GTI ENERGY

RAISE

Reliable Affordable Infrastructure for Secure Energy

October 2026

Regional Emerging Fuel Pathways for a Reliable and Resilient U.S. Energy Future

ENERGY SYSTEMS MODELING EVALUATION



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Acknowledgements

GTI Energy designed the Resilient Affordable Infrastructure for Secure Energy (RAISE) collaborative to map the most valuable opportunities for leveraging gas infrastructure in current and future energy systems including the potential for integrating lower emission fuels. By mapping these opportunities, RAISE provides a holistic understanding of the natural gas infrastructure system and actionable recommendations on the research, technology development, partnerships and investments required to upgrade and evolve the country's vast network of gas pipelines and storage systems.

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Glossary

Term	Definition
Business-as-Usual (BAU)	OL-NEMS scenarios that represent a baseline for emerging fuels adoption, assuming no significant changes in current policies, technologies, or behaviors. See "Description of Business-as-Usual (BAU) Scenarios" section for scenario descriptions.
Carbon Capture, Utilization, & Storage (CCS)	Recovery of CO_2 from industrial or natural sources, and storage into geological or synthetic storage.
Emerging Fuels	Low-carbon fuels that have the potential to replace conventional natural gas. For this case study, the emerging fuels considered are H_2 and RNG.
Greenhouse Gas (GHG)	Greenhouse gases trap heat in the atmosphere. These gases include carbon dioxide, methane, nitrous oxide, and fluorinated gases.
Hydrogen (H_2)	Low-density fuel, able to be produced from several renewable sources and can be blended into NG systems.
Lifecycle Analysis (LCA)	Estimation of fuel-specific GHG emissions impact.
OnLocation's National Energy Modeling System (OL-NEMS)	A custom version of EIA's NEMS developed to model long-term energy markets and associated climate impacts with specific fuel pathways, by integrating lifecycle, economic, and market level data. OnLocation is a division of KeyLogic.
Renewable Natural Gas (RNG)	Biomass-derived methane produced via micro-organisms or thermal processes, compositionally similar to NG and blendable into NG systems.
Technoeconomic Analysis (TEA)	Cost analysis of fuel pathway.

Executive Summary

The U.S. energy system is undergoing significant transformation as electrification, data center expansion, evolving energy policies, and emerging low-carbon fuels reshape long-term energy outlooks. To better understand how these changes may affect energy infrastructure and reliability, RAISE evaluated representative future energy market conditions across five U.S. regions using OnLocation's National Energy Modeling System (OL-NEMS). The analysis evaluated six Business-as-Usual scenarios, along with hydrogen and renewable natural gas (RNG) deployment cases, to assess future energy demand, energy costs, power generation, infrastructure needs, and carbon capture opportunities through 2050.

Across the scenarios evaluated, future natural gas demand growth is expected to be concentrated primarily within the transportation[1], industrial, and liquefied natural gas (LNG) export sectors. Transportation demand exhibited the most consistent growth across scenarios, while industrial demand increased in most regions, particularly in the East Coast and Rocky Mountain regions. LNG export-related demand is projected to remain concentrated in the Gulf Coast. In contrast, residential and commercial natural gas demand generally remained flat or declined slightly across most regions, reflecting continued efficiency improvements and ongoing electrification. The Rocky Mountain region was a notable exception where residential demand is expected to grow.

Hydrogen demand outcomes varied significantly depending on market assumptions and deployment pathways. Under the Annual Energy Outlook 2025 Reference case, transportation applications emerged as the dominant source of hydrogen demand growth. However, hydrogen demand declined or remained relatively flat under several alternative scenarios, suggesting the sector's sensitivity to policy incentives and project economics. In comparison, hydrogen blending into existing natural gas systems could create more substantial geographically diverse demand growth across regions, suggesting that blending may provide a practical near- to mid-term pathway for supporting hydrogen market development.

[1] In this report, the transportation sector includes light-duty vehicle, air travel, freight, military, mass transit, recreational boating, and lubricant demand.

Across every region evaluated, electricity demand growth is expected to be dominated by rapid expansion of data centers. Data center electricity consumption significantly outpaced growth in all other sectors, experiencing nearly 25 years of sustained growth and emerging as the largest driver of future electric load growth. Industrial electrification also contributed to increasing electricity demand, while residential, commercial, and transportation sectors experienced more moderate growth. Despite these increases in demand, electricity prices remained relatively stable across scenarios, suggesting that continued investments in generation resources and grid infrastructure could help maintain prices.

Natural gas prices likewise varied only modestly across regions and scenarios. While regional differences persisted, long-term price volatility was limited, underpinning the long-term stabilizing role of gas in energy systems. This dynamic suggests that projected supply growth and existing transmission infrastructure are generally capable of meeting future demand requirements. The High Oil and Gas Supply scenario consistently produced the lowest natural gas prices, highlighting the importance of supply-side assumptions in shaping future market outcomes.

Natural gas-fired power generation is expected to remain an important component of the future electricity system across most scenarios, although the magnitude of growth varied considerably. Regions experiencing significant renewable deployment and lower clean technology costs saw reductions in gas-fired generation, while many other scenarios projected continued growth driven by increasing electricity demand and the need for dispatchable generation resources. These findings suggest that natural gas is likely to continue playing a key reliability role within an increasingly diverse energy portfolio.

Infrastructure analysis results suggest that future natural gas infrastructure needs are likely to be concentrated along key transportation corridors. In particular, the East Coast-to-Midwest and Midwest-to-Gulf Coast corridors emerge as the primary regions where additional capacity may be needed to accommodate projected demand growth.

Of the sectors evaluated, carbon capture deployment growth was concentrated within the natural gas and hydrogen value chains. Natural gas production, processing, delivery systems, and hydrogen production facilities represented the strongest opportunities for

carbon management deployment, while other sectors demonstrated comparatively limited growth potential.

Overall, the analysis suggests that future energy system evolution will be driven by a combination of growing transportation demand, industrial activity, LNG exports, data center expansion, and emerging fuels deployment. These drivers are expected to influence both the scale and geographic distribution of future energy needs, creating new requirements for energy supply, infrastructure capacity, and system flexibility. For example, LNG export demand is projected to increase in the Gulf Coast across all evaluated scenarios, reinforcing the region's role as a major energy hub, while LNG exports from the East Coast are projected to decline modestly. The results highlight opportunities to leverage existing natural gas infrastructure while supporting energy resilience, affordability, and lower-carbon energy pathways through targeted investments in hydrogen blending, RNG deployment, carbon management, and strategic infrastructure expansion.

It is important to note that the scenarios presented in this report reflect broad modeled outcomes rather than project-specific determinations. As such, the results should be considered alongside operators' future planning efforts and evaluated within the context of affordability, reliability, customer impacts, community priorities, technical and economic considerations, safety and environmental objectives, workforce opportunities, and implementation feasibility.

Introduction

As the U.S. energy landscape continues to evolve, there is growing emphasis on maintaining a reliable, secure, and resilient energy supply. Emerging fuels such as hydrogen (H_2) and renewable natural gas (RNG) offer promising opportunities to diversify the nation's energy portfolio, strengthen energy security, and reduce greenhouse gas emissions associated with energy production and use.

Recognizing that infrastructure, resource availability, and end-user needs vary significantly across regions, RAISE conducted a series of regional analyses to identify the most viable emerging fuel pathways within each of the five major U.S. regions defined by the Petroleum Administration for Defense Districts (PADD). These regions were selected to capture key differences in natural gas and electricity systems that influence emerging fuel deployment and energy security (Figure 1).

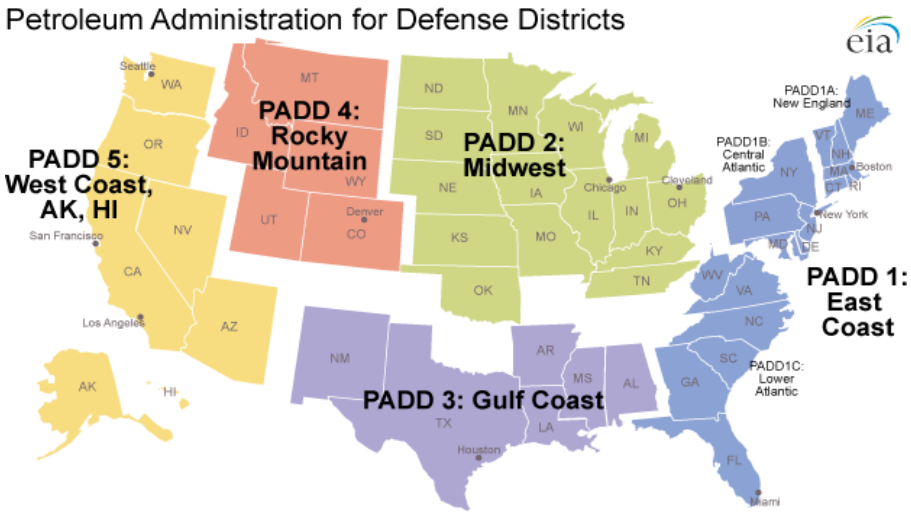


Figure 1. Case Study Regions (Source: EIA)

The case study integrates technoeconomic assessment (TEA), life cycle assessment (LCA), energy systems modeling, and policy and regulatory reviews to evaluate emerging fuel opportunities across the U.S. By identifying near-term opportunities and infrastructure strategies, the analysis highlights pathways to enhance energy system resilience, improve reliability, and ensure the continued delivery of affordable energy to customers.

This report focuses on the energy systems modeling portion of the case study.

Case Study Approach

Optimization Model

Model Description

The National Energy Modeling System (NEMS) is developed and maintained by the Energy Information Administration (EIA). NEMS is an energy-economy modeled representation of the U.S. energy market for the period extending from the base year to 2050. It produces an optimized solution with energy supply always meeting demand in the U.S. energy markets for each year of the model run. The model outputs include projections of energy production, imports, exports, conversion, consumption, and the prices of energy carriers, subject to a number of assumptions. These assumptions encompass macroeconomic and financial factors, world energy markets, resource availability and costs, behavioral and technological choice criteria, technology characteristics, and demographics[2].

The EIA Annual Energy Outlook (AEO) presents long-term projections of energy supply, demand, and prices, based on NEMS results annually. OnLocation, a division of KeyLogic, produced an energy system projection to 2050 with the application of their customized version of NEMS (OL-NEMS). OL-NEMS includes all the Energy Supply, Energy Conversion, and Energy Demand modules in NEMS with enhancements and additional modules for H_2 supply and critical materials demand as shown in Figure 2.

[2] https://www.eia.gov/outlooks/aeo/

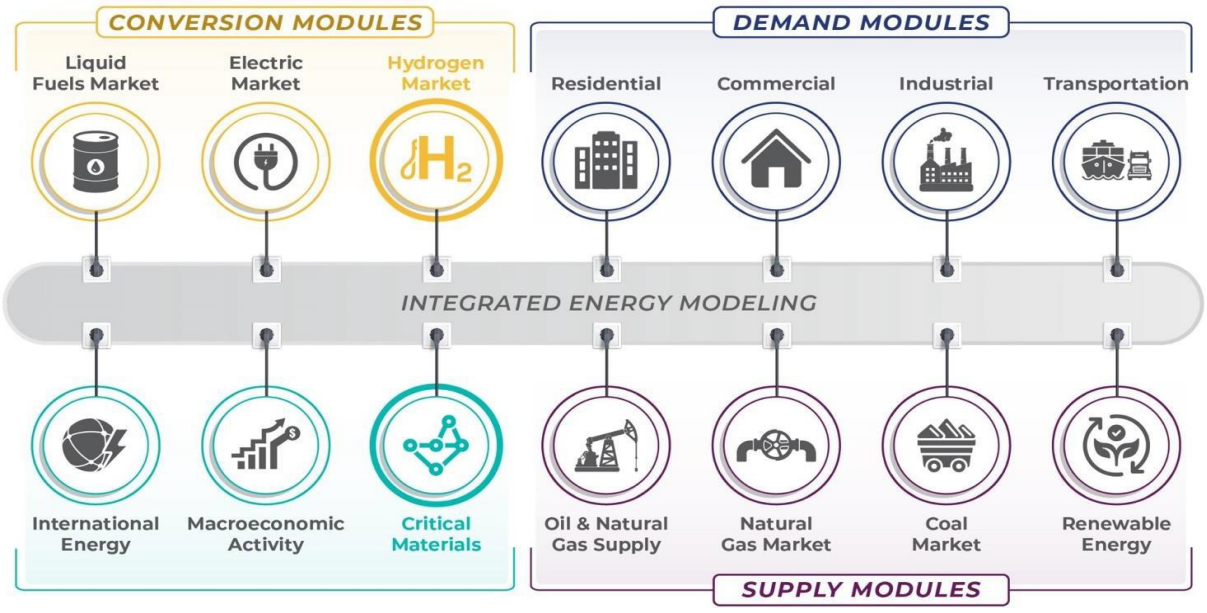


Figure 2. OL-NEMS Modules (Used with Permission From OnLocation)

This case study leveraged the Annual Energy Outlook 2025 release (AEO25) as one of the Business-as-Usual scenarios along with OL-NEMS modeling to evaluate a range of potential energy demand scenarios, comparing proactive, incentive-driven cases with favorable demand conditions to more passive scenarios characterized by market constraints and a lack of additional regulatory support. The results provide insights into how emerging fuels can be scaled under various market conditions in each region.

Regional Inputs

OL-NEMS is a national model that considers interactions between regions as a critical piece for deriving the most accurate forecasts for energy. Since PADD regions are not directly used in OL-NEMS, module adjustments were made to represent gas and electricity demand and prices for each region. These region-specific adjustments resolve the regionality differences between OL-NEMS and PADD. Appendix B contains information on the adjustments made.

Description of Business-as-Usual (BAU) Scenarios

To account for different economic conditions, the modeling analysis considers six Business-as-Usual scenarios as described in Table 1.

Table 1. Summary of BAU Scenarios

BAU Scenario	Description
#1: AEO25 Reference Case	Laws and regulations through December 2024

#2: OL25-NEMS Reference	Same as Scenario #1, plus updates for Inflation Reduction Act and other policies listed below:
	▪ **One Big Beautiful Bill Act (OBBBA):**
	  ▪ Early phaseout of tax credits for solar and wind technologies.
	  ▪ Later phaseout of tax credits for existing and new nuclear technologies.
	▪ **Power Plant Regulations:**
	  ▪ Removes the U.S. EPA's Clean Air Act Section 111 regulations for fossil-fuel power plants.
	  ▪ Removes EIA's 3% risk premium for fossil power technologies
	  ▪ Removes offshore wind mandates.
	▪ **Vehicle Regulations:** Removes EPA greenhouse gas tailpipe rule, latest corporate average fuel economy (CAFE) standards, and Advanced Clean Truck rule.
	▪ **Additional Updates:** Appliance standards, EV tax credit expiration, rooftop solar credit, CCS 45Q and hydrogen 45V credits, oil and gas royalty rate, Renewable Fuels Standard (RFS) credits.

#3: High Oil and Gas Supply	Estimated recovery per well for oil and gas in the U.S. and rates of technological improvement 50% higher than the AEO25 case, plus the additional policies and technologies added for Scenario #2
#4: Low-Zero-Carbon	Capital cost reductions from learning by doing for zero-

Technology Cost	emissions power technologies higher than AEO25 Reference case (i.e., 40% lower costs by 2050), plus the additional policies and technologies added for Scenario #2
#5: High Zero-Carbon Technology Cost	The overnight capital cost is held constant at the 2025 level throughout the projection period, plus the additional policies and technologies added for Scenario #2
#6: High Economic Growth	Real Gross Domestic Product growth of 2.1% (1.8% in AEO25 case), plus the additional policies and technologies added for Scenario #2

Case Study Findings

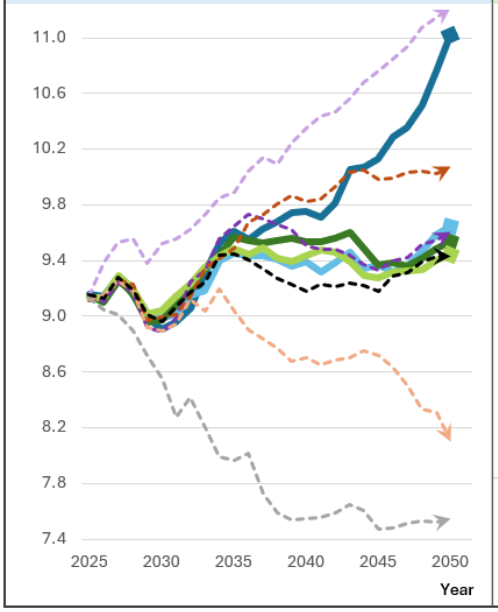
Estimated Future End-Use Demand

Natural Gas Demand

Across the scenarios evaluated, the largest increases in natural gas demand are projected in the transportation[3], industrial, and LNG export sectors, driven by continued growth in freight transportation, industrial activity, and global demand for U.S. natural gas exports. Among these sectors, transportation exhibits the strongest and most consistent growth, with demand increasing at compound annual growth rates (CAGRs) ranging from 0.9% to 4.8% depending on the scenario and region. Growth is particularly pronounced in the Rocky Mountain region, where transportation sector demand is projected to increase at CAGRs of 2.8% to 4.8% (Figure 6).

[3] In this report, the transportation sector includes light-duty vehicle, air travel, freight, military, mass transit, recreational boating, and lubricant demand.

East Coast: Natural Gas Demand Projections

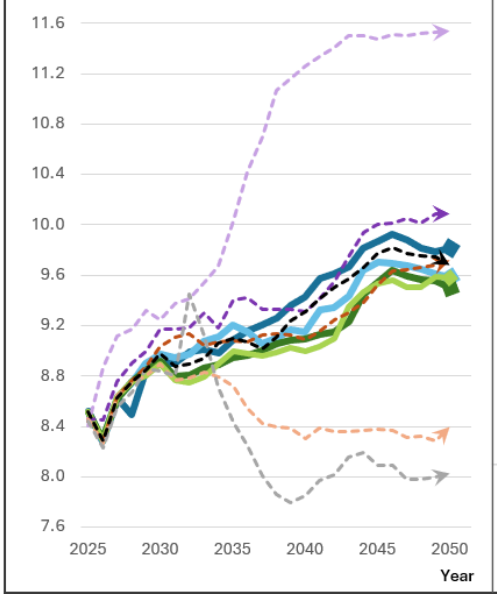


Scenarios	Demand in Year 2025	Demand in Year 2050	Compound Annual Growth Rate (%) by Sector: Commercial	Electric Power	Industrial	LNG Exports	Residential	Transportation
H2 20%	9.2	11.0	0.2	0.0	3.8	-0.4	-0.4	2.4
H2 5%	9.1	9.6	0.3	0.0	1.5	-0.4	-0.4	2.5
RNG Max	9.2	9.5	0.3	0.2	0.4	-0.4	-0.3	2.7
RNG Min	9.1	9.4	0.3	0.2	0.4	-0.4	-0.3	2.6
High Econ Growth	9.2	9.6	0.4	0.1	0.8	-0.4	-0.3	3.0
High O&G Supply	9.1	11.2	0.5	1.4	0.6	-0.4	-0.3	2.6
High Tech Cost	9.1	10.1	0.3	0.7	0.3	-0.4	-0.4	2.5
Low Tech Cost	9.1	8.1	0.4	-1.1	0.4	-0.4	-0.3	2.8
AEO25	9.1	7.5	0.4	-2.0	1.1	-0.4	-0.4	4.0
OL25-NEMS	9.2	9.4	0.3	0.2	0.3	-0.4	-0.4	2.5

Demand Sectors

Figure 3. Projected Natural Gas Demand in the East Coast

Midwest: Natural Gas Demand Projections

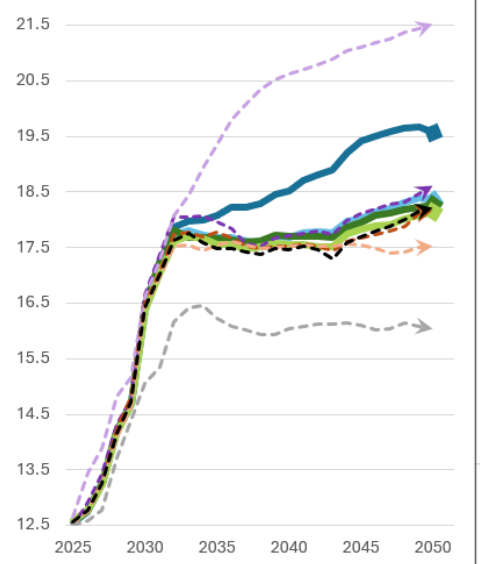


Scenarios	Demand in Year 2025	Demand in Year 2050	Compound Annual Growth Rate (%) by Sector: Commercial	Electric Power	Industrial	LNG Exports	Residential	Transportation
H2 20%	8.5	9.8	-0.2	1.6	0.3	0.0	-0.6	2.4
H2 5%	8.5	9.6	-0.1	1.6	-0.1	0.0	-0.6	2.6
RNG Max	8.5	9.5	-0.1	1.7	-0.3	0.0	-0.5	2.8
RNG Min	8.5	9.6	-0.1	1.7	-0.3	0.0	-0.5	2.7
High Econ Growth	8.5	10.1	0.0	2.0	0.2	0.0	-0.5	3.2
High O&G Supply	8.4	11.5	0.0	3.2	0.2	0.0	-0.5	2.7
High Tech Cost	8.4	9.7	-0.1	2.0	-0.3	0.0	-0.6	2.5
Low Tech Cost	8.5	8.4	-0.1	0.4	-0.2	0.0	-0.5	2.9
AEO25	8.4	8.0	-0.1	-0.7	0.4	0.0	-0.6	4.7
OL25-NEMS	8.5	9.7	-0.1	1.8	-0.3	0.0	-0.5	2.6

Demand Sectors

Figure 4. Projected Natural Gas Demand in the Midwest

Gulf Coast: Natural Gas Demand Projections

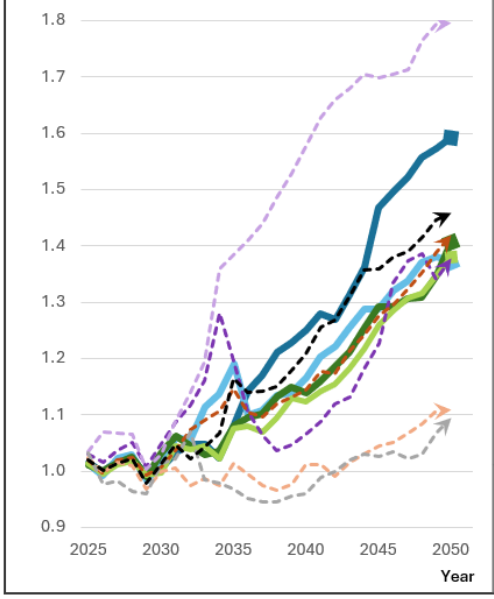


Scenarios	Demand in Year 2025	Demand in Year 2050	Compound Annual Growth Rate (%) by Sector: Commercial	Electric Power	Industrial	LNG Exports	Residential	Transportation
H2 20%	12.6	19.6	0.0	-0.3	1.5	3.3	-0.4	2.3
H2 5%	12.6	18.4	0.1	-0.3	0.5	3.3	-0.3	2.4
RNG Max	12.6	18.3	0.1	-0.3	0.1	3.4	-0.3	2.6
RNG Min	12.6	18.1	0.1	-0.2	0.1	3.3	-0.3	2.6
High Econ Growth	12.5	18.6	0.2	0.0	0.3	3.4	-0.3	3.0
High O&G Supply	12.7	21.5	0.3	2.3	0.3	3.4	-0.2	2.6
High Tech Cost	12.5	18.2	0.1	0.2	-0.1	3.2	-0.3	2.4
Low Tech Cost	12.5	17.5	0.1	-1.8	0.1	3.5	-0.3	2.7
AEO25	12.5	16.0	0.2	-2.6	0.5	2.9	-0.4	4.2
OL25-NEMS	12.6	18.2	0.1	0.0	0.0	3.3	-0.3	2.4

Demand Sectors

Figure 5. Projected Natural Gas Demand in the Gulf Coast

Rocky Mountain: Natural Gas Demand Projections



Scenarios	Demand in Year 2025	Demand in Year 2050	Compound Annual Growth Rate (%) by Sector: Commercial	Electric Power	Industrial	LNG Exports	Residential	Transportation
H2 20%	1.0	1.6	-0.1	2.0	3.8	0.0	0.4	2.8
H2 5%	1.0	1.4	-0.1	1.9	0.3	0.0	0.5	2.9
RNG Max	1.0	1.4	0.0	2.1	0.0	0.0	0.5	3.1
RNG Min	1.0	1.4	-0.1	2.0	-0.1	0.0	0.5	3.0
High Econ Growth	1.0	1.4	0.1	1.8	0.3	0.0	0.5	3.4
High O&G Supply	1.0	1.8	0.1	3.5	0.0	0.0	0.6	3.0
High Tech Cost	1.0	1.4	-0.1	2.2	-0.2	0.0	0.5	2.8
Low Tech Cost	1.0	1.1	0.0	0.4	-0.2	0.0	0.5	3.2
AEO25	1.0	1.1	0.0	-0.4	2.0	0.0	0.4	4.8
OL25-NEMS	1.0	1.5	-0.1	2.3	-0.1	0.0	0.5	2.9

Demand Sectors

Figure 6. Projected Natural Gas Demand in the Rocky Mountain Region

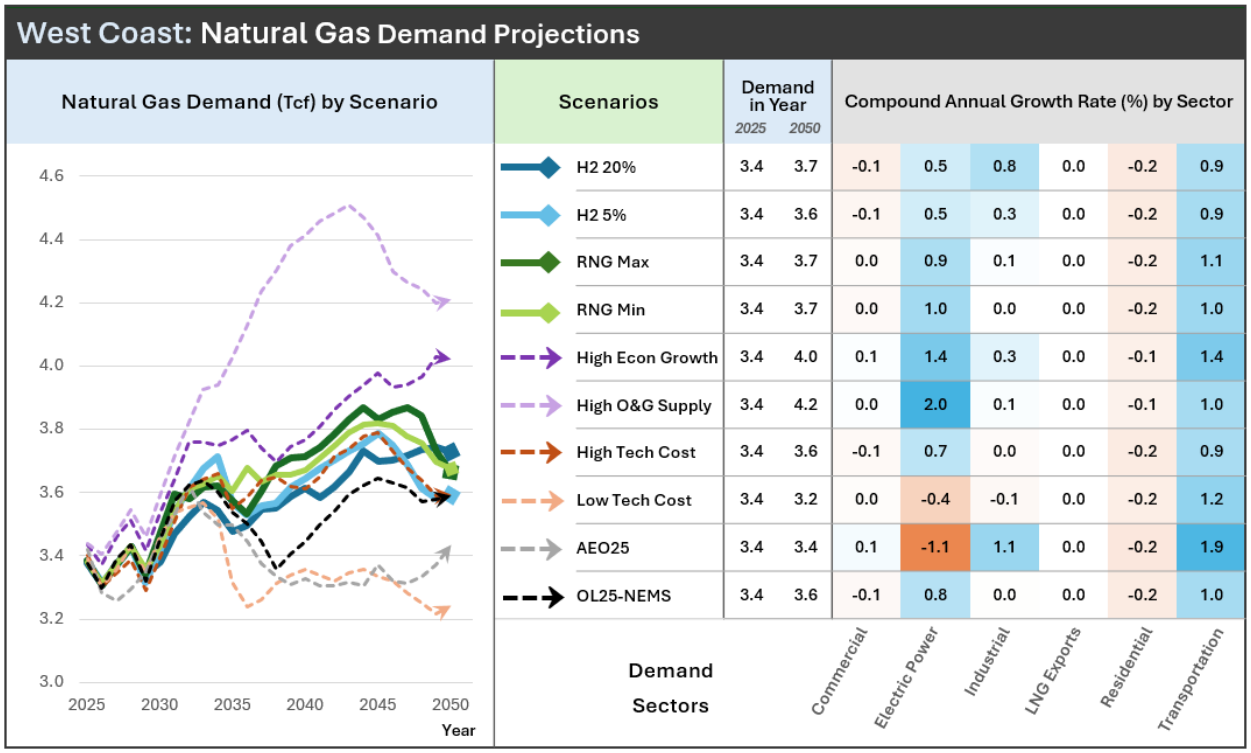


Figure 7. Projected Natural Gas Demand in the West Coast

Industrial demand generally trends upward, although growth varies by scenario and region. Across all scenarios, industrial natural gas demand is projected to change at CAGRs ranging from -0.3% to 3.8%. The strongest growth occurs in the East Coast and Rocky Mountain regions (Figure 3), where demand increases approximately 2.0% to 3.8% annually under the hydrogen blending and AEO25 Reference scenarios. However, growth is not universal. Under the RNG blending, OL25-NEMS Reference, and Low and High Zero-Carbon Technology Cost scenarios, portions of the Midwest and Rocky Mountain regions experience modest declines, with industrial demand decreasing by approximately 0.1% to 0.3% annually (Figure 4).

Demand associated with LNG exports also increases in key export areas. The Gulf Coast, the primary hub for U.S. LNG export infrastructure, is projected to grow at CAGRs of 2.9% to 3.5%, reflecting continued expansion and utilization of export facilities (Figure 5). In contrast, LNG export-related demand on the East Coast is projected to decline slightly at approximately 0.4% annually, highlighting regional differences in export infrastructure development and market activity.

Residential natural gas demand remains relatively stable but generally trends downward across most regions. With the exception of the Rocky Mountain region, residential demand declines at CAGRs of approximately -0.1% to -0.6%, reflecting the combined effects of improved energy efficiency and ongoing building electrification. The Rocky Mountain region is the only area projected to experience residential demand growth, with CAGRs ranging from 0.4% to 0.6%.

The commercial sector exhibits only modest changes across the evaluated scenarios. The East Coast shows the strongest growth, with commercial demand increasing at CAGRs of 0.2% to 0.5%. The Gulf Coast remains largely unchanged, ranging from flat demand to annual growth of 0.3%, while the Midwest experiences stable to slightly declining demand, with CAGRs as low as -0.2%. Commercial demand in the Rocky Mountain and West Coast (Figure 7) regions remains essentially flat, fluctuating within a narrow annual growth range of ±0.1%, indicating a relatively stable outlook through 2050.

The electric power sector displays the greatest variability of any demand segment, reflecting the influence of power generation technology choices, fuel prices, renewable energy deployment, and electricity demand growth. Natural gas demand for power generation ranges from annual declines of 2.6% to growth of 3.5%, depending on the scenario. Under the High Oil and Gas Supply, OL25-NEMS Reference, High Zero-Carbon Technology Cost, High Economic Growth, and RNG blending scenarios, the Rocky Mountain, Midwest, Gulf Coast, and West Coast regions experience growth of approximately 2.0% to 3.5% annually as natural gas remains a competitive generation resource.[4] Conversely, under the hydrogen blending, Low Zero-Carbon Technology Cost, and AEO25 Reference scenarios, power-sector natural gas demand declines across all regions, with CAGRs ranging from -0.2% to -2.6%. The largest reductions occur in the Gulf Coast and East Coast, where demand decreases by approximately 1.8% to 2.6% annually.

Overall, the results suggest that future natural gas demand growth is likely to be concentrated in the transportation, industrial, and LNG export sectors, while residential and commercial demand remains relatively stable or gradually declines. The electric

[4] Note that West Coast natural gas demand declines after approximately 2043 under the High Oil and Gas Supply scenario. This trend is driven in part by a modeling assumption that no new natural gas-fired generation capacity is constructed beyond that point.

power sector represents the largest source of uncertainty, with future natural gas consumption highly dependent on the pace of decarbonization, technology costs, fuel availability, and evolving regional energy market conditions.

Hydrogen Demand

Under the AEO2025 Reference scenario, hydrogen demand growth is projected to be concentrated overwhelmingly within the transportation sector, making mobility the primary driver of future hydrogen market expansion across all regions evaluated. Transportation sector hydrogen demand is expected to increase rapidly, with CAGRs ranging from approximately 21.3% to 25.7% across the five regions. Of all the regions, the Rocky Mountain region exhibits the strongest growth trajectory (Figure 11).

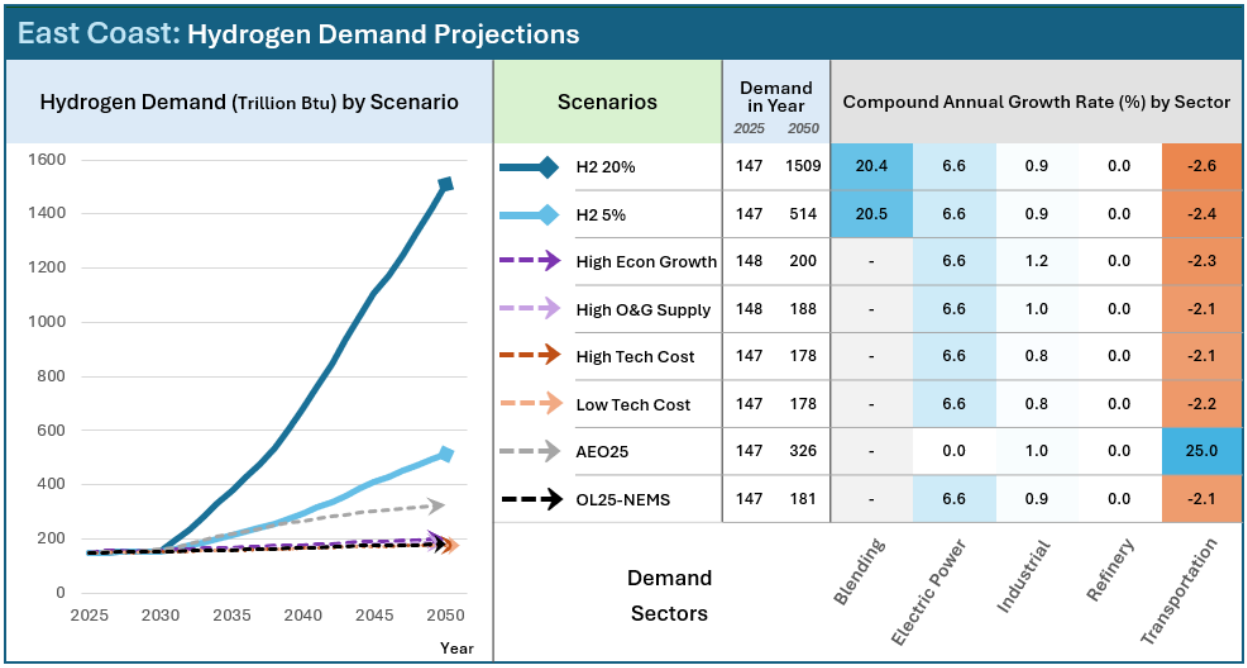
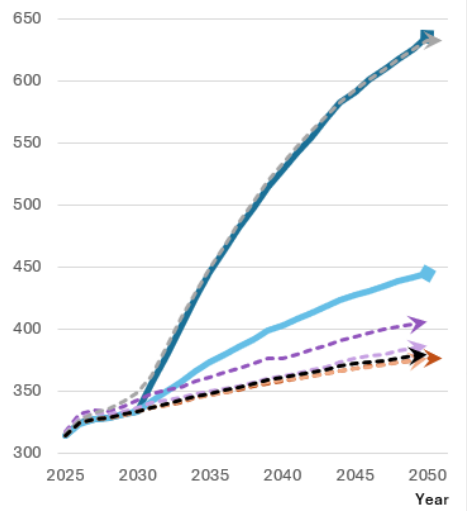


Figure 8. Projected Hydrogen Demand in the East Coast

Midwest: Hydrogen Demand Projections

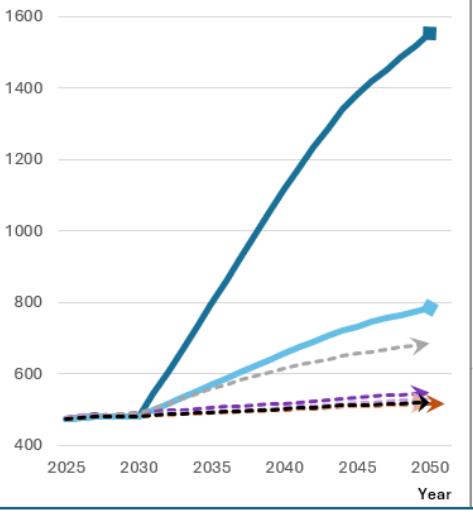


Scenarios	Demand in Year 2025	Demand in Year 2050	Compound Annual Growth Rate (%) by Sector: Blending	Electric Power	Industrial	Refinery	Transportation
H2 20%	314	636	14.8	0.0	1.1	0.0	0.3
H2 5%	314	445	15.0	0.0	1.1	0.0	0.3
High Econ Growth	317	406	-	0.0	1.5	0.0	0.3
High O&G Supply	316	386	-	0.0	1.2	0.0	0.3
High Tech Cost	314	376	-	0.0	1.1	0.0	0.4
Low Tech Cost	314	376	-	0.0	1.1	0.0	0.4
AEO25	315	633	-	0.0	1.2	0.0	25.1
OL25-NEMS	314	380	-	0.0	1.1	0.0	0.4

Demand Sectors

Figure 9. Projected Hydrogen Demand in the Midwest

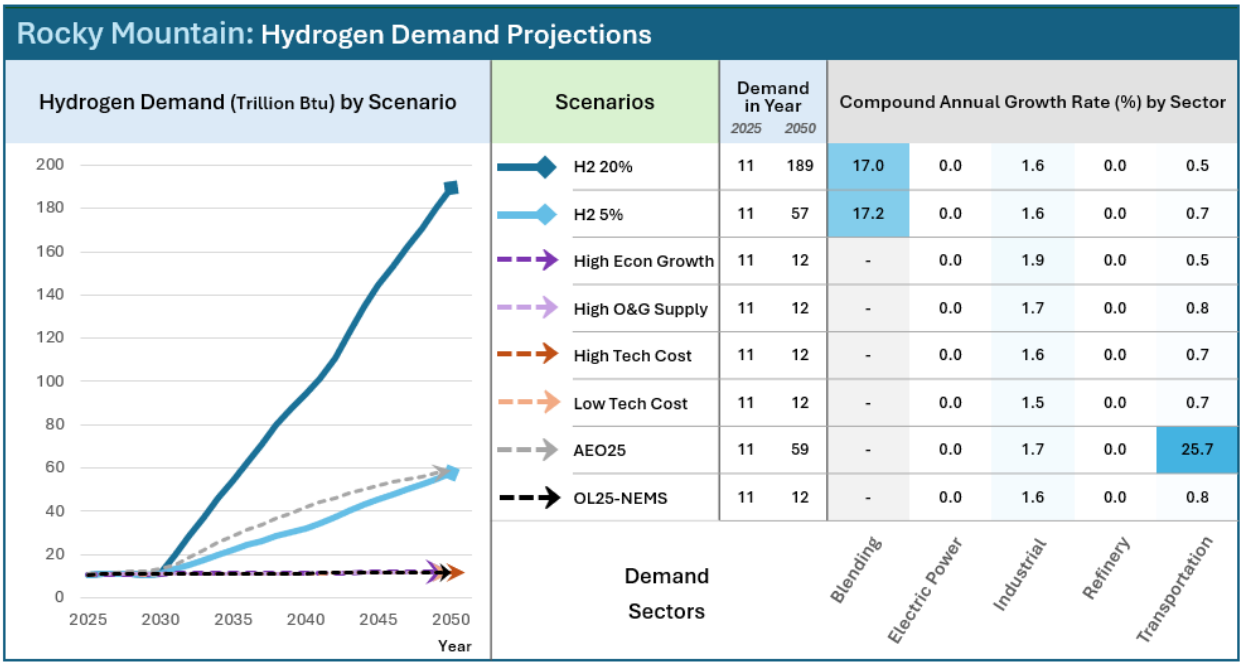
Gulf Coast: Hydrogen Demand Projections



Scenarios	Demand in Year 2025	Demand in Year 2050	Compound Annual Growth Rate (%) by Sector: Blending	Electric Power	Industrial	Refinery	Transportation
H2 20%	474	1556	16.3	0.0	0.9	0.0	1.6
H2 5%	474	787	16.5	0.0	0.9	0.0	1.7
High Econ Growth	477	547	-	0.0	1.2	0.0	2.0
High O&G Supply	476	530	-	0.0	1.0	0.0	1.6
High Tech Cost	474	517	-	0.0	0.8	0.0	1.9
Low Tech Cost	474	517	-	0.0	0.8	0.0	1.9
AEO25	475	685	-	0.0	1.0	0.0	25.1
OL25-NEMS	474	521	-	0.0	0.9	0.0	1.9

Demand Sectors

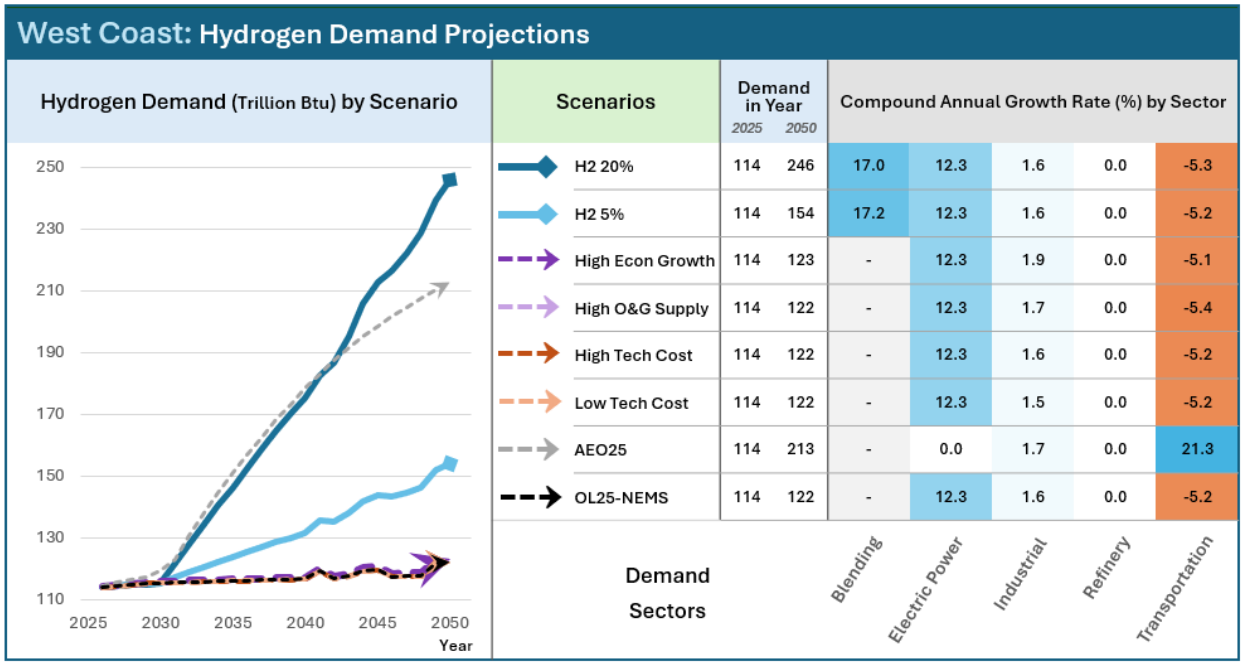
Figure 10. Projected Hydrogen Demand in the Gulf Coast



Scenarios	Demand in Year 2025	Demand in Year 2050	Compound Annual Growth Rate (%) by Sector: Blending	Electric Power	Industrial	Refinery	Transportation
H2 20%	11	189	17.0	0.0	1.6	0.0	0.5
H2 5%	11	57	17.2	0.0	1.6	0.0	0.7
High Econ Growth	11	12	-	0.0	1.9	0.0	0.5
High O&G Supply	11	12	-	0.0	1.7	0.0	0.8
High Tech Cost	11	12	-	0.0	1.6	0.0	0.7
Low Tech Cost	11	12	-	0.0	1.5	0.0	0.7
AEO25	11	59	-	0.0	1.7	0.0	25.7
OL25-NEMS	11	12	-	0.0	1.6	0.0	0.8

Demand Sectors

Figure 11. Projected Hydrogen Demand in the Rocky Mountain Region



Scenarios	Demand in Year 2025	Demand in Year 2050	Compound Annual Growth Rate (%) by Sector: Blending	Electric Power	Industrial	Refinery	Transportation
H2 20%	114	246	17.0	12.3	1.6	0.0	-5.3
H2 5%	114	154	17.2	12.3	1.6	0.0	-5.2
High Econ Growth	114	123	-	12.3	1.9	0.0	-5.1
High O&G Supply	114	122	-	12.3	1.7	0.0	-5.4
High Tech Cost	114	122	-	12.3	1.6	0.0	-5.2
Low Tech Cost	114	122	-	12.3	1.5	0.0	-5.2
AEO25	114	213	-	0.0	1.7	0.0	21.3
OL25-NEMS	114	122	-	12.3	1.6	0.0	-5.2

Demand Sectors

Figure 12. Projected Hydrogen Demand in the West Coast

In contrast, all other scenarios show substantially lower transportation sector growth, and in some cases, hydrogen demand declines relative to current levels. Under these scenarios, CAGRs ranged from -5.4% to +2.0%. This divergence appears to be driven

largely by changes in hydrogen economics following updates associated with the One Big Beautiful Bill Act, which reduce the competitiveness of hydrogen as a transportation fuel compared to the assumptions embedded within the AEO2025 Reference case. As a result, transportation sector hydrogen demand is highly sensitive to policy support mechanisms and the resulting cost of hydrogen.

Outside of transportation, hydrogen demand remains relatively flat across the refining, industrial, and power generation sectors. Growth rates for these end-use markets ranged from 0% to 1.9% annually, indicating limited expansion through 2050 under the scenarios analyzed. While these sectors continue to represent an important baseline source of hydrogen consumption, they do not emerge as significant growth markets.

The hydrogen blending scenarios present a distinctly different growth pathway. These scenarios assume that hydrogen blending into the natural gas system increases progressively between 2031 and 2050, reaching average systemwide blend levels of 5% and 20% by volume under the low- and high-blending cases, respectively. Under these assumptions, hydrogen demand grows substantially across all regions, with projected CAGRs ranging from 14.8% to 20.5%. The East Coast region is expected to experience the highest growth, reflecting its large natural gas demand base and correspondingly greater opportunity to absorb hydrogen through pipeline blending (Figure 8). These results suggest that blending policies can create a significant additional source of hydrogen demand independent of transportation-sector adoption.

The results indicate that the long-term outlook for hydrogen market development is highly dependent on the sector through which hydrogen achieves widespread adoption. Under the AEO25 Reference assumptions, transportation hydrogen demand is expected to significantly increase and drive hydrogen infrastructure investment and market scale-up. However, the low expected demand observed under alternative policy and economic assumptions demonstrates that transportation-sector adoption remains highly uncertain and sensitive to market conditions. Conversely, hydrogen blending could provide a more stable and geographically distributed demand pathway, particularly in regions with extensive natural gas infrastructure.

Overall, these findings suggest that future hydrogen deployment will be influenced most strongly by the interplay among transportation sector economics, policy incentives, infrastructure buildout, and blending opportunities within existing energy

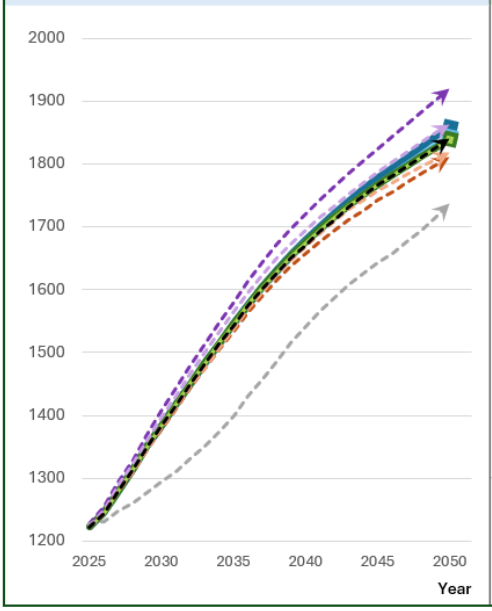
systems. While traditional refining and industrial applications continue to provide a stable demand foundation, meaningful growth in the hydrogen economy will likely depend on whether transportation and natural gas blending applications can scale sufficiently to create sustained, long-term demand across regions.

Electricity Demand

Across all regions and scenarios evaluated, data centers are projected to be the dominant driver of electricity demand growth through 2050. Annual electricity demand from data centers is expected to increase at CAGRs ranging from 4.1% to 8.1%, significantly outpacing all other sectors. Among the regions analyzed, the Gulf Coast is expected to experience the strongest growth, reflecting continued expansion of data center infrastructure (Figure 15).

East Coast: Electricity Demand Projections

Electricity Demand (BkWh) by Scenario

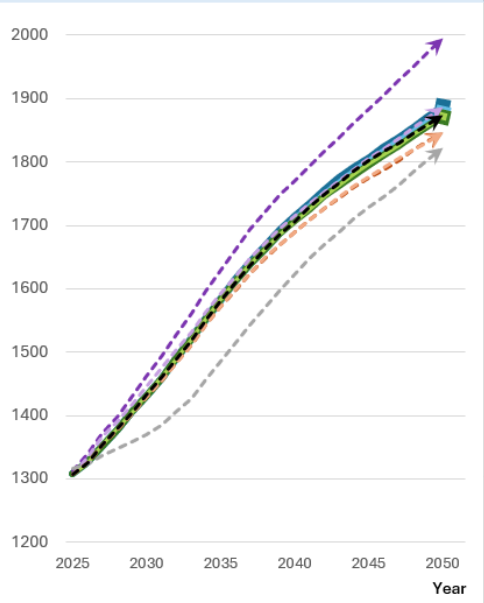


Scenarios	Demand in Year 2025	Demand in Year 2050	Compound Annual Growth Rate (%) by Sector: Commercial	Data Centers	Industrial	Residential	Transportation
H2 20%	1222	1859	0.9	6.5	1.5	0.6	1.2
H2 5%	1222	1843	0.9	6.5	1.3	0.6	1.2
RNG Max	1222	1839	0.9	6.5	1.2	0.6	1.2
RNG Min	1222	1839	0.9	6.5	1.2	0.6	1.2
High Econ Growth	1227	1920	1.1	6.5	1.8	0.7	1.5
High O&G Supply	1224	1863	1.0	6.5	1.2	0.7	1.2
High Tech Cost	1222	1811	0.9	6.5	1.1	0.6	1.2
Low Tech Cost	1222	1819	0.9	6.5	1.1	0.6	1.2
AEO25	1227	1737	1.1	4.1	1.1	1.2	1.1
OL25-NEMS	1222	1840	0.9	6.5	1.2	0.6	1.2

Demand Sectors

Figure 13. Projected Electricity Demand in the East Coast

Midwest: Electricity Demand Projections

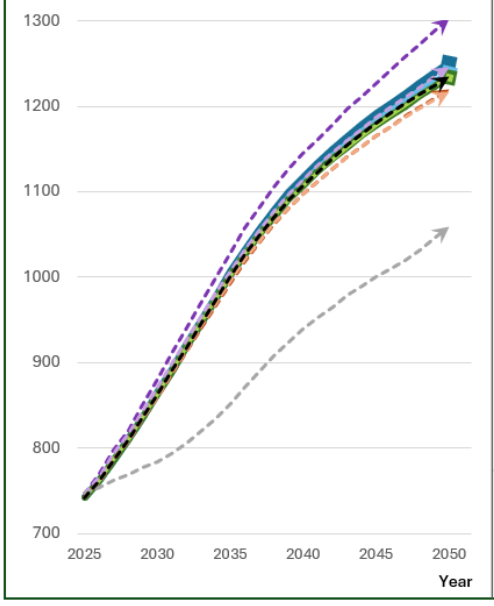


Scenarios	Demand in Year 2025	Demand in Year 2050	Compound Annual Growth Rate (%) by Sector: Commercial	Data Centers	Industrial	Residential	Transportation
H2 20%	1308	1888	0.9	6.9	1.3	0.6	0.3
H2 5%	1308	1877	0.9	6.9	1.2	0.6	0.3
RNG Max	1308	1871	0.9	6.9	1.1	0.6	0.3
RNG Min	1308	1872	0.9	6.9	1.1	0.6	0.3
High Econ Growth	1314	1995	1.1	6.9	1.7	0.6	0.5
High O&G Supply	1308	1886	1.0	6.9	1.1	0.7	0.3
High Tech Cost	1308	1847	0.9	6.9	1.0	0.6	0.3
Low Tech Cost	1308	1845	0.8	6.9	1.0	0.6	0.3
AEO25	1317	1823	1.3	4.1	1.0	1.2	0.3
OL25-NEMS	1308	1874	0.9	6.9	1.1	0.6	0.3

Demand Sectors

Figure 14. Projected Electricity Demand in the Midwest

Gulf Coast: Electricity Demand Projections

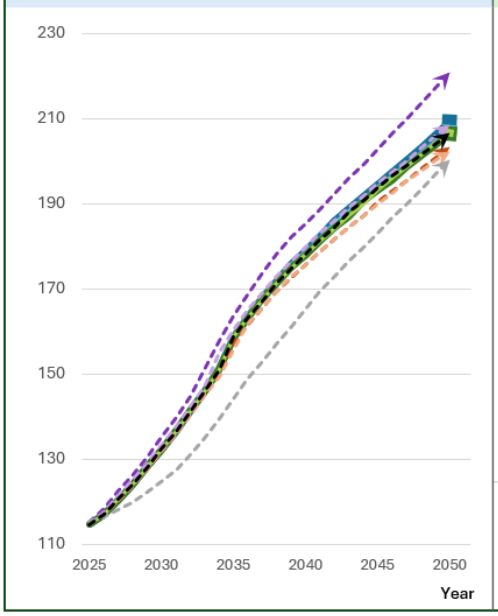


Scenarios	Demand in Year 2025	Demand in Year 2050	Compound Annual Growth Rate (%) by Sector: Commercial	Data Centers	Industrial	Residential	Transportation
H2 20%	742	1251	1.1	8.1	1.7	0.7	0.8
H2 5%	742	1239	1.1	8.1	1.6	0.7	0.8
RNG Max	742	1234	1.1	8.1	1.5	0.7	0.8
RNG Min	742	1234	1.1	8.1	1.5	0.7	0.8
High Econ Growth	746	1303	1.3	8.1	2.0	0.8	0.9
High O&G Supply	747	1246	1.2	8.1	1.4	0.9	0.7
High Tech Cost	742	1220	1.0	8.1	1.4	0.7	0.8
Low Tech Cost	742	1217	1.0	8.1	1.4	0.7	0.8
AEO25	747	1059	1.0	4.1	1.2	1.3	0.7
OL25-NEMS	742	1235	1.1	8.1	1.5	0.7	0.8

Demand Sectors

Figure 15. Projected Electricity Demand in the Gulf Coast

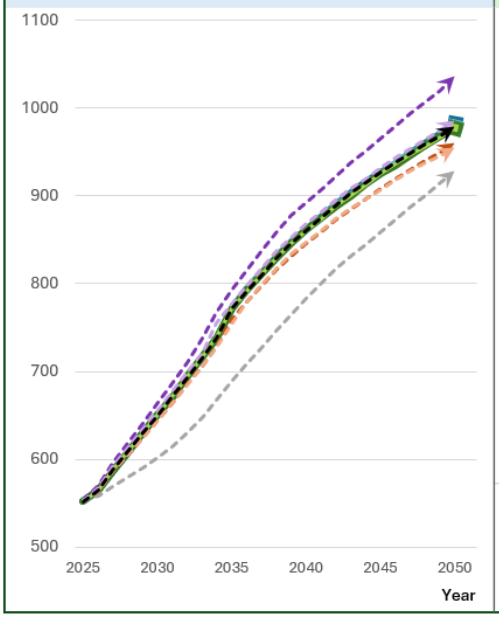
Rocky Mountain: Electricity Demand Projections



Scenarios	Demand in Year 2025	Demand in Year 2050	Compound Annual Growth Rate (%) by Sector: Commercial	Data Centers	Industrial	Residential	Transportation
H2 20%	115	209	1.2	6.0	2.9	1.3	1.3
H2 5%	115	207	1.2	6.0	2.7	1.3	1.3
RNG Max	115	207	1.2	6.0	2.7	1.4	1.3
RNG Min	115	207	1.2	6.0	2.7	1.4	1.3
High Econ Growth	115	221	1.4	6.0	3.3	1.4	1.5
High O&G Supply	115	209	1.3	6.0	2.7	1.4	1.3
High Tech Cost	115	203	1.1	6.0	2.6	1.3	1.3
Low Tech Cost	115	202	1.0	6.0	2.6	1.3	1.3
AEO25	116	200	1.8	4.1	2.3	2.0	1.3
OL25-NEMS	115	207	1.2	6.0	2.7	1.3	1.3
Demand Sectors			Commercial	Data Centers	Industrial	Residential	Transportation

Figure 16. Projected Electricity Demand in the Rocky Mountain Region

West Coast: Electricity Demand Projections



Scenarios	Demand in Year 2025	Demand in Year 2050	Compound Annual Growth Rate (%) by Sector: Commercial	Data Centers	Industrial	Residential	Transportation
H2 20%	552	982	1.2	6.5	2.8	0.8	1.2
H2 5%	552	978	1.2	6.5	2.8	0.8	1.2
RNG Max	552	977	1.2	6.5	2.7	0.8	1.2
RNG Min	552	978	1.2	6.5	2.7	0.8	1.2
High Econ Growth	554	1036	1.4	6.5	3.3	0.9	1.5
High O&G Supply	553	986	1.3	6.5	2.8	0.9	1.2
High Tech Cost	552	960	1.1	6.5	2.6	0.7	1.2
Low Tech Cost	552	955	1.0	6.5	2.6	0.7	1.2
AEO25	555	929	1.8	4.1	2.3	1.6	1.2
OL25-NEMS	552	979	1.2	6.5	2.8	0.8	1.2
Demand Sectors			Commercial	Data Centers	Industrial	Residential	Transportation

Figure 17. Projected Electricity Demand in the West Coast

The industrial sector represents the second-largest source of electricity demand growth, with projected CAGRs of approximately 1.0% to 3.3% across the scenarios evaluated. Growth is driven by expanding manufacturing activity and electrification of industrial processes. The Rocky Mountain (Figure 16) and West Coast (Figure 17) regions are expected to experience the highest industrial demand growth, with projected CAGRs ranging from 2.3% to 3.3%.

Electricity demand in the residential sector is projected to grow at a more moderate pace, with CAGRs ranging from 0.6% to 2.0%. This growth is primarily attributable to broader adoption of electric appliances and heating technologies, and rising cooling demand in some regions, partially offset by continued improvements in energy efficiency. The Rocky Mountain region is projected to experience the strongest residential demand growth, with CAGRs ranging from 1.3% to 2%.

Similarly, the commercial sector is expected to experience steady growth, with projected CAGRs between 0.8% and 1.8%. Demand increases are supported by economic growth and ongoing electrification trends, while efficiency improvements continue to moderate overall consumption growth. The Rocky Mountain and West Coast regions are projected to have the highest commercial sector growth rates, with CAGRs ranging from 1% to 1.8%.

The transportation sector is projected to have the lowest electricity demand growth among the sectors analyzed, with CAGRs ranging from 0.3% to 1.5%. Although electric vehicle adoption contributes to increased electricity consumption, the overall impact remains relatively modest compared to the rapid expansion of data center loads and growing industrial electricity requirements. The Midwest region (Figure 14) is expected to experience the slowest transportation-sector growth, with projected CAGRs ranging from 0.3% to 0.5%.

Overall, the results suggest that future electricity demand growth will be increasingly concentrated in a small number of high-growth sectors, particularly data centers and industrial applications, while residential, commercial, and transportation demand are expected to grow more gradually.

Estimated Future Energy Costs

Natural Gas

Across all scenarios evaluated, average delivered natural gas prices[5] are projected to remain relatively stable through 2050, with regional average prices changing at CAGRs of approximately -0.3% to +2.2%. The most notable price reductions occur under the High Oil and Gas Supply scenario, where increased domestic production expands supply availability and places downward pressure on fuel costs. Under this scenario, average natural gas prices in the Midwest and East Coast decline at CAGRs of approximately -0.2% and -0.3%, respectively, reaching about $5.08/MMBtu in the Midwest and $5.76/MMBtu on the East Coast by 2050.

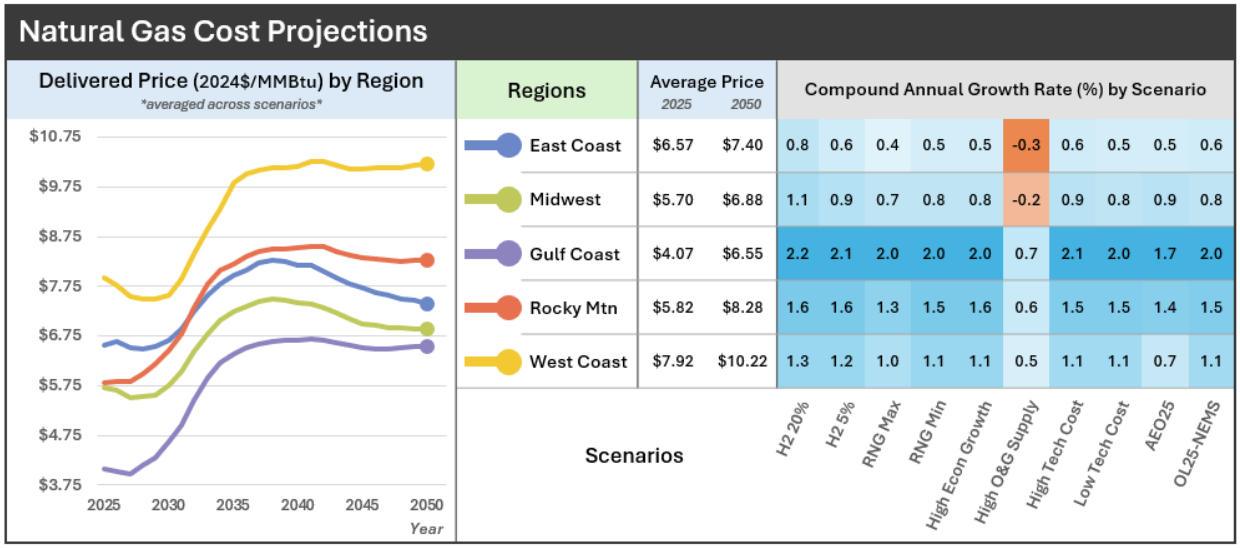


Figure 18. Projected Average Regional Delivered Natural Gas Prices

[5] Delivered natural gas prices are estimated by applying a markup to the applicable regional average citygate or spot price. Annual quantity-weighted average citygate prices are calculated for each census division by averaging monthly prices across relevant states, using combined residential and commercial natural gas consumption as weighting factors. Residential and commercial sector prices, as well as certain transportation fuel prices, are derived from these average citygate prices. Industrial and electric generation sector prices are based on quantity-weighted average spot prices, using industrial and electric generation consumption levels, respectively, as weighting factors. Source: https://www.eia.gov/outlooks/aeo/nems/documentation/ngmm/pdf/NGMM_AEO2025.pdf

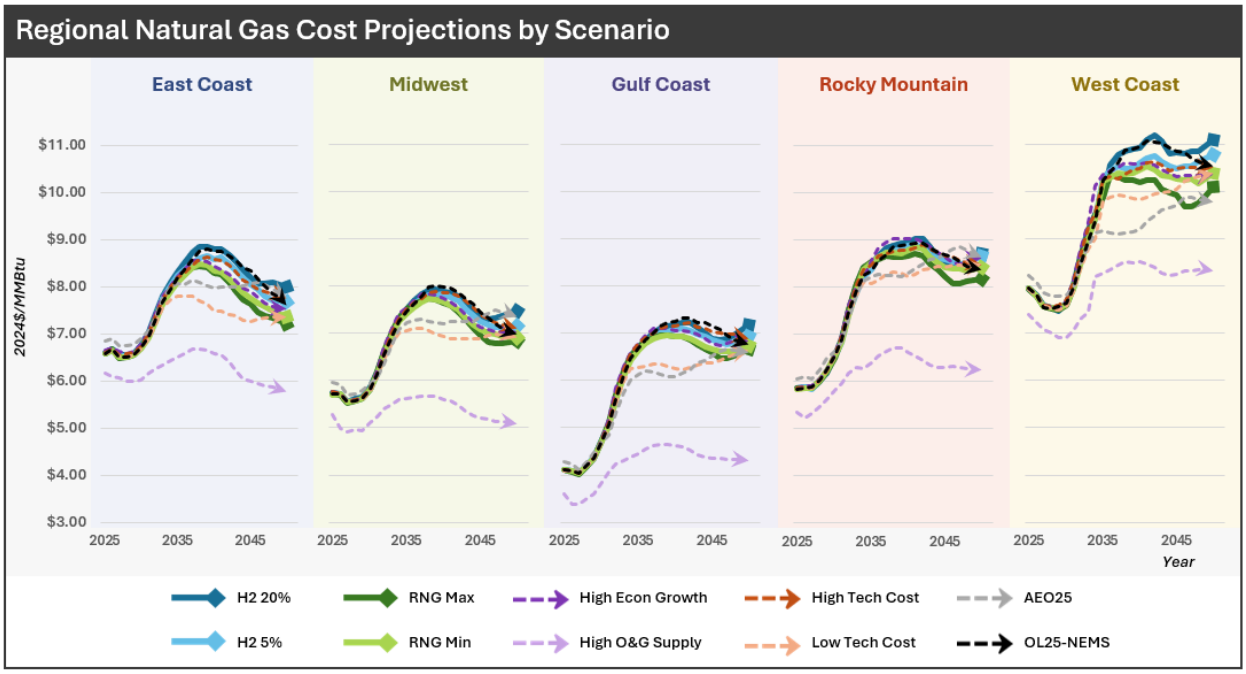


Figure 19. Projected Regional Delivered Natural Gas Prices by Scenario

Under all other scenarios, natural gas prices in the Midwest and East Coast generally increase modestly. East Coast prices are projected to rise at CAGRs of approximately 0.4% to 0.8%, reaching $7.22 to $7.98/MMBtu by 2050, while Midwest prices increase at CAGRs of approximately 0.7% to 1.1%, reaching $6.84 to $7.47/MMBtu. Although these regions experience some upward pressure on prices, the overall magnitude of change remains relatively modest over the 25-year study horizon.

The Gulf Coast is projected to experience the largest percentage increase in natural gas prices, with CAGRs ranging from approximately 0.7% to 2.2% across the evaluated scenarios. Despite these increases, the region remains one of the most cost-competitive natural gas markets in the country due to its proximity to major production basins, extensive pipeline infrastructure, and highly developed energy supply networks. By 2050, Gulf Coast prices are projected to range from approximately $4.31 to $7.18/MMBtu, remaining below those of other U.S. regions.

In contrast, the West Coast consistently emerges as the highest-cost natural gas market. Projected 2050 prices range from approximately $8.32 to $11.09/MMBtu, reflecting a combination of limited local production, constrained pipeline import capacity, and increasing competition for available natural gas supplies. As a result, the West Coast

maintains a significant price premium relative to the rest of the country across all scenarios.

It is important to note that the model accounts for natural gas storage. While storage plays a critical role in balancing natural gas markets in the short term and helping to moderate price increases during periods of peak demand, it is not assumed to influence long-term pricing. Accordingly, the model assumes that net storage withdrawals over each projection year are zero, meaning that annual storage injections are equal to annual storage withdrawals at each hub.

Overall, the results suggest that regional price differences persist, but future natural gas markets remain relatively well balanced through 2050. For comparison, between 2000 and 2023, the average U.S. natural gas citygate price ranged from $3.30 to $8.85/MMBtu[6], suggesting future projections are within historical range. The limited range of price projections across a diverse set of scenarios suggests that natural gas supply growth and infrastructure capabilities are generally sufficient to accommodate evolving demand patterns, including those associated with electrification and renewables integration. Notably, the High Oil and Gas Supply scenario consistently produces the lowest natural gas prices across all regions, demonstrating that fuel costs are considerably more sensitive to upstream resource availability and production assumptions than to variations in technology costs. This finding highlights the continued importance of supply-side factors in shaping long-term natural gas market outcomes and regional fuel affordability.

Electricity

Despite growing electricity demand driven by data center expansion, building electrification, and increased electric vehicle adoption, electricity prices are projected to remain relatively stable through 2050. Across all scenarios evaluated, regional average electricity prices change at CAGRs of approximately -1.0% to +0.9%, indicating limited long-term price volatility despite significant increases in electric load.

6 https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.eia.gov%2Fdnav%2Fng%2Fhist_xls%2FN3050US3a.xls&wdOrigin=BROWSELINK

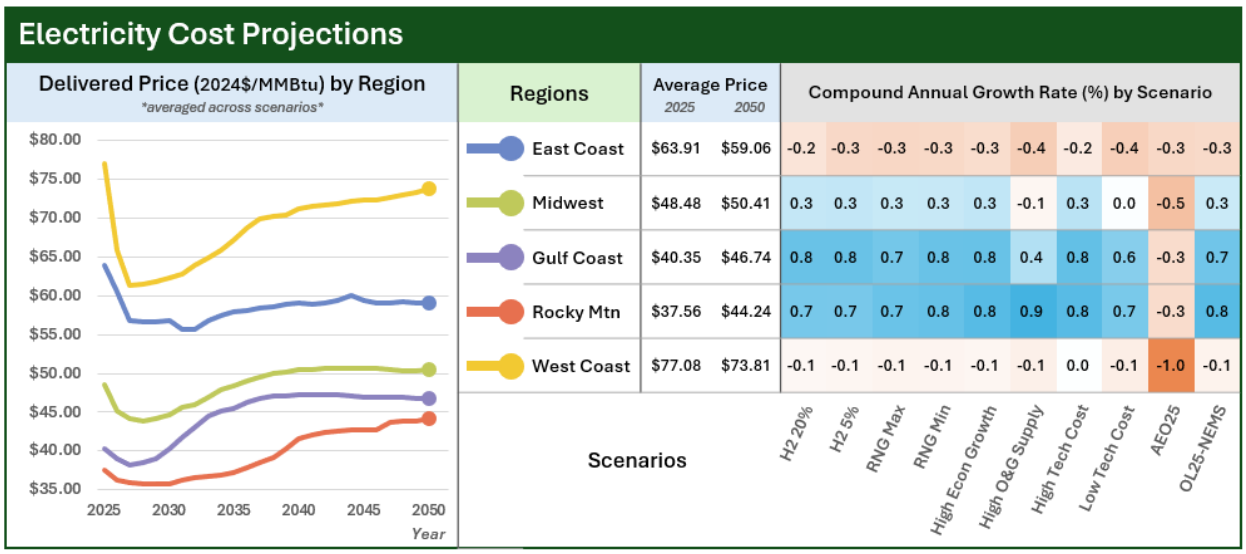


Figure 20. Projected Average Regional Delivered Electricity Prices

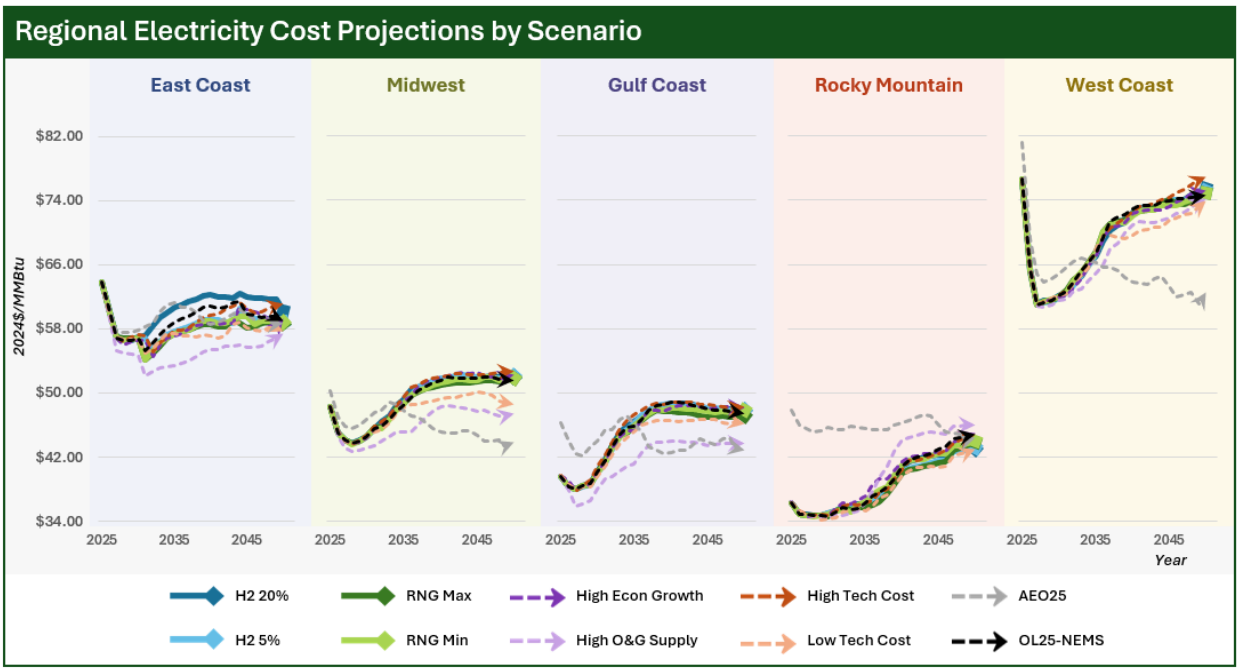


Figure 21. Projected Regional Delivered Electricity Prices by Scenario

Regional differences are generally modest. Under the High Oil and Gas Supply, OL25-NEMS Reference, High Economic Growth, High Zero-Carbon Technology Cost, RNG Blending, Hydrogen Blending, and Low Zero-Carbon Technology Cost scenarios, the Rocky Mountain and Gulf Coast regions are projected to experience the largest increases in electricity prices. Even so, the magnitude of change remains relatively small,

with prices increasing at CAGRs of approximately 0.4% to 0.9%. By 2050, projected electricity prices range from approximately $43.05 to $46.06/MMBtu ($146.88 to $157.15/MWh) in the Rocky Mountain region and $42.91 to $48.31/MMBtu ($146.40 to $164.82/MWh) in the Gulf Coast region

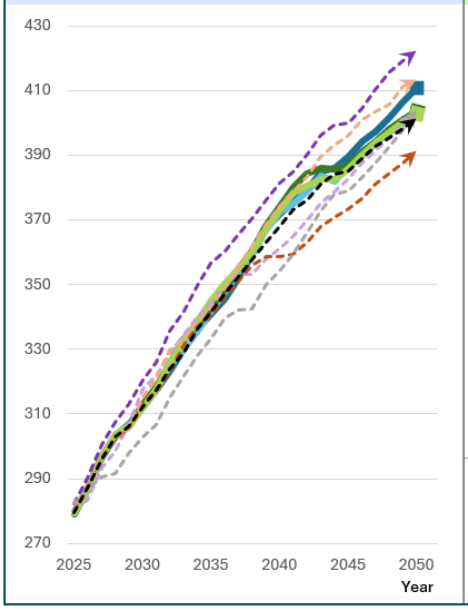
In contrast, the East Coast is projected to experience modest declines in electricity prices across all scenarios, with average prices decreasing at CAGRs of approximately -0.2% to -0.4%, reaching $57.50 to $61.23/MMBtu ($196.18 to $208.90/MWh) by 2050. Similarly, the West Coast is expected to experience stable to declining electricity prices, ranging from no growth to annual declines of approximately 1.0%, resulting in projected 2050 prices of $62.57 to $76.88/MMBtu ($213.48 to $262.30/MWh). The Midwest exhibits the greatest variability among scenarios, with electricity prices changing at CAGRs ranging from -0.5% to +0.3% and reaching approximately $43.88 to $52.69/MMBtu ($149.71 to $179.77/MWh) by 2050. However, even in this region, overall price movements remain relatively modest over the study period.

Collectively, these results suggest that continued deployment of renewable generation, coupled with ongoing grid investments, is sufficient to largely offset future demand growth. The increasing contribution of low-cost renewable resources helps moderate wholesale electricity prices, while strategic capacity additions and grid enhancements reduce the risk of supply constraints and scarcity pricing during peak demand periods.

Estimated Power Generation From Natural Gas

Across the majority of scenarios evaluated, natural gas-fired power generation is projected to increase between now and 2050, reflecting the continued role of natural gas as a reliable and flexible generation resource that supports growing electricity demand. Rising loads from data centers, industrial electrification, and broader economic growth contribute to increased natural gas generation requirements in many regions, particularly where natural gas remains cost-competitive and complements expanding renewable energy resources.

East Coast: Power Generation Projections

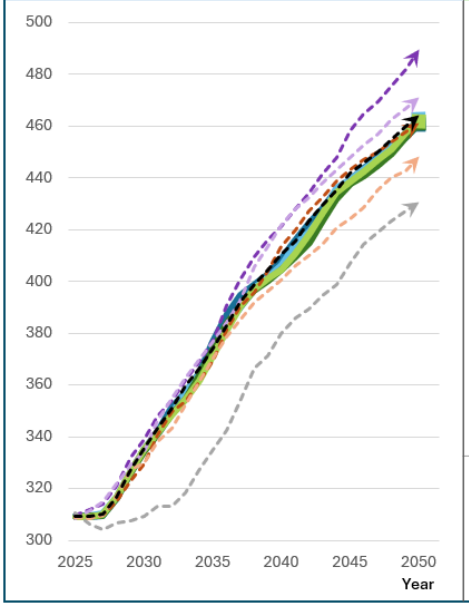


Scenarios	Generation in Year 2025	Generation in Year 2050	Coal	Distributed Generation	Hydrogen	Natural Gas	Nuclear	Petroleum	Pumped Storage	Renewables	Total Elec. Generation
			Compound Annual Growth Rate (%) by Source								
H2 20%	2516	3698	-1.2	18.2	0.0	0.5	0.2	-5.9	-201.7	6.4	1.6
H2 5%	2513	3630	-1.5	17.9	0.0	0.5	0.2	-5.8	-200.9	6.2	1.5
RNG Max	2512	3633	-1.6	17.0	0.0	0.7	0.2	-5.8	-200.6	5.9	1.5
RNG Min	2514	3626	-1.6	19.1	0.0	0.7	0.2	-6.0	-201.0	6.0	1.5
High Econ Growth	2540	3802	-1.8	18.1	0.0	0.6	0.1	-6.3	-203.6	6.6	1.6
High O&G Supply	2529	3623	-5.3	18.1	0.0	1.8	0.1	-7.0	-194.7	4.2	1.4
High Tech Cost	2522	3523	-1.6	16.4	0.0	1.2	0.2	-5.2	-194.9	4.6	1.3
Low Tech Cost	2519	3720	-6.3	17.5	0.0	-0.6	0.0	-8.4	-210.6	7.9	1.6
AEO25	2540	3637	-25.2	20.7	0.0	-2.0	0.0	-12.7	-213.4	8.2	1.4
OL25-NEMS	2515	3612	-1.6	18.6	0.0	0.6	0.2	-6.0	-201.9	6.0	1.5

Generation Sources

Figure 22. Projected Power Generation by Source and Scenario in the East Coast

Midwest: Power Generation Projections

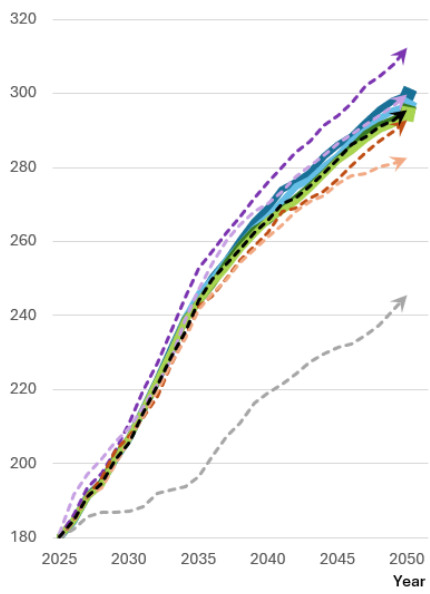


Scenarios	Generation in Year 2025	Generation in Year 2050	Coal	Distributed Generation	Hydrogen	Natural Gas	Nuclear	Petroleum	Pumped Storage	Renewables	Total Elec. Generation
			Compound Annual Growth Rate (%) by Source								
H2 20%	2784	4145	-3.2	16.6	0.0	2.0	-0.1	-3.0	1.5	4.5	1.6
H2 5%	2783	4166	-3.3	16.7	0.0	2.0	-0.2	-3.2	1.5	4.6	1.6
RNG Max	2783	4150	-3.3	17.0	0.0	2.1	-0.2	-3.2	1.5	4.5	1.6
RNG Min	2783	4157	-3.2	17.1	0.0	2.2	-0.2	-3.1	1.5	4.5	1.6
High Econ Growth	2786	4405	-3.3	19.0	0.0	2.3	0.1	-3.2	1.5	4.8	1.8
High O&G Supply	2775	4240	-5.1	17.4	0.0	3.6	-0.2	-4.0	1.2	3.7	1.7
High Tech Cost	2779	4149	-3.2	16.8	0.0	2.3	0.1	-2.8	1.1	4.2	1.6
Low Tech Cost	2781	4033	-4.2	15.4	0.0	0.5	-0.2	-3.9	6.3	5.3	1.5
AEO25	2795	3877	-22.2	7.6	0.0	-1.0	-0.1	-10.3	8.7	6.1	1.3
OL25-NEMS	2784	4177	-3.4	17.6	0.0	2.3	-0.2	-3.2	1.3	4.4	1.6

Generation Sources

Figure 23. Projected Power Generation by Source and Scenario in the Midwest

Gulf Coast: Power Generation Projections

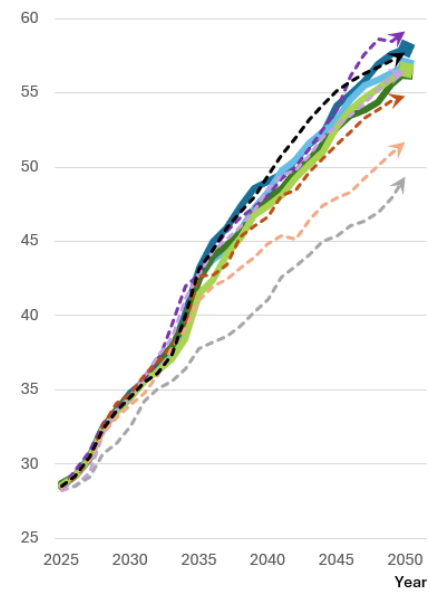


Scenarios	Generation in Year 2025	Generation in Year 2050	Compound Annual Growth Rate (%) by Source: Coal	Distributed Generation	Hydrogen	Natural Gas	Nuclear	Petroleum	Pumped Storage	Renewables	Total Elec. Generation
H2 20%	1620	2698	-1.9	21.1	0.0	0.4	0.2	-3.1	3.6	4.9	2.1
H2 5%	1623	2668	-1.7	20.9	0.0	0.3	0.2	-2.8	3.8	4.8	2.0
RNG Max	1623	2657	-1.7	20.8	0.0	0.4	0.2	-3.1	3.9	4.8	2.0
RNG Min	1623	2650	-1.8	20.8	0.0	0.4	0.2	-3.2	3.8	4.7	2.0
High Econ Growth	1622	2812	-1.4	20.4	0.0	0.6	0.2	-3.1	3.9	5.0	2.2
High O&G Supply	1629	2698	-4.9	20.8	0.0	3.2	-0.1	-5.6	1.5	1.8	2.0
High Tech Cost	1617	2635	-1.6	20.5	0.0	0.9	0.2	-2.6	3.4	4.3	2.0
Low Tech Cost	1618	2544	-3.3	20.4	0.0	-1.2	-0.7	-4.6	9.1	5.5	1.8
AEO25	1621	2209	-100.0	19.6	0.0	-2.7	-1.4	-19.5	9.9	5.4	1.2
OL25-NEMS	1621	2658	-2.4	20.9	0.0	0.6	0.2	-3.5	3.7	4.6	2.0

Generation Sources

Figure 24. Projected Power Generation by Source and Scenario in the Gulf Coast

Rocky Mountain: Power Generation Projections



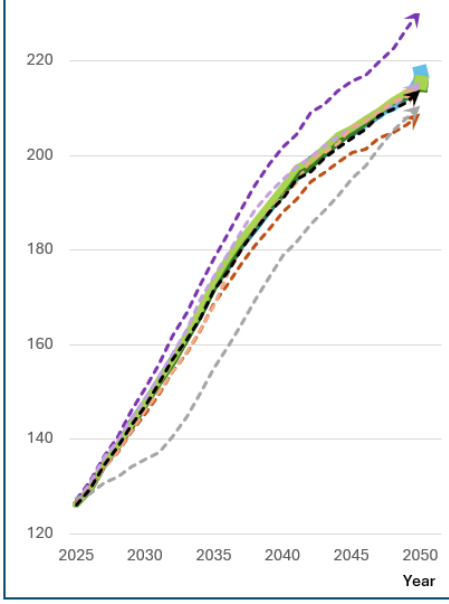
Scenarios	Generation in Year 2025	Generation in Year 2050	Compound Annual Growth Rate (%) by Source: Coal	Distributed Generation	Hydrogen	Natural Gas	Nuclear	Petroleum	Pumped Storage	Renewables	Total Elec. Generation
H2 20%	256	522	-6.7	14.2	0.0	3.4	1.5	-5.4	0.4	4.8	2.9
H2 5%	258	511	-7.0	13.7	0.0	3.2	1.1	-5.6	0.7	4.9	2.8
RNG Max	258	508	-5.4	13.8	0.0	3.0	1.2	-5.6	0.3	4.8	2.7
RNG Min	257	509	-7.0	13.9	0.0	3.2	1.4	-5.5	0.6	4.8	2.8
High Econ Growth	255	533	-6.2	14.7	0.0	3.2	0.6	-5.1	0.0	5.1	3.0
High O&G Supply	254	508	-8.6	14.6	0.0	3.8	0.7	-5.9	-0.9	4.5	2.8
High Tech Cost	255	493	-6.5	13.8	0.0	3.0	0.6	-5.5	0.4	4.7	2.7
Low Tech Cost	255	465	-6.9	13.8	0.0	2.0	0.1	-5.4	7.0	4.8	2.4
AEO25	257	444	-100.0	15.9	0.0	1.1	0.3	-8.4	6.5	5.1	2.2
OL25-NEMS	257	520	-7.0	14.0	0.0	3.5	1.6	-5.6	0.5	4.8	2.9

Generation Sources

Figure 25. Projected Power Generation by Source and Scenario in the Rocky Mountain Region

West Coast: Power Generation Projections

Power Generation (BkWh) by Scenario



Scenarios	Generation in Year 2025	Generation in Year 2050	Compound Annual Growth Rate (%) by Source: Coal	Distributed Generation	Hydrogen	Natural Gas	Nuclear	Petroleum	Pumped Storage	Renewables	Total Elec. Generation
H2 20%	1136	1944	-6.6	20.2	0.0	1.2	-1.7	-1.3	1.3	3.3	2.2
H2 5%	1135	1958	-6.9	19.6	0.0	1.2	-1.7	-1.3	1.2	3.4	2.2
RNG Max	1135	1935	-6.8	19.7	0.0	1.6	-1.7	-1.3	1.3	3.2	2.2
RNG Min	1135	1939	-6.9	17.7	0.0	1.6	-1.6	-1.4	1.3	3.2	2.2
High Econ Growth	1145	2076	-5.3	17.7	0.0	1.9	-1.8	-1.1	0.9	3.4	2.4
High O&G Supply	1142	1939	-9.1	18.4	0.0	2.9	-1.7	-1.3	1.1	2.5	2.1
High Tech Cost	1138	1881	-5.6	19.7	0.0	1.5	-1.7	-1.2	1.2	3.0	2.0
Low Tech Cost	1137	1924	-6.4	17.7	0.0	-0.1	-2.2	-1.0	4.0	3.7	2.1
AEO25	1147	1895	-100.0	20.5	0.0	-1.3	-2.3	-1.3	6.2	3.9	2.0
OL25-NEMS	1135	1925	-6.8	19.9	0.0	1.6	-1.6	-1.3	1.2	3.2	2.1

Generation Sources

Figure 26. Projected Power Generation by Source and Scenario in the West Coast

However, under the AEO25 Reference and Low-Carbon Technology Cost scenarios, most regions are projected to experience a decline in natural gas-fired generation. Specifically, the West Coast, East Coast, Gulf Coast, and Midwest regions are expected to see reductions, with projected CAGRs ranging from -0.1% to -2.7% through 2050. These declines are primarily driven by accelerated deployment of lower-cost clean energy technologies and increased renewable generation capacity.

Despite these regional declines in select scenarios, the overall results indicate that natural gas is expected to remain a significant component of the future power generation mix across most scenarios evaluated. Its ability to provide dispatchable generation, maintain system reliability during periods of peak demand, and complement variable renewable resources continues to support its role in the evolving electric power system. Nevertheless, the magnitude and direction of future natural gas generation growth remain highly dependent on technology cost assumptions, regional policy objectives, and the pace of clean energy adoption.

Estimated Natural Gas Capacity Needed

Across all scenarios evaluated, the East Coast-to-Midwest corridor is projected to require the largest expansion in natural gas capacity through 2050 (Figure 27).[7] Capacity requirements along this corridor are estimated to increase at CAGRs of approximately 3.8% to 5.1%, reaching 15.01 to 20.66 trillion cubic feet (Tcf) by 2050. This growth reflects sustained increases in regional demand and the corridor's critical role in connecting major supply basins with high-demand population and industrial centers.

Natural Gas Capacity: Compound Annual Growth Rate (%) by Region

From Region	To Region	H2 20%	H2 5%	RNG Max	RNG Min	High Econ Growth	High O&G Supply	High Tech Cost	Low Tech Cost	AEO25	OL25-NEMS
East Coast	Canada	0.01	0.27	0.28	0.28	0.30	0.33	0.01	0.24	0.23	0.29
	East Coast	0.24	0.08	0.08	0.08	0.08	0.21	0.19	0.07	0.04	0.14
	Midwest	5.12	4.87	4.85	4.83	4.94	4.69	4.80	3.96	3.78	4.78
Midwest	East Coast	0.29	0.34	0.33	0.30	0.28	0.36	0.31	0.21	0.14	0.30
	Gulf Coast	1.64	1.40	1.46	1.43	1.44	0.90	1.16	1.04	0.92	1.26
	Midwest	0.55	0.48	0.48	0.47	0.49	0.42	0.43	0.32	0.30	0.44
	Rocky Mountain	0.03	0	0.03	0.03	0	0	0	0	0.12	0
Gulf Coast	East Coast	0.23	0.04	0.02	0.02	0.03	0.46	0.31	0.02	0.02	0.09
	Gulf Coast	0.20	0.17	0.15	0.15	0.16	0.20	0.16	0.17	0.14	0.16
	West Coast	0.98	0.69	0.53	0.56	0.78	1.17	0.43	0	0	0.55
Rocky Mountain	Rocky Mountain	0.35	0.25	0.17	0.20	0.25	0.45	0.15	0.09	0.07	0.19
	West Coast	0.62	0.59	0.46	0.51	0.66	0.79	0.44	0.45	0.37	0.55
Canada	East Coast	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	Rocky Mountain	0.27	0.24	0.25	0.23	0.40	0.00	0.19	0.00	0.00	0.29

Regional Cases of Non-Zero Capacity with no Change Over Time

From East Coast	From Midwest	From Gulf Coast	From Rocky Mountain	From West Coast	From Canada	From Mexico
To Gulf Coast	To Canada	To Mexico, Midwest, Rocky Mountain	To Canada, Gulf Coast, Midwest	To Canada, Mexico, Rocky Mountain, West Coast	To Midwest, West Coast	To Gulf Coast, West Coast

Figure 27. Projected Natural Gas Capacity Growth by Region

The Midwest-to-Gulf Coast corridor represents the second most significant need for capacity expansion. Under six of the evaluated scenarios (including the hydrogen blending, RNG blending, High Economic Growth, and AEO2025 NEMS Reference cases), capacity requirements along this corridor increase at CAGRs of approximately 1.3% to 1.6%, reaching 10.61 to 11.65 Tcf by 2050 (Figure 28).

[7] In this report, capacity refers to the maximum volume that can be transported over the course of a year.

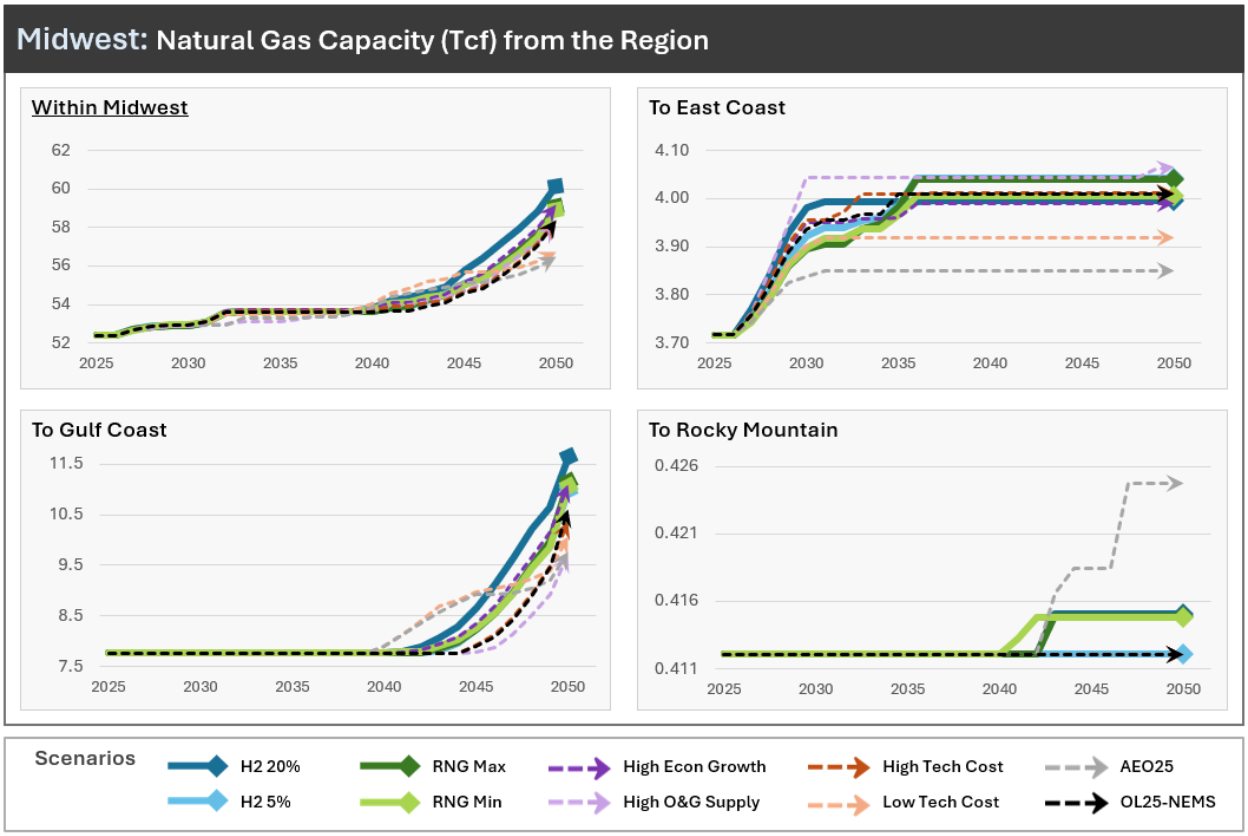


Figure 28. Projected Natural Gas Capacity Needs for the Midwest Region

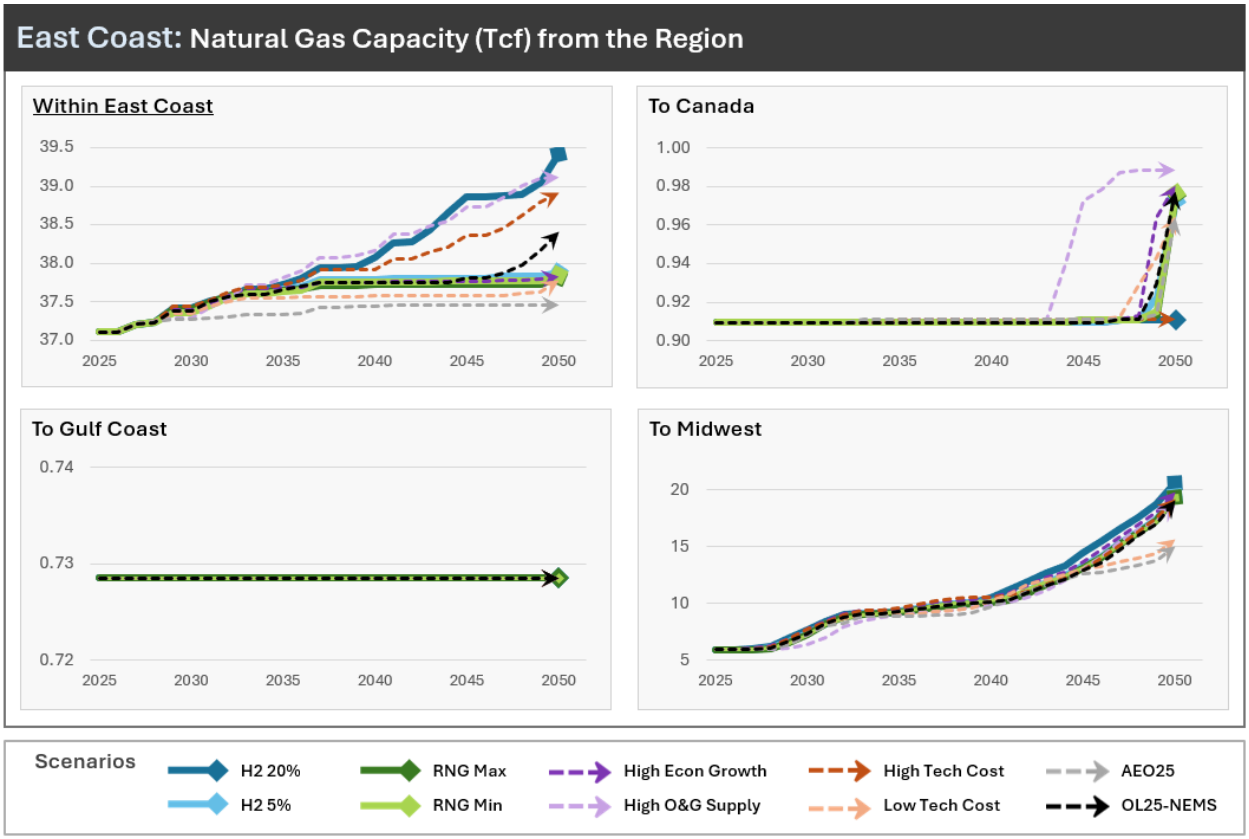


Figure 29. Projected Natural Gas Capacity Needs for the East Coast

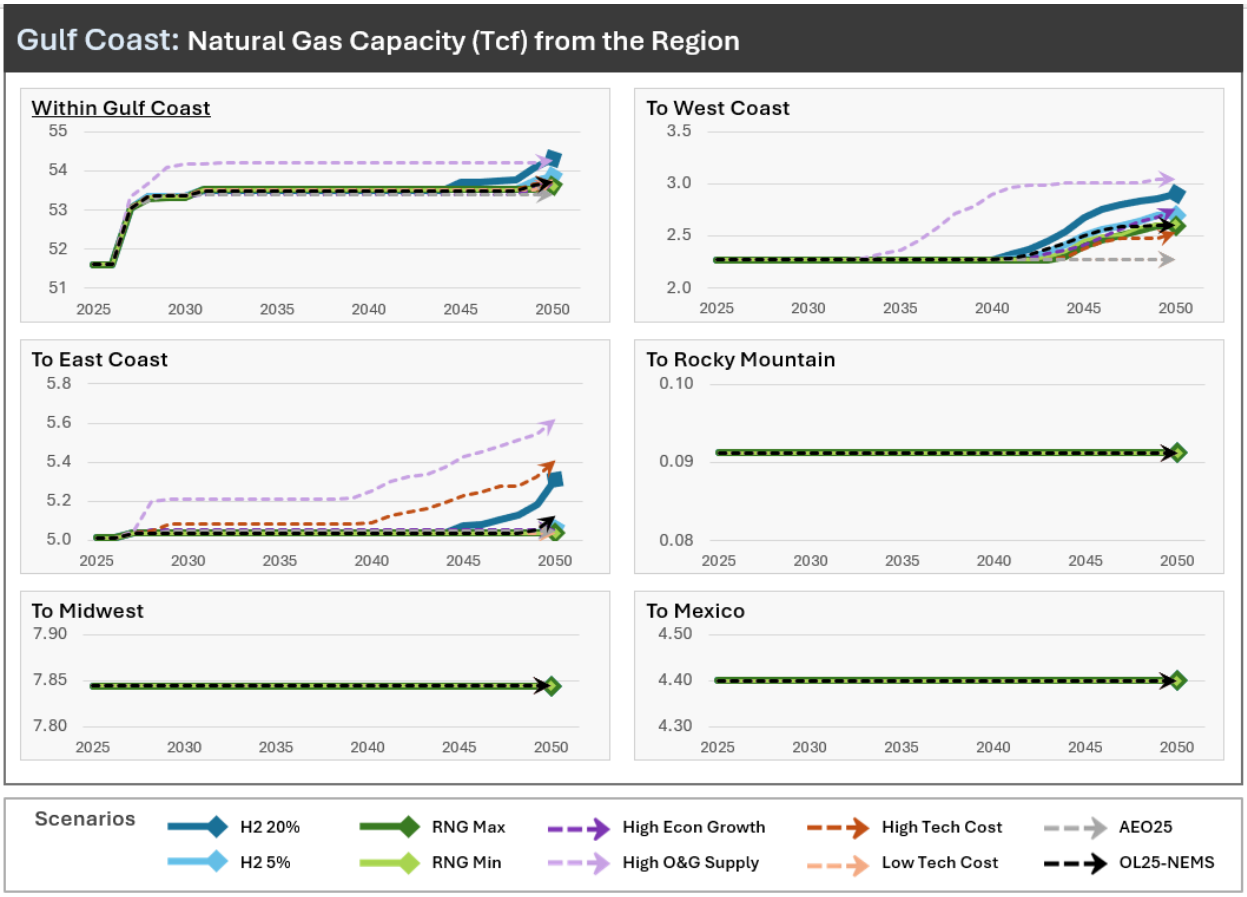


Figure 30. Projected Natural Gas Capacity Needs for the Gulf Coast

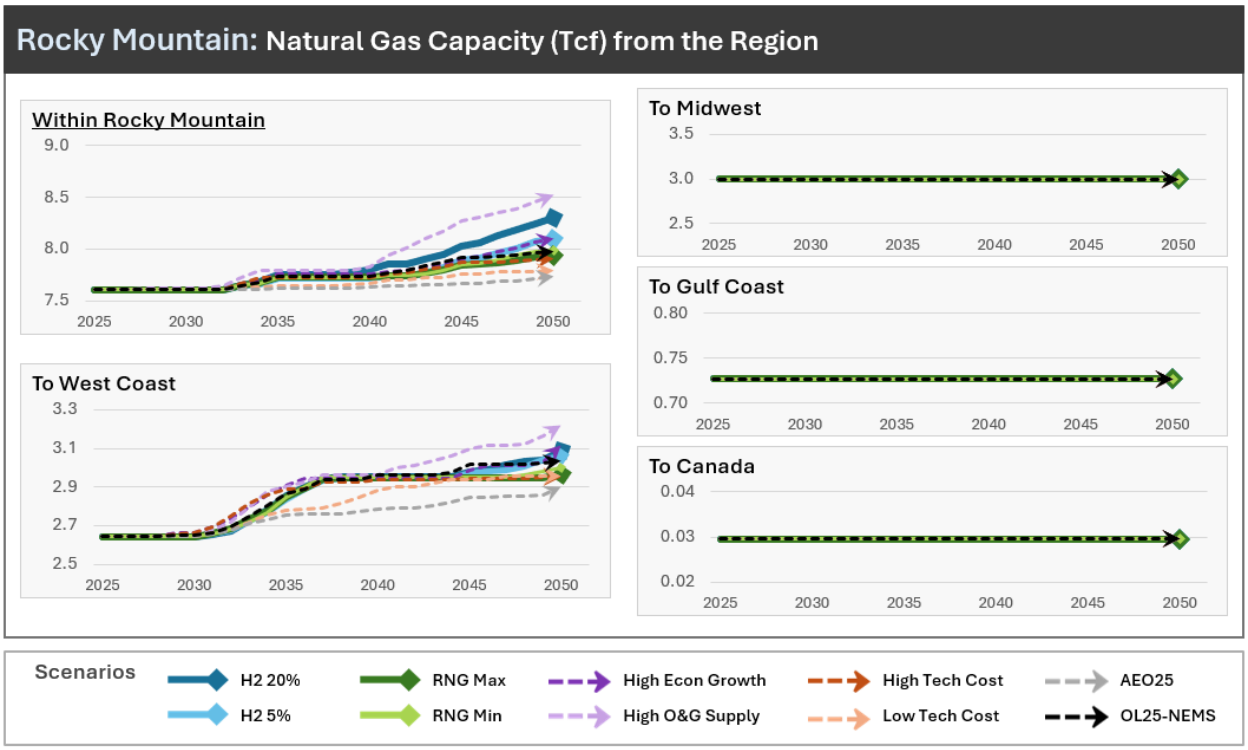


Figure 31. Projected Natural Gas Capacity Needs for the Rocky Mountain Region

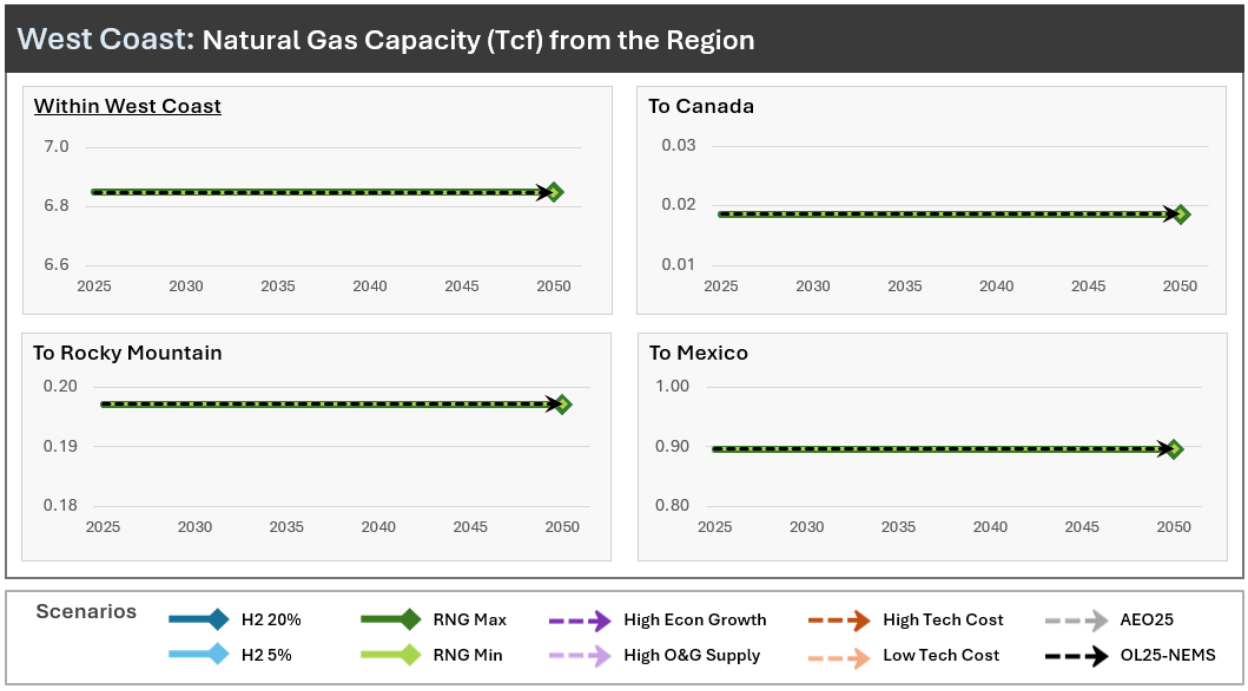


Figure 32. Projected Natural Gas Capacity Needs for the West Coast

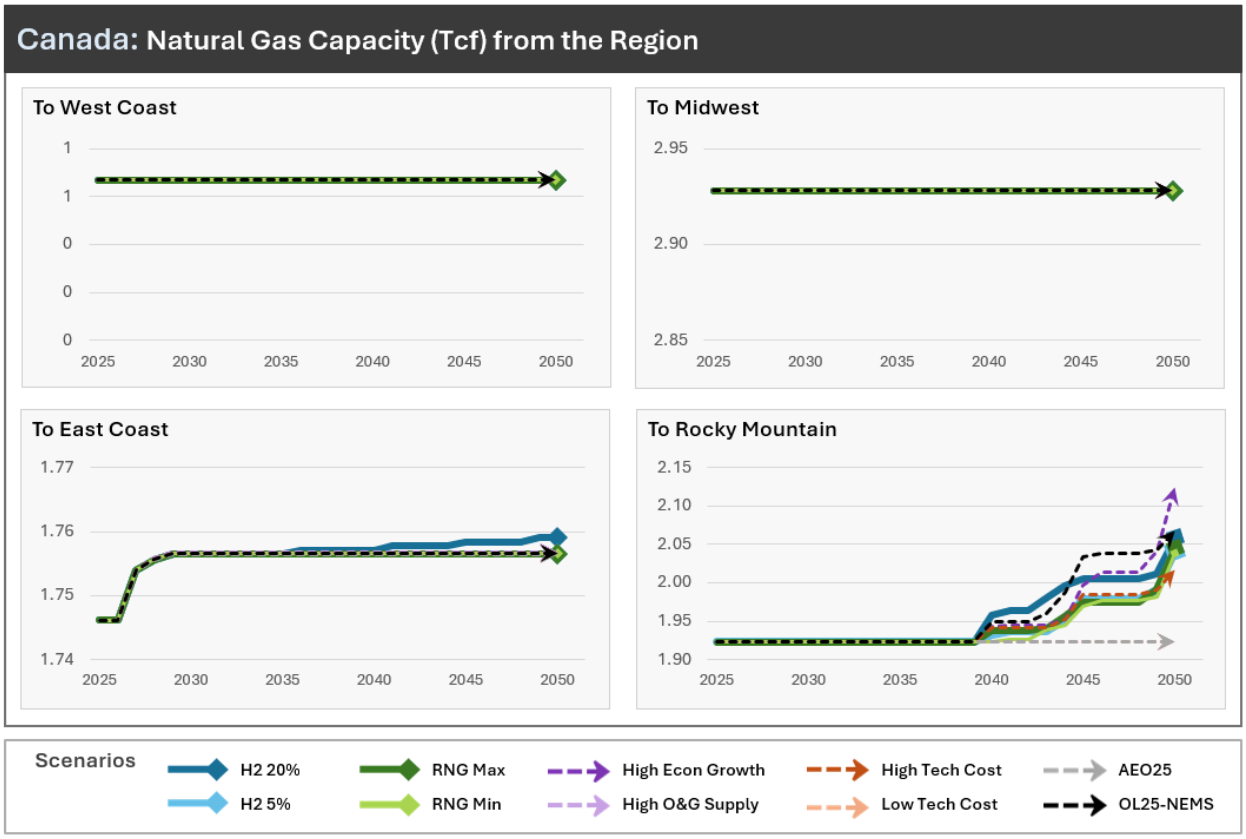


Figure 33. Projected Natural Gas Capacity Needs from Canada

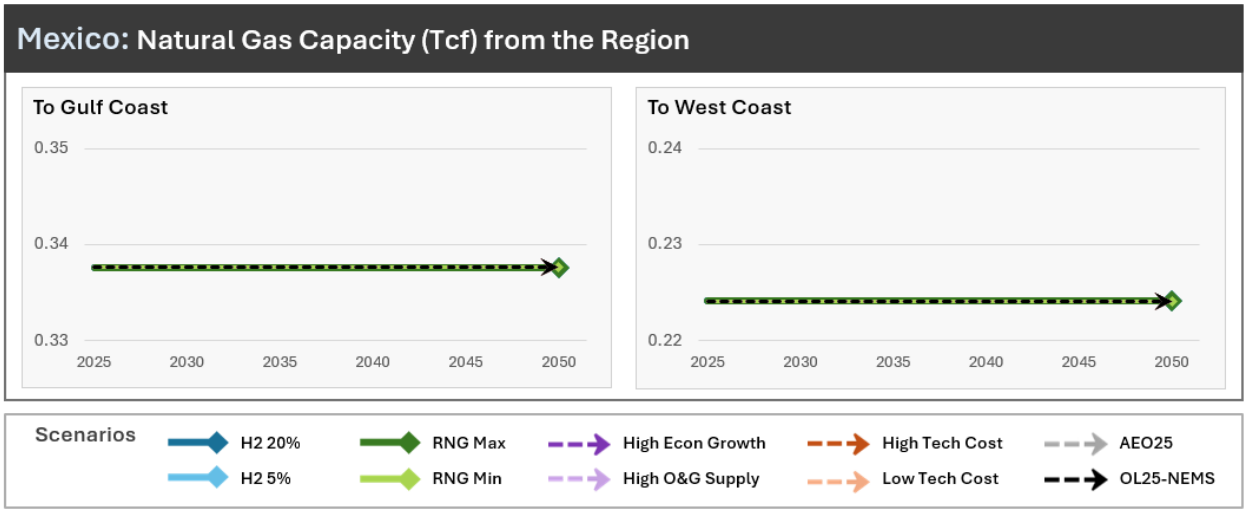


Figure 34. Projected Natural Gas Capacity Needs from Mexico

In contrast, all other major corridors (including Gulf Coast-to-West Coast, Rocky Mountain-to-West Coast, Midwest-to-Midwest, Gulf Coast-to-East Coast, Rocky Mountain-to-Rocky Mountain, Canada-to-Rocky Mountain, Midwest-to-East Coast, East

Coast-to-East Coast, Gulf Coast-to-Gulf Coast, Midwest-to-Rocky Mountain, and West Coast-to-other regions) show comparatively modest or no growth in modeled interregional capacity . Across these corridors, projected capacity growth generally remains at or below 1.2% CAGR.

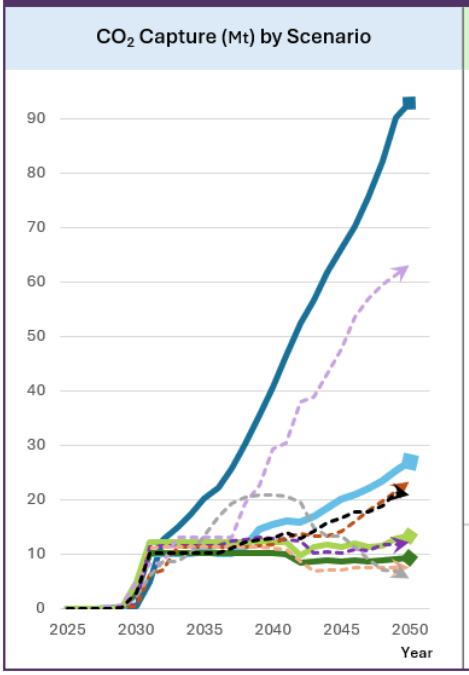
For projected natural gas pipeline capacity needs by state, see the accompanying "National Case Study NEMS Outputs" document.

Overall, the results suggest that much of the future natural gas infrastructure needs are likely to be concentrated within strategic transportation corridors. The East Coast-to-Midwest and Midwest-to-Gulf Coast corridors emerge as the primary areas where additional capacity may be required to support projected demand growth. These findings suggest that strategic regional investments can be prioritized for future system expansion to increase investment efficiency. These regional modeling results are intended to characterize broad system trends and should not be interpreted as an assessment of the need for any individual pipeline project or local infrastructure investment.

Estimated Carbon Capture

Across the scenarios evaluated, the natural gas production and delivery, natural gas processing, and hydrogen sectors are projected to experience the most significant growth in carbon capture deployment through 2050. These sectors are expected to account for the largest increases in captured carbon dioxide (CO_2), driven by expanding production activities, increasing decarbonization initiatives, and the availability of relatively concentrated CO_2 streams that are well-suited for capture technologies.

East Coast: Carbon Capture Projections

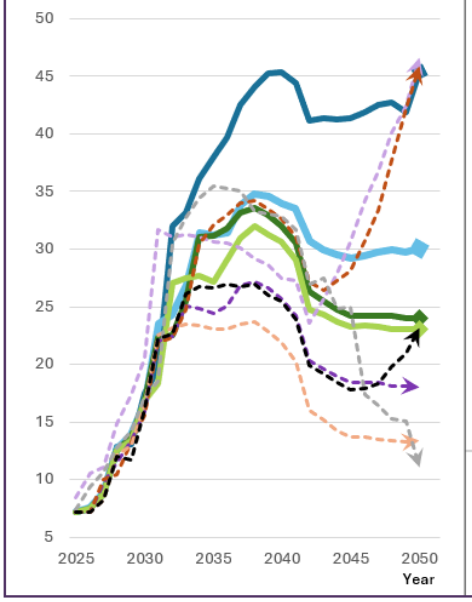


Scenarios	Mt in Year 2025	Mt in Year 2050	Compound Annual Growth Rate (%) by Sector						
			Bioenergy	Cement	Coal	Ethanol	Hydrogen	Natural Gas	NG Processing
H2 20%	0	93	0.0	-100.0	0.0	-100.0	25.0	5.3	0.0
H2 5%	0	27	0.0	-100.0	0.0	-100.0	29.6	6.8	0.0
RNG Max	0	9	0.0	-100.0	0.0	-100.0	0.0	6.9	0.0
RNG Min	0	13	0.0	-100.0	0.0	-100.0	0.0	5.6	0.0
High Econ Growth	0	12	0.0	-100.0	0.0	-100.0	0.0	15.8	0.0
High O&G Supply	0	63	0.0	-100.0	0.0	-100.0	0.0	29.6	0.0
High Tech Cost	0	23	0.0	-100.0	0.0	-100.0	0.0	7.6	0.0
Low Tech Cost	0	8	0.0	-100.0	0.0	-100.0	0.0	5.7	0.0
AEO25	0	6	0.0	-100.0	-100.0	-100.0	-100.0	5.0	0.0
OL25-NEMS	0	21	0.0	-100.0	0.0	-100.0	0.0	11.3	0.0

Demand Sectors

Figure 35. Projected Carbon Capture Opportunities by Source and Scenario in the East Coast

Midwest: Carbon Capture Projections

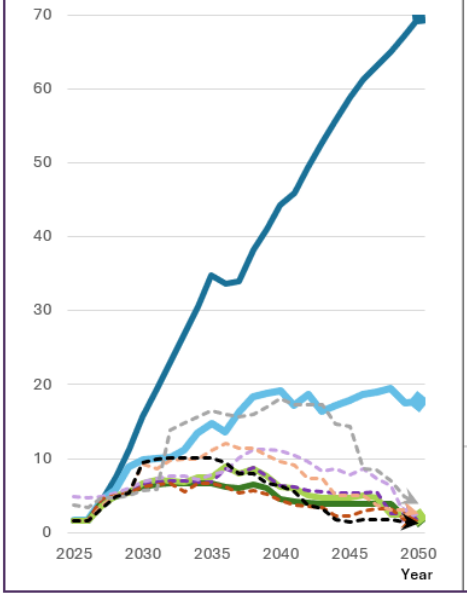


Scenarios	Mt in Year 2025	Mt in Year 2050	Compound Annual Growth Rate (%) by Sector						
			Bioenergy	Cement	Coal	Ethanol	Hydrogen	Natural Gas	NG Processing
H2 20%	7	45	0.0	-100.0	0.0	-0.9	19.2	14.4	-100.0
H2 5%	7	30	0.0	-100.0	-4.6	-0.9	14.1	5.2	-100.0
RNG Max	7	24	0.0	-100.0	-4.8	-0.9	-100.0	5.8	-4.1
RNG Min	7	23	0.0	-100.0	-4.5	-0.9	-100.0	34.6	-4.1
High Econ Growth	7	18	0.0	-100.0	-4.5	-0.9	-100.0	39.1	-100.0
High O&G Supply	8	47	0.0	-100.0	0.0	-0.9	-100.0	16.4	-100.0
High Tech Cost	7	46	0.0	-100.0	-4.8	-0.9	-100.0	10.3	-4.1
Low Tech Cost	7	13	2.1	-100.0	-7.8	-0.9	-100.0	0.9	-4.1
AEO25	7	11	0.0	-100.0	-13.6	-0.9	-100.0	2.0	12.0
OL25-NEMS	7	23	0.0	-100.0	-100.0	-0.9	-100.0	34.7	-4.1

Demand Sectors

Figure 36. Projected Carbon Capture Opportunities by Source and Scenario in the Midwest

Gulf Coast: Carbon Capture Projections

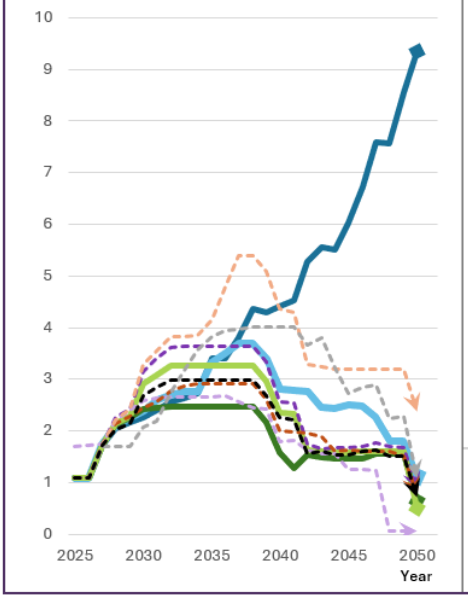


Scenarios	Mt in Year 2025	Mt in Year 2050	Compound Annual Growth Rate (%) by Sector: Bioenergy	Cement	Coal	Ethanol	Hydrogen	Natural Gas	NG Processing
H2 20%	2	70	0.0	-100.0	0.0	-0.6	19.1	1.0	-100.0
H2 5%	2	18	0.0	-100.0	-4.3	-0.6	10.6	-6.3	-8.4
RNG Max	2	2	0.0	-100.0	-4.8	-0.6	-100.0	-8.2	-2.0
RNG Min	2	2	0.0	-100.0	-4.5	-0.6	-100.0	0.4	-2.3
High Econ Growth	2	2	0.0	-100.0	-4.5	-0.6	-100.0	-1.6	-8.4
High O&G Supply	5	2	0.0	-100.0	0.0	-0.6	-100.0	9.2	-100.0
High Tech Cost	2	2	0.0	-100.0	-4.8	-0.6	-100.0	-4.0	-2.0
Low Tech Cost	2	3	17.2	-100.0	-7.8	-0.6	-100.0	-3.2	-2.0
AEO25	4	4	0.0	-100.0	-100.0	-0.6	-100.0	15.5	1.3
OL25-NEMS	2	1	0.0	-100.0	-100.0	-0.6	-100.0	4.3	-2.0

Demand Sectors

Figure 37. Projected Carbon Capture Opportunities by Source and Scenario in the Gulf Coast

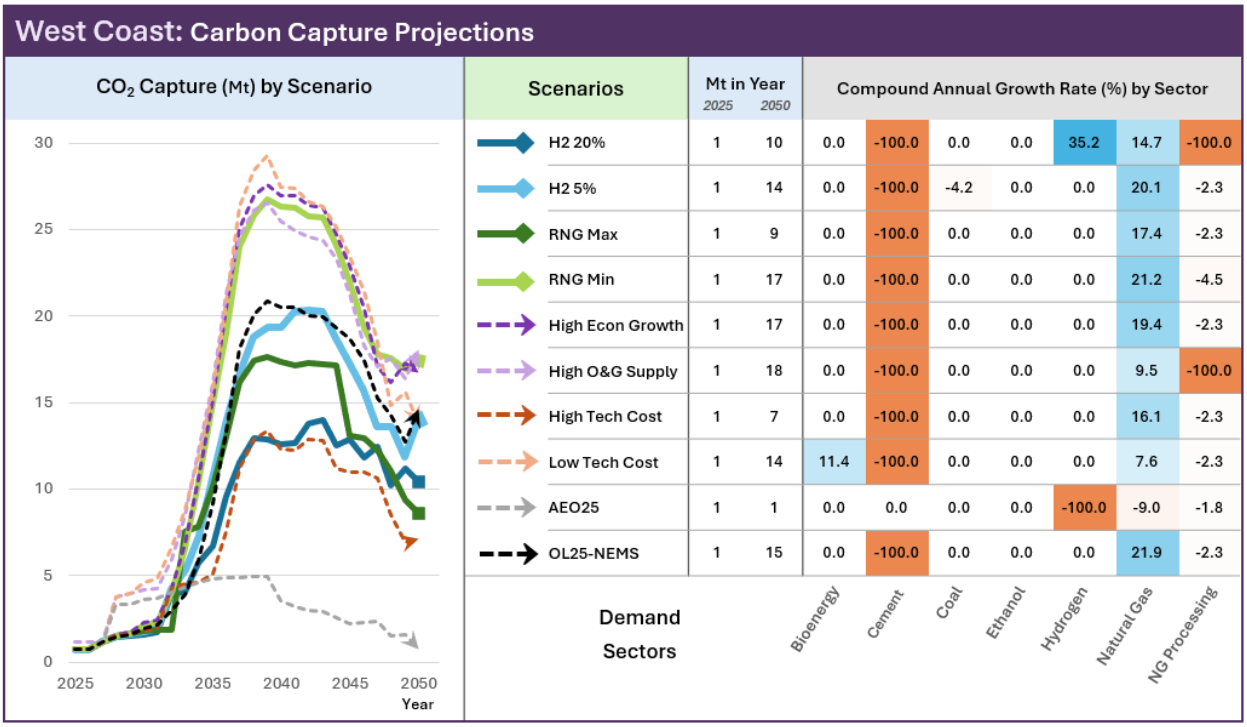
Rocky Mountain: Carbon Capture Projections



Scenarios	Mt in Year 2025	Mt in Year 2050	Compound Annual Growth Rate (%) by Sector: Bioenergy	Cement	Coal	Ethanol	Hydrogen	Natural Gas	NG Processing
H2 20%	1	9	0.0	-100.0	0.0	0.0	35.2	-5.7	-100.0
H2 5%	1	1	0.0	-100.0	-4.2	0.0	0.0	-6.3	-2.3
RNG Max	1	1	0.0	-100.0	0.0	0.0	0.0	-8.2	-2.3
RNG Min	1	1	0.0	-100.0	0.0	0.0	0.0	-3.3	-4.5
High Econ Growth	1	1	0.0	-100.0	0.0	0.0	0.0	-2.9	-2.3
High O&G Supply	2	0	0.0	-100.0	0.0	0.0	0.0	-8.2	-100.0
High Tech Cost	1	1	0.0	-100.0	0.0	0.0	0.0	-4.0	-2.3
Low Tech Cost	1	2	11.4	-100.0	0.0	0.0	0.0	-3.2	-2.3
AEO25	1	1	0.0	0.0	0.0	0.0	-100.0	0.4	-1.8
OL25-NEMS	1	1	0.0	-100.0	0.0	0.0	0.0	-4.2	-2.3

Demand Sectors

Figure 38. Projected Carbon Capture Opportunities by Source and Scenario in the Rocky Mountain Region



Scenarios	Mt in Year 2025	Mt in Year 2050	Compound Annual Growth Rate (%) by Sector: Bioenergy	Cement	Coal	Ethanol	Hydrogen	Natural Gas	NG Processing
H2 20%	1	10	0.0	-100.0	0.0	0.0	35.2	14.7	-100.0
H2 5%	1	14	0.0	-100.0	-4.2	0.0	0.0	20.1	-2.3
RNG Max	1	9	0.0	-100.0	0.0	0.0	0.0	17.4	-2.3
RNG Min	1	17	0.0	-100.0	0.0	0.0	0.0	21.2	-4.5
High Econ Growth	1	17	0.0	-100.0	0.0	0.0	0.0	19.4	-2.3
High O&G Supply	1	18	0.0	-100.0	0.0	0.0	0.0	9.5	-100.0
High Tech Cost	1	7	0.0	-100.0	0.0	0.0	0.0	16.1	-2.3
Low Tech Cost	1	14	11.4	-100.0	0.0	0.0	0.0	7.6	-2.3
AEO25	1	1	0.0	0.0	0.0	0.0	-100.0	-9.0	-1.8
OL25-NEMS	1	15	0.0	-100.0	0.0	0.0	0.0	21.9	-2.3

Demand Sectors

Figure 39. Projected Carbon Capture Opportunities by Source and Scenario in the West Coast

While the timing of deployment varies by region and scenario, most sectors exhibit sustained carbon capture growth once initial investments and infrastructure are established. In some cases, meaningful deployment does not occur until 2030 or later. For example, under the 20% hydrogen blending scenario, carbon capture within the Rocky Mountain region's hydrogen sector remains limited in the near term but accelerates after initial projects come online (Figure 38). Similar patterns are observed in other regions where market conditions, policy incentives, or infrastructure development delay early adoption. However, once deployment begins, carbon capture volumes generally increase steadily through 2050.

In contrast, sectors such as bioenergy, cement, coal, and ethanol are projected to experience little to no change in carbon capture activity between now and 2050. Across most scenarios, these sectors maintain comparatively low capture volumes and contribute only marginally to overall carbon capture growth. As a result, future expansion of carbon capture is expected to be concentrated primarily within the natural gas and hydrogen value chains, with these sectors serving as the principal drivers of carbon capture deployment across the regions evaluated.

Key Insights

This section discusses the key insights from the case study, highlighting the considerations and potential opportunities for deploying emerging fuels in natural gas infrastructure.

1. **Transportation, industrial, and LNG sectors are expected to drive future natural gas demand growth.**
    - Across the scenarios evaluated, the strongest natural gas demand growth is expected to occur in the transportation, industrial, and LNG export sectors. Transportation demand exhibits the most consistent growth across all scenarios, while industrial demand increases in most regions, particularly in the East Coast and Rocky Mountain regions. LNG export growth remains concentrated along the Gulf Coast, reinforcing its role as the nation's primary export hub. This finding suggests that future natural gas demand growth is increasingly tied to economic development, industrial competitiveness, freight movement, and export activity rather than traditional residential or commercial consumption.
2. **Residential and commercial sectors show minor or declining growth through 2050.**
    - Most regions are projected to have slight declines due to efficiency improvements and electrification trends. Utilities may need to adjust long-term planning assumptions as customer growth increasingly shifts from traditional space heating demand toward industrial, transportation, and emerging energy applications
3. **Natural gas demand for power generation varies significantly across scenarios.**
    - Projected natural gas demand for power generation exhibits the greatest level of uncertainty among all end-use sectors. Depending on the scenario, demand ranges from substantial growth to notable declines by 2050. The future role of natural gas in the power sector is influenced primarily by renewable energy deployment, clean energy technology costs, and decarbonization policies. These factors have a greater impact on power-sector natural gas demand than on any other natural gas end-use sector. Additional upside potential could emerge if data center developers increasingly rely on natural gas-fired generation to support growing electricity needs and reliability requirements.

4. **Hydrogen demand growth depends on policy and adoption pathways.**
    - Under the AEO25 Reference scenario, the transportation sector is the dominant hydrogen demand driver. However, under other scenarios, hydrogen demand for the transportation sector is substantially lower. Hydrogen market development remains highly dependent on supportive policies, project economics, and deployment strategies. Blending may be a more stable and immediate pathway to market expansion than transportation fuel adoption alone.
5. **Data centers dominate future electricity demand growth.**
    - Data centers are projected to be the fastest-growing electricity demand segment in every region, with growth rates significantly exceeding all other sectors. Energy infrastructure planning will likely need to consider data center growth areas rather than traditional population growth alone.
6. **Energy prices are expected to remain relatively stable through 2050.**
    - Natural gas and electricity prices vary modestly despite increased demand. Renewable deployment, supply growth, and infrastructure investments help reduce long-term cost increases.
7. **Natural gas is expected to remain a critical reliability resource.**
    - Most scenarios project continued growth in natural gas-fired generation, particularly where renewable deployment creates greater flexibility and balancing requirements. Even in scenarios where generation declines, natural gas remains an important dispatchable resource.
8. **Carbon capture growth is concentrated in natural gas and hydrogen value chains.**
    - Carbon capture deployment is projected to be focused on natural gas production, delivery, and processing, and hydrogen production. These sectors will likely serve as the primary areas for scaling carbon capture.

Potential Opportunities

1. **Expand natural gas capacity and RNG integration along high-growth corridors.**
    - Projected demand growth across the East Coast-Midwest and Midwest-Gulf Coast corridors presents an opportunity to strategically expand natural gas infrastructure and enhance system reliability in regions expected to experience increasing energy needs. As these corridors emerge as key demand centers for power generation, industrial activity,

and other end-use sectors, targeted investments in pipeline capacity, storage assets, and system interconnections can help ensure the continued delivery of affordable and reliable energy. Increasing deployment of RNG within these areas also offers an opportunity to supplement growing demand with lower-carbon gas supplies while leveraging existing infrastructure. Expanding RNG production, injection capabilities, and market access in high-growth areas can enhance fuel supply diversity and improve system resilience.

2. **Hydrogen blending presents an opportunity to support hydrogen market growth through a more stable and diversified demand pathway.**
    - Given the uncertainty surrounding long-term hydrogen adoption in the transportation sector, stakeholders should continue to evaluate transportation applications where hydrogen economics are favorable while also expanding the assessment of hydrogen blending opportunities within existing natural gas systems. Further evaluation of regional infrastructure readiness, operational requirements, and deployment timelines can help identify practical pathways for incremental blending implementation. By cultivating demand across multiple end-use sectors, this approach can reduce reliance on a single market outcome and support more resilient growth of the hydrogen economy.
3. **Expand carbon management across natural gas and hydrogen value chains.**
    - Carbon capture deployment is projected to grow most significantly in the natural gas and hydrogen sectors. Concentrated CO_2 streams present favorable opportunities for cost-effective capture deployment. Utilities, producers, technology developers, and policymakers may benefit from advancing carbon management strategies that leverage existing natural gas and hydrogen infrastructure.
4. **Rapid data center expansion may create significant opportunities for natural gas, electric infrastructure, and integrated energy solutions.**
    - Data centers are projected to be the largest source of electricity demand growth across all regions. Utilities, developers, and technology providers can position themselves to support emerging data center hubs through integrated energy planning and infrastructure development. Utilities and planners should identify emerging data center clusters and incorporate data center growth into resource adequacy studies. Given the wide range of possible outcomes for gas-fired generation, preserving optionality

among natural gas, renewables, storage, and hydrogen can increase system reliability.

5. **Focus strategy on growth in industrial and transportation natural gas markets.**
    - Industrial facilities and transportation applications represent some of the most resilient long-term natural gas demand growth opportunities. These sectors appear less exposed to the declines projected in residential demand and some electrification-sensitive end uses. Utilities and fuel providers can focus customer engagement, infrastructure planning, and innovation efforts on industrial and transportation market segments with stronger growth prospects.

Conclusion

The findings indicate that natural gas is likely to remain an important component of the U.S. energy portfolio. Even under scenarios with accelerated deployment of clean energy technologies, natural gas continues to provide operational flexibility, reliability, and energy security benefits. Future infrastructure needs appear manageable and concentrated within a limited number of strategic corridors, enabling a targeted approach to capacity expansion and system modernization.

Hydrogen and RNG present important opportunities to leverage existing natural gas infrastructure while supporting decarbonization objectives. Hydrogen blending offers a pathway for stimulating demand growth across multiple regions, reducing dependence on a single end-use sector and providing a scalable mechanism for integrating low-carbon fuels. Similarly, RNG deployment can increase fuel supply diversity and support emissions reductions without requiring extensive new delivery infrastructure.

The study further highlights the growing importance of carbon management as part of future energy system planning. Carbon capture deployment within natural gas and hydrogen value chains appears well positioned to support emissions reduction goals while preserving the affordability and reliability benefits of existing energy assets.

Taken together, these results suggest that energy system planning efforts should prioritize flexibility, targeted infrastructure investments, and technology pathways that leverage existing assets while accommodating evolving market conditions. Strategies that support hydrogen blending, RNG deployment, carbon management, natural gas

system optimization, and integrated planning for data center growth can help strengthen energy resilience and position stakeholders to respond effectively to future energy needs.