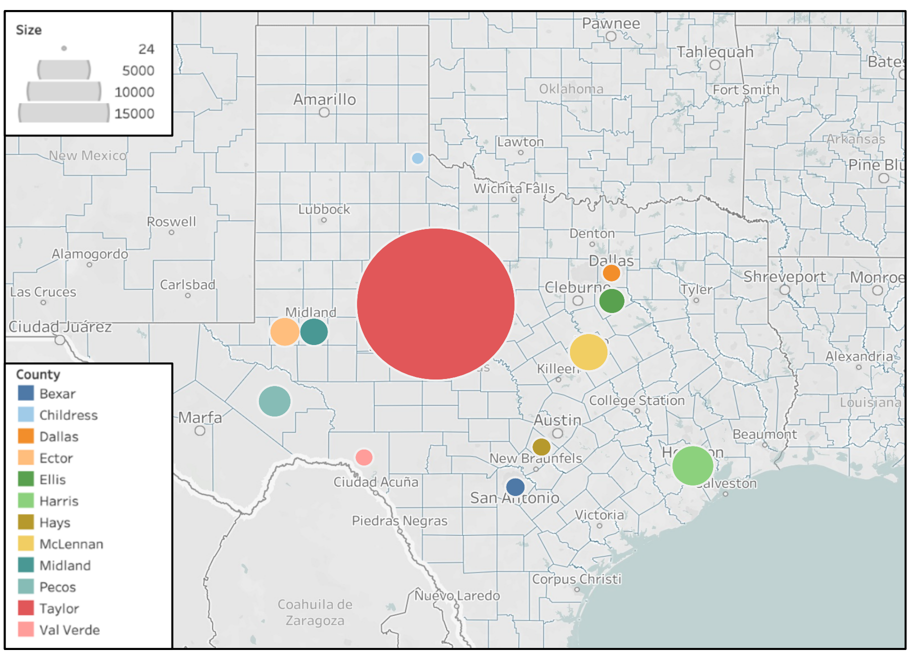

Figure 11. Major upcoming data centers in Texas. The size of the marker depicts the anticipated power requirement of the planned data centers in the county (in MW).

3.3 Expected Shortage in Electricity from the Growth in Data Centers

Based on the planned electricity generation projects expected to come online in each of the weather zones, the large load interconnection requests made public by ERCOT, and the trends observed in Figure 12, the difference between planned generation and expected additional demand from large loads is presented in Tables 4a and 4b. We assumed that half of the growth in data centers would continue to be in the West, Far West, and North weather zones and the rest in the Coast, East, North Central, South-, and South-Central weather zones. The highlighted values underscore the electricity deficit that is expected to arise. Notably, a statewide deficit can be expected in 2026, ranging from about 2,700 MW if considering the 'approved to energize' projects and over 33,000 MW if all the projects are considered. Details of the planned electricity generation projects that are expected to come online in the West, Far West, and North weather zones and in the Coast, East, North Central, South, and South-Central weather zones by 2026, and the expected statewide growth in large load interconnection requests that were used to estimate the deficit is included in Appendix I, available online.

Based on the scenario modeling for the 'approved to energize' projects, and assuming Texas will maintain a growth similar to the planned capacity additions between 2025 and 2026, the state could potentially experience a deficit of 17 GW- 40 GW by 2035, as presented in Figure 13. The most likely scenario, based on moderate growth, would result in a 27 GW shortage by 2035. Moreover, given the current planned capacity additions to the grid, the state will experience an electricity deficit regardless of the scenario beginning in 2031.

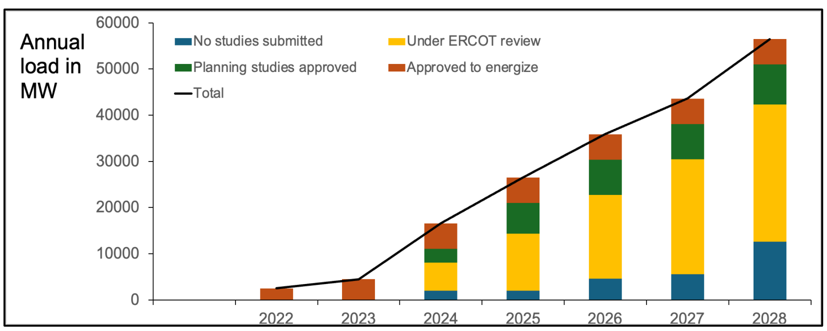

Figure 12. Actual and projected large load growth 2022- 2028. Data source: ERCOT.

Table 4a. Difference between planned capacity and large load interconnection requests - West, Far West, and North weather zones

	2022	2023	2024	2025	2026
Approved to energize	-1221	491	19754	1317	-2092
Total	-1221	491	14205	-9199	-17275

Table 4b. Difference between planned capacity and large load interconnection requests - Coast, East, North Central, South, South Central

	2022	2023	2024	2025	2026
Approved to energize	-1195	979	14645	5800	-595
Total	-1195	979	9096	-4716	-15778

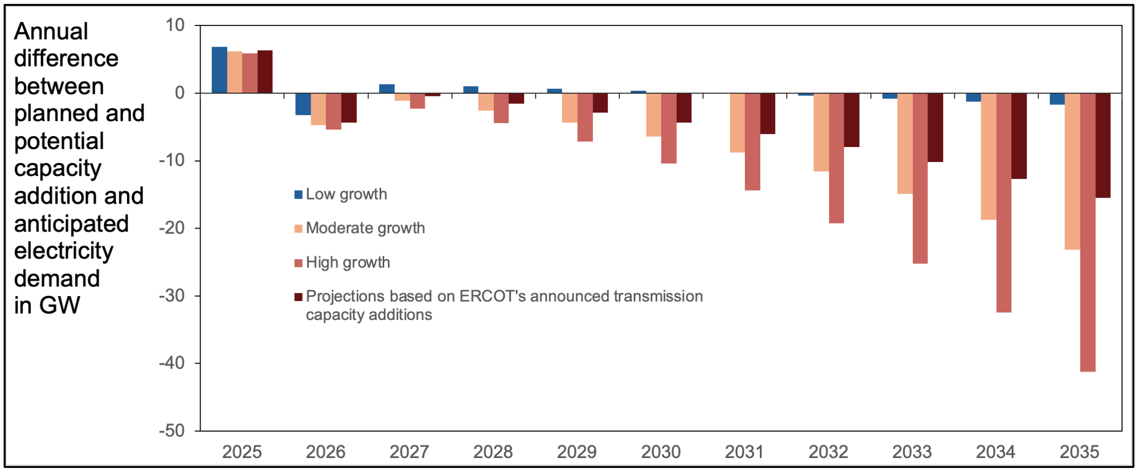

Figure 13. The difference between planned and potential capacity additions and the growth in electricity demand from data centers in Texas, 2025-2035.

3.4 Land and Water Impacts of the Growth in Electricity Demand from Data Centers

Based on this expected growth, we analyzed the impacts on land and water resources – indirect impact through electricity generation and direct impact through cooling. We assumed that the increased electricity demand can be met through a range of options: a) all solar and wind generation (50% each), b) 70% solar and wind, and 30% natural gas with CCUS, c) 30% solar and wind, and 70% natural gas with CCUS, and d) all natural gas with CCUS. Data centers require a constant, uninterrupted supply of electricity as the servers and cooling systems need to run continuously for data availability and to avoid downtime. Moreover, because of the global nature of the clientele that data centers service, they are likely to favor low-carbon intensity electricity, and therefore, the coupling of carbon capture with natural gas-based power generation is contemplated for this sector.

The land required is the most significant for wind farms, at 184 m^2 per MWh, followed by solar (16 m^2 per MWh) and natural gas with CCUS (1.3 m^2 per MWh) (Lovering et al., 2022; Ritchie, 2022). In contrast, natural gas with CCUS has the greatest water requirements among the considered sources of electricity, at 1.25 m^3 per MWh, followed by solar (0.02 m^3 per MWh) and wind (0.001 m^3 per MWh) (Rosa et al., 2021). Resultantly, the land use is the greatest when the increased demand is met through solar and wind, while the water use is the greatest when the demand is met through natural gas with CCUS. Depending on the scenario, the cumulative land and water impacts are presented in Appendix J, Figure J1, available online. Since the land impacts for renewables are more than two orders of magnitude higher than for natural gas, and the water impacts of natural gas are more than two orders of magnitude higher than renewables, we present selected scenarios in the figure.

The water demand in the state based on the projections from the Texas Water Development Board (figures included in Appendix J, available online), without accounting for the impact of data centers, is not expected to grow in some parts of the North, West, and Far West weather zones. However, these projections are likely to change dramatically when the impact of data centers is accounted for. In addition to the water needed for electricity generation (indirect), data centers also directly use water for cooling needs (Appendix J, Figure J2, available online).

Based on recent disclosures from large publicly traded data companies, we assumed that the water demand for the cooling needs of data centers is about 1.8 cubic meters per MWh (Siddik et al., 2021). Figure 14 presents the total demand for water for selected scenarios and highlights that the demand will scale with the electricity and cooling needs of data centers.

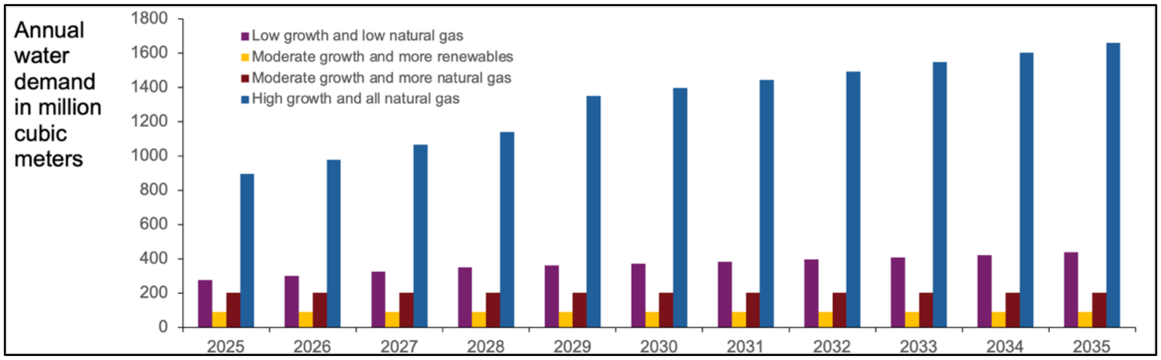

Figure 14. Total water demand for electricity generation and cooling needs for data centers in million cubic meters.

About 54% of the water supply in the state is provided by nine groundwater aquifers, 43% through lakes, rivers, and reservoirs that make up surface water resources, and the remaining through water reuse. Given about 20,750 million cubic meters of current supply, and 22,000 million cubic meters of current demand, Texas is already facing water shortages. The state's water resources will be further strained by the expected demand of about 22,730 million cubic meters between 2030 and 2040. These projects account for the growth in water demand for irrigation, livestock, manufacturing, mining, steam electric, and municipal needs, and do not account for the additional water needs of data centers. When the water needs from data centers are accounted for, the water deficit in 2035 can range from 2,400 million cubic meters (or ~ 2 million acre-feet) to over 3,600 million cubic meters (or ~ 3 million acre-feet), based on the scenario (Figure 15).

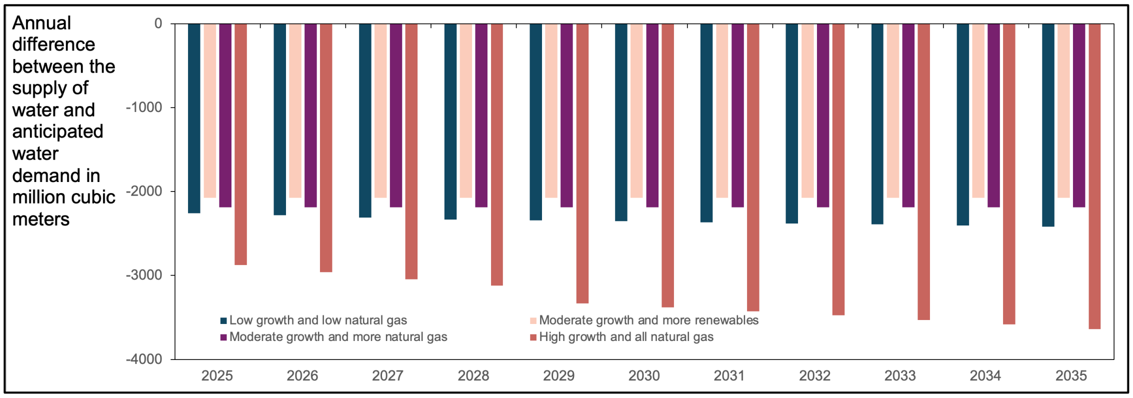

Figure 15. The annual difference between available water resources and cumulative demand (irrigation, livestock, manufacturing, mining, steam electric, municipal, and data center related) in Texas in million cubic meters (bottom), selected scenarios 2025-2035.

3.5 Expected Growth in the Demand for Natural Gas

In 2022, about 47% of the state's summer capacity was met through natural gas, and natural gas production saw a 7% year-over-year increase between 2022 and 2023 (U.S. EIA, 2025), fueled by both in-state demand and LNG exports. The expansion of export facilities in the state led to an increase of more than 270% in LNG exports since 2019 when just four trains were in service. In 2023, Texas exported over 1.3 TCF of LNG, representing 31% of total U.S. LNG exports (Texas Comptroller of Public Accounts, 2024b). Meanwhile, 22 additional trains are currently under construction and are expected to be operational by 2028. However, the takeaway capacity of natural gas pipeline infrastructure remains highly constrained in the state, with more than 90% of pipeline utilization in 2024, *i.e.*, pipelines have been operating at near full capacity and cannot carry any new LNG (Deloitte, 2025).

The increased demand for electricity from large loads like data centers and on-demand electricity for EV charging will strain the current natural gas value chain in the state. We calculated the increased demand for natural gas, including the additional parasitic load from CCUS. Based on future scenarios and utilizing the efficiency factor modeled based on electricity generation from natural gas per Mcf of natural gas used in the state, the demand for natural gas-based electricity generation will grow to between 4 TCF and 10.5 TCF by 2035 (Figure 16).

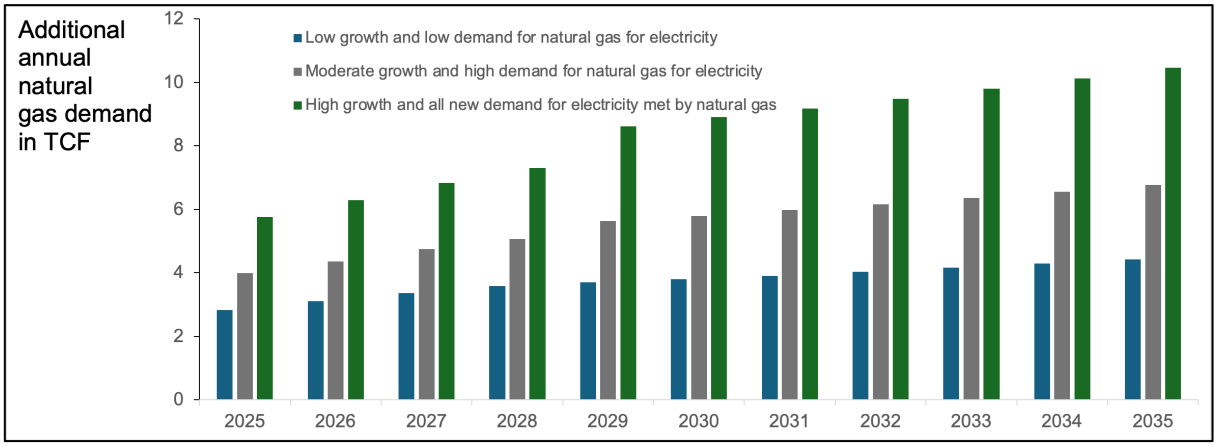

Figure 16. Additional natural gas required to meet new electricity demand and the parasitic load from CCUS for selected scenarios in TCF, 2025 to 2035.

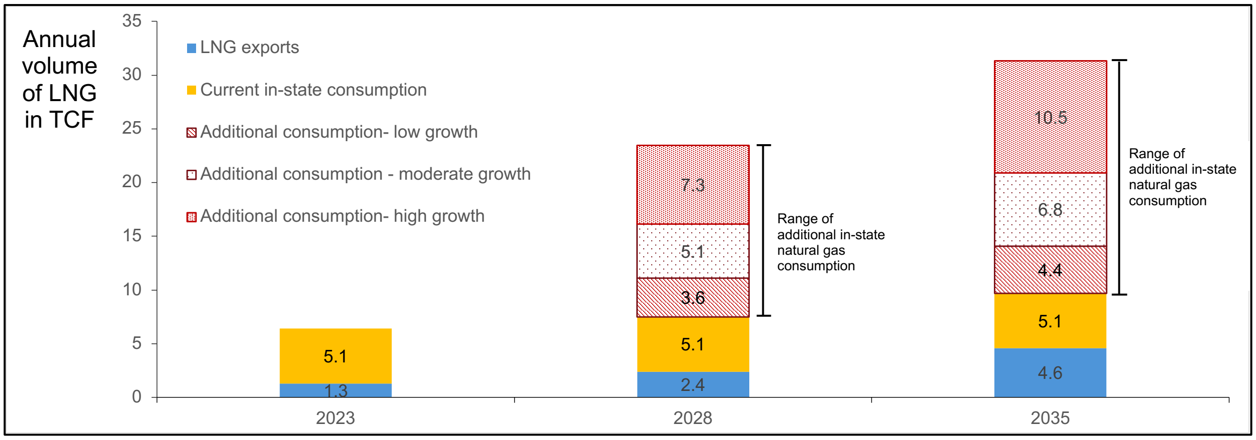

Figure 17. Expected growth in the in-state consumption and growth in LNG exports from Texas. In 2035, we anticipate that the total annual volume of Texas natural gas consumption will be ~14 TCF in the low growth scenario, and ~20 TCF in the high growth scenario.

LNG exports are expected to almost double to about 2.4 TCF by 2028, if projects currently under construction begin operations as planned, and increase by 3.5 times to about 4.6 TCF by 2035 (U.S. EIA, 2024a). Combined, the increased demand for exports and the in-state demand will be between three and eight times as high as current LNG exports and will at least be equal to or up to more than twice that of LNG exports in 2035 (Figure 17).

We note that Texas currently produces a total of 9.75 TCF of natural gas, representing ~26% of the nation's dry gas production (U.S. EIA, 2023).Our projections underscore that there will be significant pressure on natural gas production and transportation in Texas during the coming decade.

3.6 Implications for Other Energy Infrastructure and Recommendations

To assess the impacts of increased electricity demand on other energy infrastructure, we examine the mismatch between supply and demand centers. From Figures 2, 9, and 11, it can be observed that the current load centers experiencing greater electricity demand from data centers are in the North Central, Coast, and South weather zones that are served predominantly by natural gas electricity production. However, emerging growth centers for data centers in the North, West, and Far West weather zones overlap with areas predominantly served by planned and upcoming wind and solar projects, with some storage and natural gas-based projects (Figures 2, 9, and 11). In the emerging growth centers, therefore, providing continuous power supply to data centers will remain a challenge unless storage is scaled appropriately, on-site co-location of generation, storage, and use is optimized, or baseload sources of generation are planned in these weather zones.

As highlighted in Figures 18 and 19, the weather zones with anticipated growth of data centers in Texas are also regions with sparser pipeline infrastructure and electricity transmission infrastructure. The limitations of infrastructure in the North, West, and Far West weather zones will also limit the sources of electricity generation and if and how large load projects like data centers can be connected to the grid. These challenges are expected to be exacerbated by emerging technologies like quantum computing.[vi] This additional strain is expected as quantum computing requires low temperatures to operate, which necessitates specialized cooling systems with a significant energy and water footprint. The growth in transmission infrastructure must match the electricity demand, and pipelines must match the in-state demand and LNG exports. This necessitates investment from the state toward expanding the energy infrastructure, along with accelerating capacity additions to the Texas electricity grid.

Separately, and equally importantly, nearly half the natural gas consumed today is by the robust industrial manufacturing industrial base in the state. For instance, Texas is responsible for roughly three-quarters of basic U.S. chemical production capacity (Federal Reserve Bank of Dallas, 2021). Specifically, natural gas is used to create heat, generate electricity, and in the production of methane, fertilizer, and hydrogen, and is a crucial player in the manufacture of base chemicals and value-added materials such as lubes and plastics. The global advantage that the state's chemical industry possesses largely emerges from the accessibility to abundant and inexpensive natural gas feedstock. The increased projected demand that is likely to emerge from the growth in LNG exports and the in-state consumption driven by the large loads will strain the supply from Texas' gas reservoirs (as well as constrained pipeline delivery) and potentially lead to increased prices. The chemicals industry is extremely sensitive to feedstock price challenges and is likely to face significant headwinds in such a supply-constrained scenario that we anticipate.

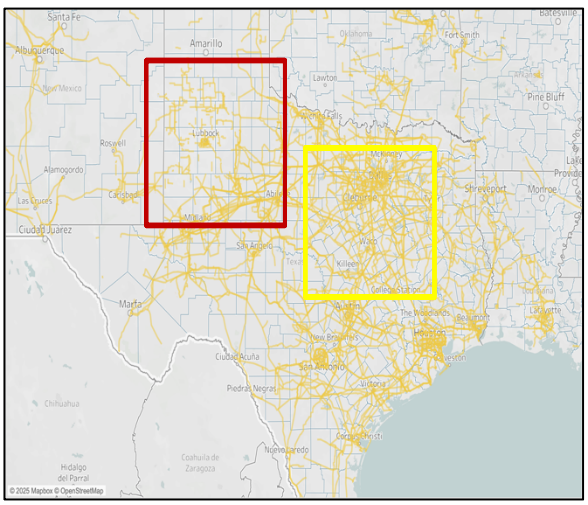

Figure 18. The network of pipelines within Texas and connections with adjoining states. Approximate contours of the weather zones with current data center growth and anticipated growth are marked in yellow and red, respectively.

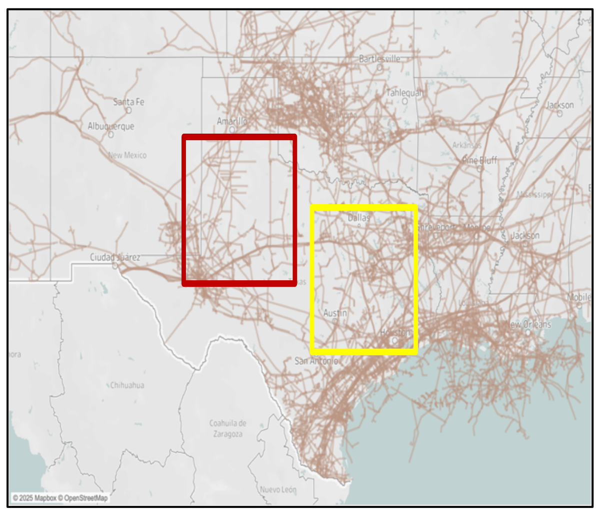

Figure 19. Electricity transmission infrastructure in Texas and adjoining states. Approximate contours of the weather zones with current data center growth and anticipated growth are marked in yellow and red, respectively.

4. Key Takeaways

- Modeling electricity consumption in Texas over the last 30 years indicated a strong positive relationship between population and economic activity. Additionally, the availability of transmission infrastructure and the price of delivered electricity are also predictors, though weaker than population and economic activity, of electricity consumption in Texas.
- Large loads, including data centers and large EV charging facilities, have emerged as other strong explanatory factors for recent increases in electricity consumption in Texas.
- Over the next 10 years, electricity consumption in Texas will increase by anywhere from 25% to 360%, with a most likely scenario of at least a doubling of consumption, compared to 2022:
    - In the most conservative model, which estimates electricity consumption will follow the trends of the last 25 years, consumption will increase by 25% by 2035 compared to 2022.
    - The big disruptor for energy consumption in the state is the burgeoning growth of data centers. When the growth in data centers is accounted for in terms of the projects that are 'approved to energize', or those projects that have received approval from ERCOT, electricity consumption is expected to grow by between 40% and 115% by 2035. If the total expected large load interconnections are accounted for, which includes those projects that are approved, under review, have submitted planning studies, and those that have not, electricity consumption is expected to grow by between 75% and 300% by 2035.
    - When the growth in industrial demand for electricity, along with the electricity needs of CCUS to decarbonize natural gas-based electricity generation, is accounted for, electricity consumption is expected to grow by between 80% and 360% by 2035.
- Most major announced data centers are in the West, Far West, and North weather zones in rural areas, in addition to those in urban and suburban Dallas and Houston. Currently, half of the growth in large load interconnections in the state is in the West, Far West, and North weather zones.
    - These regions were previously not expected to account for major population or GDP growth or the growth in water demand in the state.
    - The regions are also underserviced by natural gas pipeline capacity and electricity transmission lines compared to the load centers in the more populous East, North Central, and Coast zones – presenting potential bottlenecks for these new data center projects.
    - In addition to transmission constraints, the regulatory wait times for projects to be approved and come online are resulting in data centers opting to co-locate electricity generation facilities on site.
- By 2035, this could result in a deficit in the electricity supply ranging from 17 GW to 40 GW, the difference between planned capacity additions and total electricity demand, unless the state invests in capacity and transmission infrastructure to outpace the growth of data center projects.
    - There will be an electricity deficit for all scenarios by 2031 unless the state invests in new capacity additions besides the current planned additions.
    - Depending on the sources of electricity used to meet the additional demand, in-state demand for natural gas by 2035 will be between 10 and 16 TCF by 2035, from a current in-state consumption of 5 TCF.
    - Currently, companies are experiencing long lead times for gas turbines, with units ordered now not expected for delivery before 2029. The equipment and supply chain constraints have already caused the withdrawal of several proposed peaker plants in Texas, which were expected to receive financial support from the Texas Energy Fund (Public Utility Commission of Texas, 2025; Plautz, 2025; Hao, 2025).

    - The supply chain constraints are exacerbated by new tariffs on steel, aluminum, and other materials needed for natural gas power plants.
    - The increased in-state demand will lead to an increase in LNG prices in response to tighter domestic supply and increased feedstock costs for exporters. This could also trigger greater market volatility, especially during peak demand periods.
- Land impacts are most significant if electricity demand is met with solar, wind, and storage. Water impacts are most significant if the demand is met with natural gas retrofitted with CCUS.
- Direct water use for cooling in data centers and indirect use for electricity generation, in addition to the expected growth from municipal needs and other sectors of the economy, could result in a water deficit ranging from 2,400 million cubic meters (~ 2 million acre-feet) to over 3,600 million cubic meters (~ 3 million acre-feet) based on the scenario in 2035.
- Even though Texas has emerged as a national leader in solar energy and is projected to maintain its lead over the next five years, ERCOT has reported a substantial backlog in connecting new solar and battery storage projects to the grid, with about 360 GW of capacity currently awaiting interconnection (Gooding, 2024). The delays are caused by the increasing demand for large-scale solar and battery storage projects, coupled with the time required for regulators to process requests.
    - New tariffs and rules that will make importing equipment more expensive will further stall development and installation for wind, solar, and storage projects.
    - Given the policy uncertainty, some solar installers have attempted to lock in prices and federal tax credits by importing equipment before the tariffs are implemented. However, projects are now struggling to be finalized and completed.
- The Texas Senate unanimously passed SB6 in the ongoing legislative session, and the bill is now pending in the House (Texas Legislature, 2025). It aims to strengthen the Texas electricity grid and respond to the increasing demand for electricity in the state. Among other provisions, the proposed bill:
    - Mandates the PUC to implement minimum transmission charges for all retail customers, including those with behind-the-meter generation, ensuring that all consumers contribute fairly to transmission cost recovery.
    - Requires large load customers to install equipment that would be capable of curtailing load during firm load shed events that are characterized by a controlled and temporary interruption of electricity service.
    - Directs the PUC to reevaluate the calculation methods used for setting transmission rates, aiming to bring greater transparency and credibility to load forecasting.
    - Establishes uniform standards for interconnecting large-load customers to the ERCOT grid, including requiring the disclosure of any similar service requests that could affect the interconnection process to minimize the risk of stranded infrastructure costs.
    - The sparse nature of energy infrastructure in regions where energy demand is expected to grow will exacerbate the geographical mismatch between electricity supply and demand in the state.

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Endnotes

[i]ERCOT, along with the Public Utility Commission of Texas (PUC), oversees system reliability, competitive wholesale and retail electricity markets, and open access to the transmission network in support of approximately 90% of the state's electric load.

[ii] The share of retirement for storage is less than <0.01%. There have been no nuclear or solar retirements in Texas since 1999.

[iii] Based on ERCOT's analysis made available in Q1 2025. ERCOT updated its mid- and long-term load forecast in Q2 2025 based on the anticipated growth in large loads.

[iv] Based on publicly available project announcements.

[v] 'Approved to energize' projects are those that have received approval from ERCOT, 'Planning studies approved' projects are those that have received ERCOT approval of required interconnection studies, 'Under ERCOT review' projects are those that have studies under review by ERCOT, and 'No studies submitted' projects are those that are tracked by ERCOT but that have not yet provided sufficient information to begin the review process. The values included in the latter category also account for those projects that have not passed review by ERCOT until a path to interconnection is identified or the customer cancels the interconnection request.

[vi] Quantum computing would be more efficient than modern computing methods and can therefore be more energy-efficient than classical supercomputers in the long-term but are expected to add to the strain on the electricity grid in the near and medium-terms.

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