16th STS-AIChE Southwest Process Technology Conference

Opening Keynote Session & Orientation

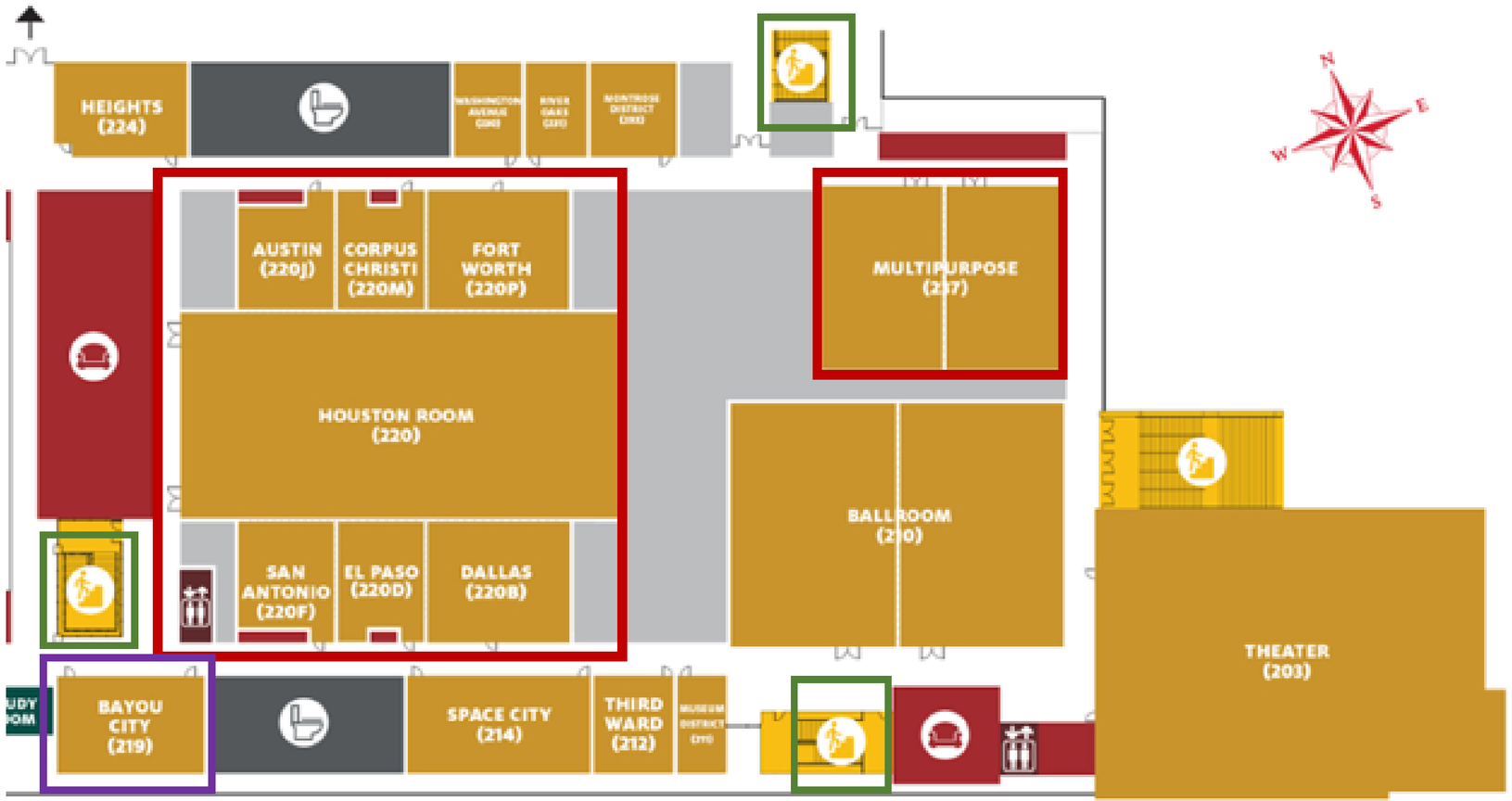
Sept 22-23, 2025, University of Houston

Orientation: Know Where You Are

Safety: Always locate emergency exits.

Key Rooms for SPTC:

- Houston Room
- Multipurpose Room
- Bayou City Room



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16th STS-AIChE Southwest Process Technology Conference

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Conference Leadership

Title	Name	Affiliation
Conference Chair	Kirtan Trivedi	ExxonMobil
Conference Co-Chair	Alan Rossiter	University of Houston, Ret.
Program Chair	Virginia Sommer	Fluor

…and more volunteer helpers than I can name

16th STS-AIChE Southwest Process Technology Conference

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Program Overview Day 1

Time	Monday September 22	
8:00-9:00 am	Keynote 1: Dean Foreman, Chief Economist of the Texas Oil & Gas Association (TXOGA). Global Economics and Energy Outlook – Q3 2025	
	Track 1 (Multipurpose Room)	Track 2 (Houston Room)
9:15-10:45 am	Energy Efficiency 1 Gary Gildert & Carlos Gamarra	Process Safety & Risk Management Samantha Scruggs & Shailesh Saraykar
10:45-11:05 am	Refreshments & Networking Break	
11:05 am - 12:05 pm	Energy Efficiency 2 Carlos Gamarra & Gary Gildert	Advances in Digitalization, Part 1: IIoT Mark Darby & Jim Brigman
12:05-1:30 pm	Lunch Break/Engineering Ethics - Alan Rossiter	
1:30-3:10 pm	Distillation and Separation Tony Cai & Babak Rafi	Advances in Digitalization, Part 2: AI Jim Brigman & Mark Darby
3:10-3:30 pm	Refreshments & Networking Break	
3:30-5:00 pm	Refinery Technology & Operations Kirtan Trivedi	Chemical Plant Technology & Operations Sanjeev Kapur & Le Wang
5:00-6:15 pm	Reception / Student Poster Session Jaci Conrad	
6:15-9:00 pm	STS-AIChE Monthly Dinner Meeting (Ticketed Event)	

16th STS-AIChE Southwest Process Technology Conference

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Program Overview Day 2

Time	Tuesday September 23	
8:00-9:00 am	Keynote 2: Dan Coombs, Board Chairman for PureCycle Technologies Inc.; formerly EVP for LyondellBasell. The Future of Chemical Engineering	
	Track 1	Track 2
9:15-10:45 am	Catalysis & Reaction Engineering Swapnil Sharma & Oxford Peng	Renewable and Sustainable Technology 1 Gus Georgeton & Dhaval Bhandari
10:45-11:05 am	Refreshments & Networking Break	
11:05 am - 12:05 pm	Efficient Water Use Gary Gildert & Somnath Basu	Renewable and Sustainable Technology 2 Emmanuel Dada & Gus Georgeton
12:05-1:20 pm	Lunch Break	
1:20-2:50 pm	Leadership & Management Forum Kenneth Kusima	Innovations in Process Technology Jayce Mathews & Sribala Gorugantu
2:50-3:10 pm	Refreshments & Networking Break	
3:10-4:40 pm	Project Development Kirtan Trivedi & Ram Kamisetty	Process Control and Reliability Doug White & Mark Darby

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Scan for Detailed Program and SPTC Orientation (“Preconference Information”)

https://onedrive.live.com/?id=42DF020CFF9B3475%21s20dbd6dd7df344db88bffc5de827fd4d&cid=42DF020CFF9B3475&redeem=aHR0cHM6Ly8xZHJ2Lm1zL2YvYy80MmRmMDIwY2ZmOWIzNDc1L0V0M1cyeUR6ZmR0RWlMXzhYZWduX1UwQlJTMXpmMHIxUDEzSG1UUWJta2p6UlE%5FZT1VeGNKOGo

16th STS-AIChE Southwest Process Technology Conference

Sept 22-23, 2025, University of Houston

PDH Certificates Available

- Monday Keynote
- Monday Early Morning Sessions
- Monday Late Morning Sessions
- Engineering Ethics Session
- Monday Early Afternoon Sessions
- Monday Late Afternoon Sessions
- STS Dinner Meeting
- Tuesday Keynote
- Tuesday Early Morning Sessions
- Tuesday Late Morning Sessions
- Tuesday Early Afternoon Sessions
- Tuesday Late Afternoon Sessions

QR Codes Available at End of Each Session

16th STS-AIChE Southwest Process Technology Conference

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Keynote Speaker 1: Dean Foreman, Chief Economist of the Texas Oil and Gas Association.
Global Economics and Energy Outlook – Q3 2025.

TXOGA

QUARTERLY ENERGY ECONOMICS OUTLOOK

R. Dean Foreman, Ph.D.

Third Quarter 2025 Outlook

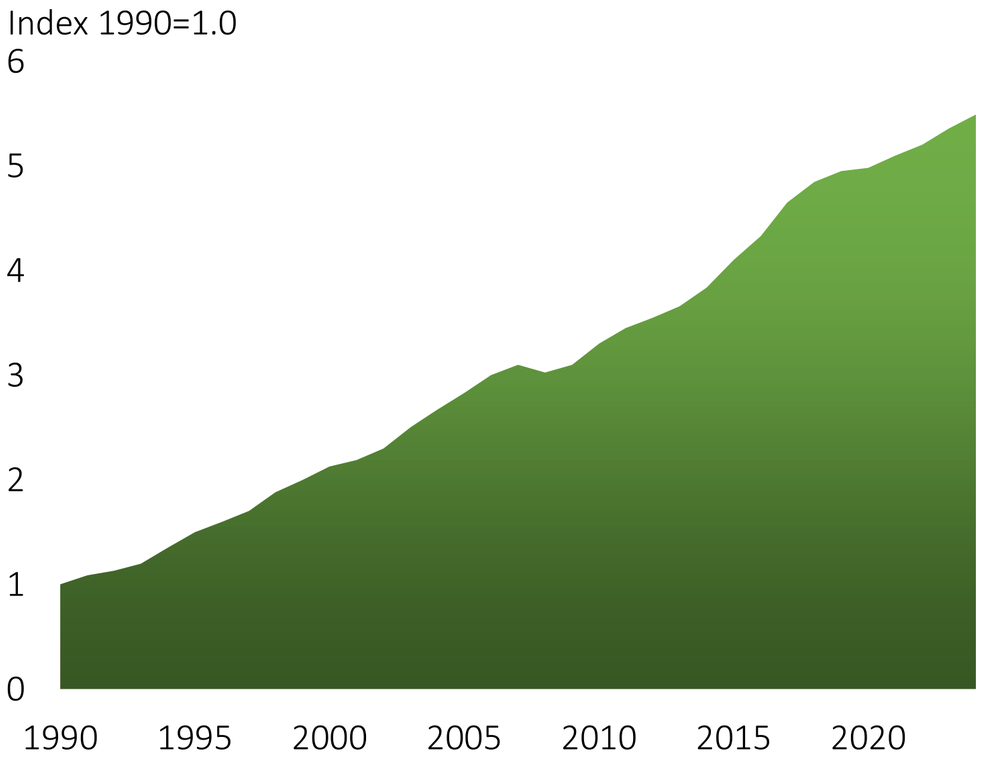
American Institute of Chemical Engineers

September 22, 2025

How chemistry products drive global demand: Plastics, materials, and energy

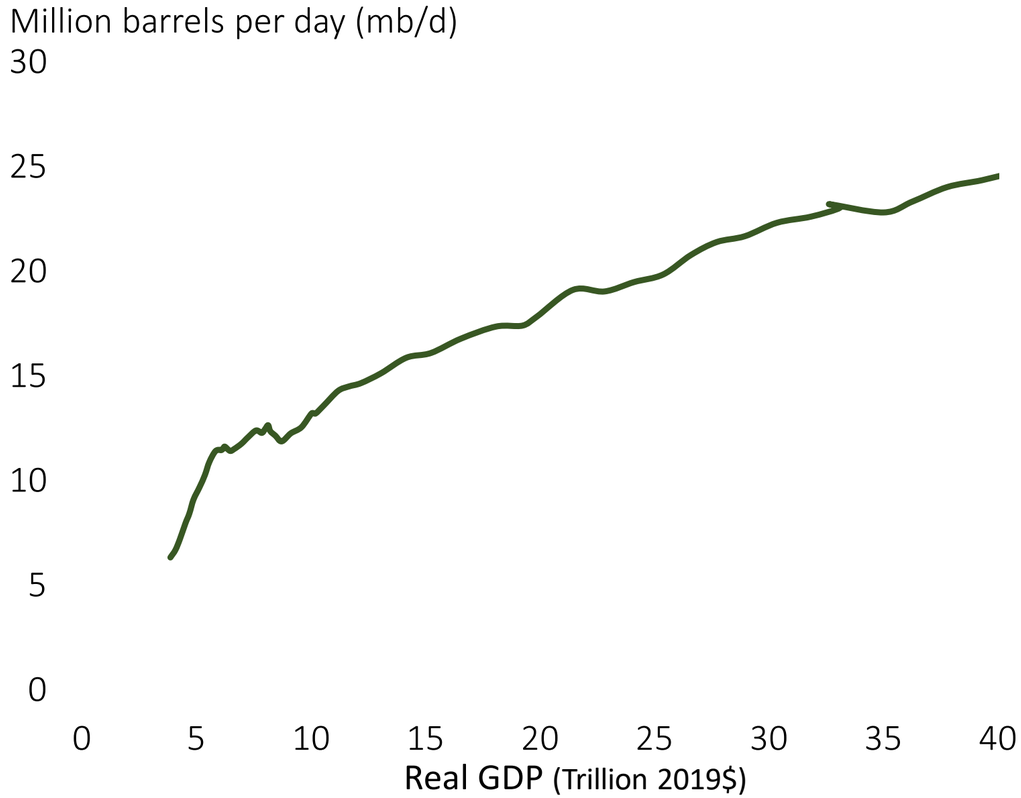
- Global plastics demand has more than quintupled since 1990, averaging over 5.3% growth annually
- Even at slower future growth (<2%/yr), plastics remain a leading driver of oil demand — more than aviation or shipping combined
- Chemical engineers connect molecules to markets — designing processes that balance consumer demand, energy, cost, and sustainability

Global plastics demand, 2000-2024



sources: International Energy Agency (2018); ExxonMobil Global Outlook (2024)

Non-OECD materials and industry-related oil demand versus GDP, 1970-2025*



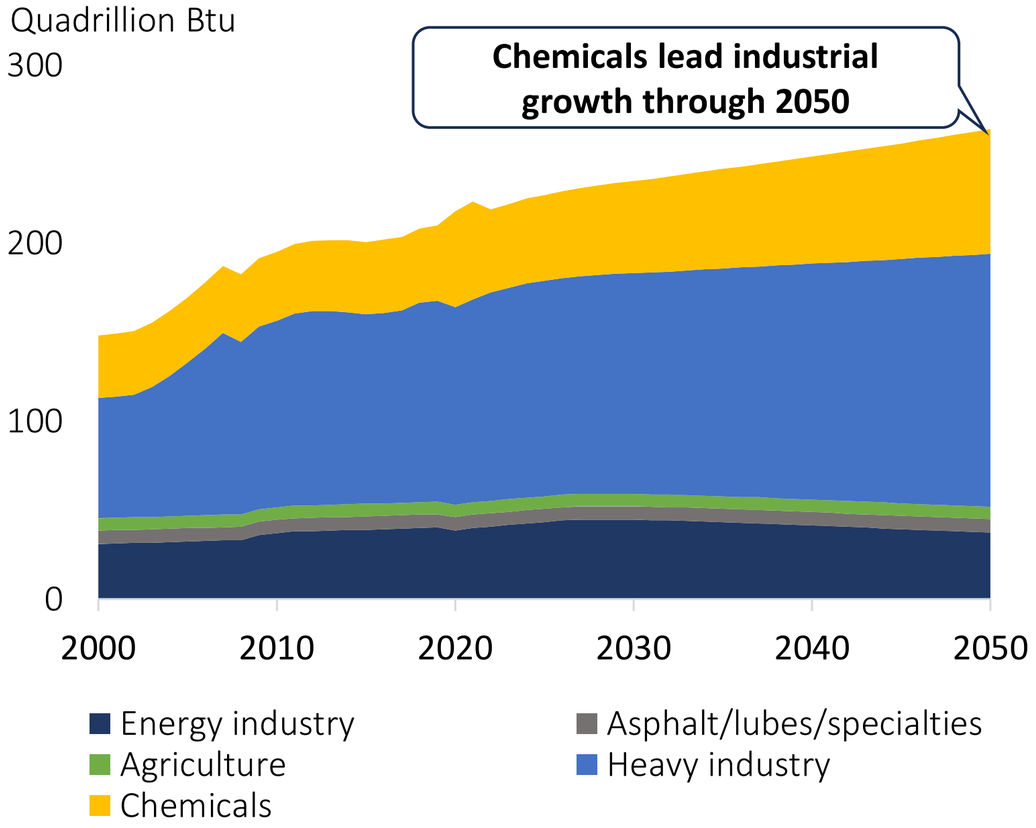
*Market exchange rate basis. sources: U.S. Energy Information Admin.; International Energy Agency; Intl. Monetary Fund; TXOGA analysis

Chemicals lead industrial energy demand growth — Powered by oil and natural gas

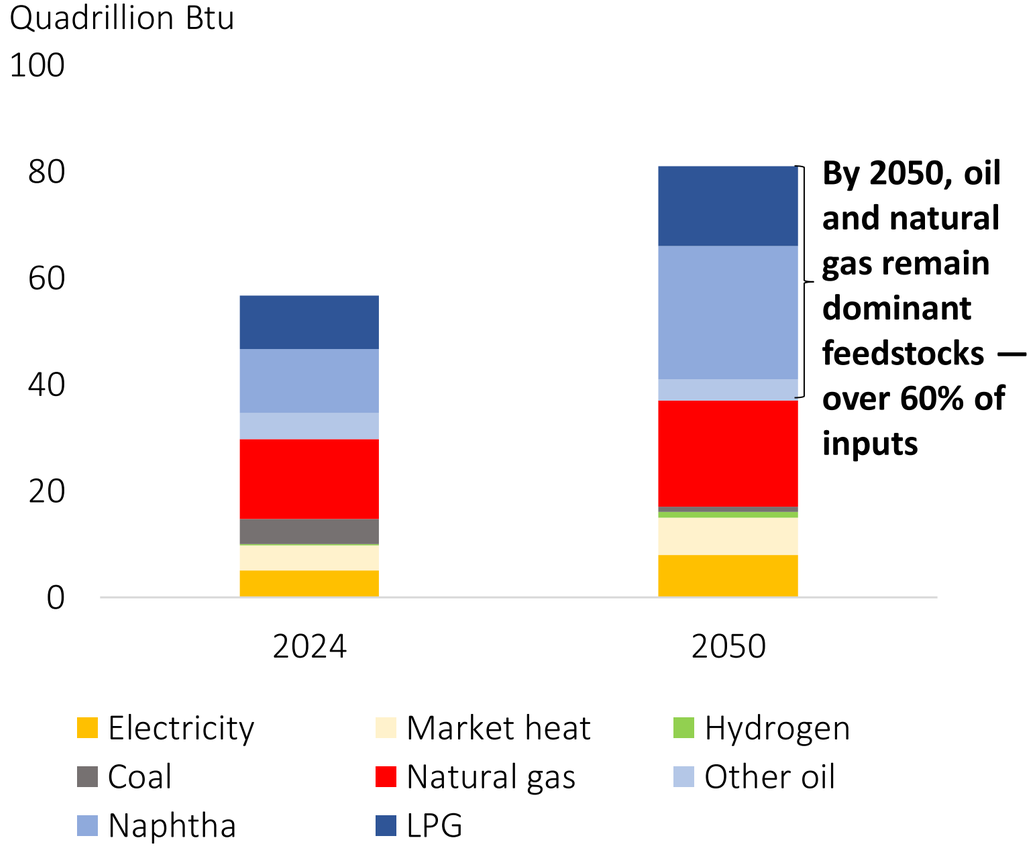
TXOGA QUARTERLY ENERGY ECONOMICS OUTLOOK

- Global industrial energy demand is projected to grow ~20% by 2050, led by chemicals and feedstock needs in developing economies
- Oil and natural gas remain the foundation of chemical production — critical for feedstocks and energy inputs
- **For chemical engineers, these trends mean sustained opportunities** in process design, feedstock optimization, and energy efficiency — linking industrial demand growth to oil and gas markets

Global industrial energy demand



Global chemicals production relies on oil and natural gas

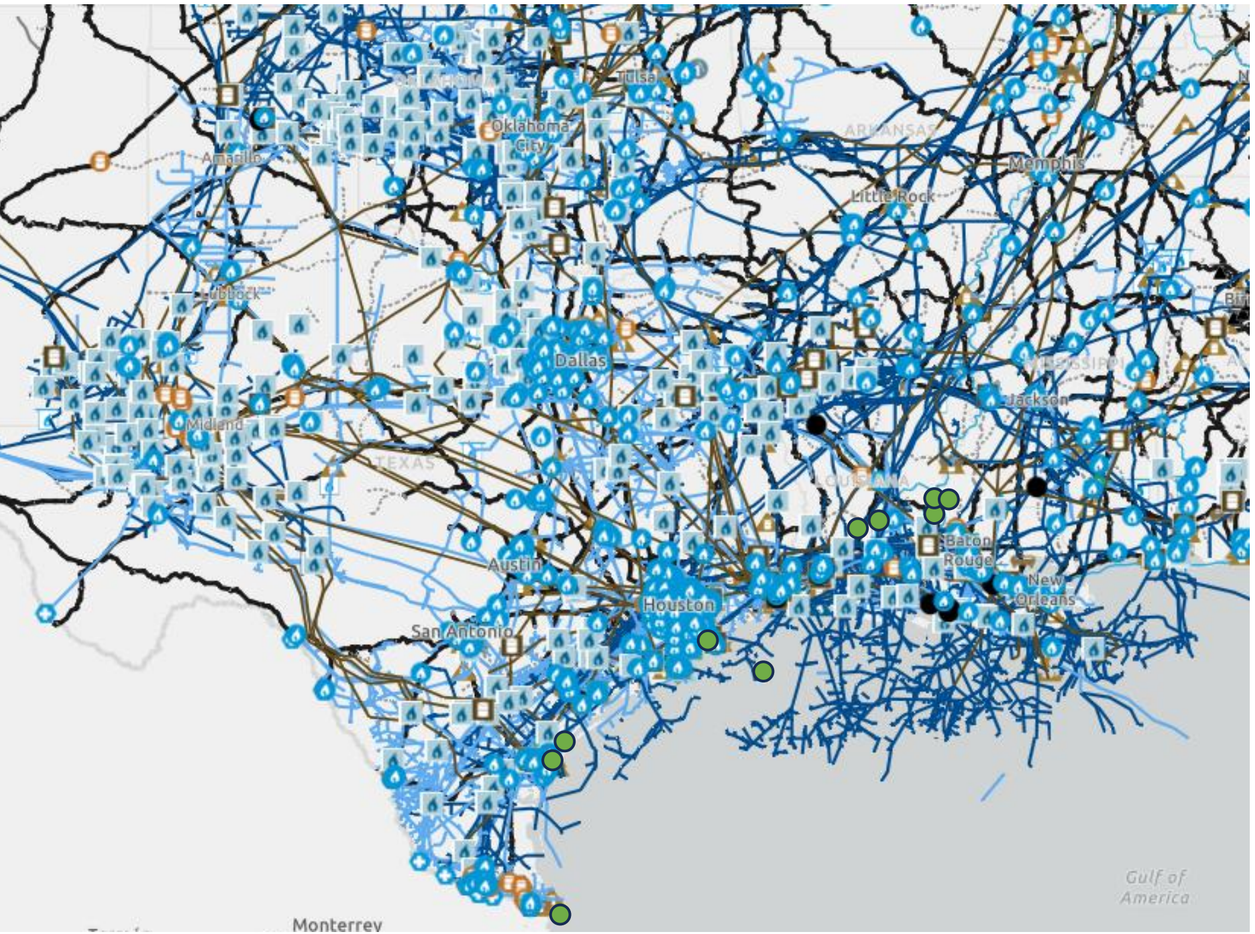


sources: International Energy Agency (2018); ExxonMobil Global Outlook (2024)

TXOGA QUARTERLY ENERGY ECONOMICS OUTLOOK

Texas and the U.S. Gulf Coast: Anchoring U.S. energy and petrochemical leadership

- **Texas leads U.S. energy production:** July 2025 estimates — **5.8 mb/d crude oil, 34.9 bcf/d marketed natural gas,** and **4.1 mb/d NGLs**
- **Through the first seven months of 2025:** Texas produced **43% of U.S. crude oil** and **30% of marketed natural gas**



- Nation-leading infrastructure across the value chain — from pipelines to processing and exports
- Natural gas pipeline expansions exceeding **45 bcf/d**, with **22 bcf/d** under construction (EIA)
- Texas hosts **100+ chemical plants**, producing **>70% of U.S. ethylene capacity**
- Texas exports **$230+ billion in oil and natural gas** annually, plus **$100+ billion in petrochemicals**
- **Chemical engineers drive innovation** in process design, efficiency, and emissions reduction — sustaining Texas' global competitiveness

Texas chemical engineers are central to global competitiveness — connecting molecules to markets

TXOGA QUARTERLY ENERGY ECONOMICS OUTLOOK

Key Points – Q3 2025

Global, U.S., and Texas Economies

- International Monetary Fund (IMF) lifts 2025 global GDP forecast to 2.6% on stronger trade and financial conditions; risks from fiscal deficits, geopolitics, and trade policy persist
- Dollar weakness continues to support oil prices
- U.S. household debt at record $18.4T; rising delinquencies—especially student loans—could weigh on growth
- ADS Index signals stalled U.S. GDP growth in Q3

Global Oil Market

- Energy Information Administration (EIA) projects record oil demand through 2026; 2025 forecast +0.2 mb/d, 2026 +0.3 mb/d
- Non-OPEC supply growth led by U.S. expected to exceed demand, pressuring prices lower in EIA's view
- U.S. crude stocks remain historically low despite SPR replenishment
- Futures prices near historical mean-reversion threshold, with more upside than downside potential

Natural Gas Markets

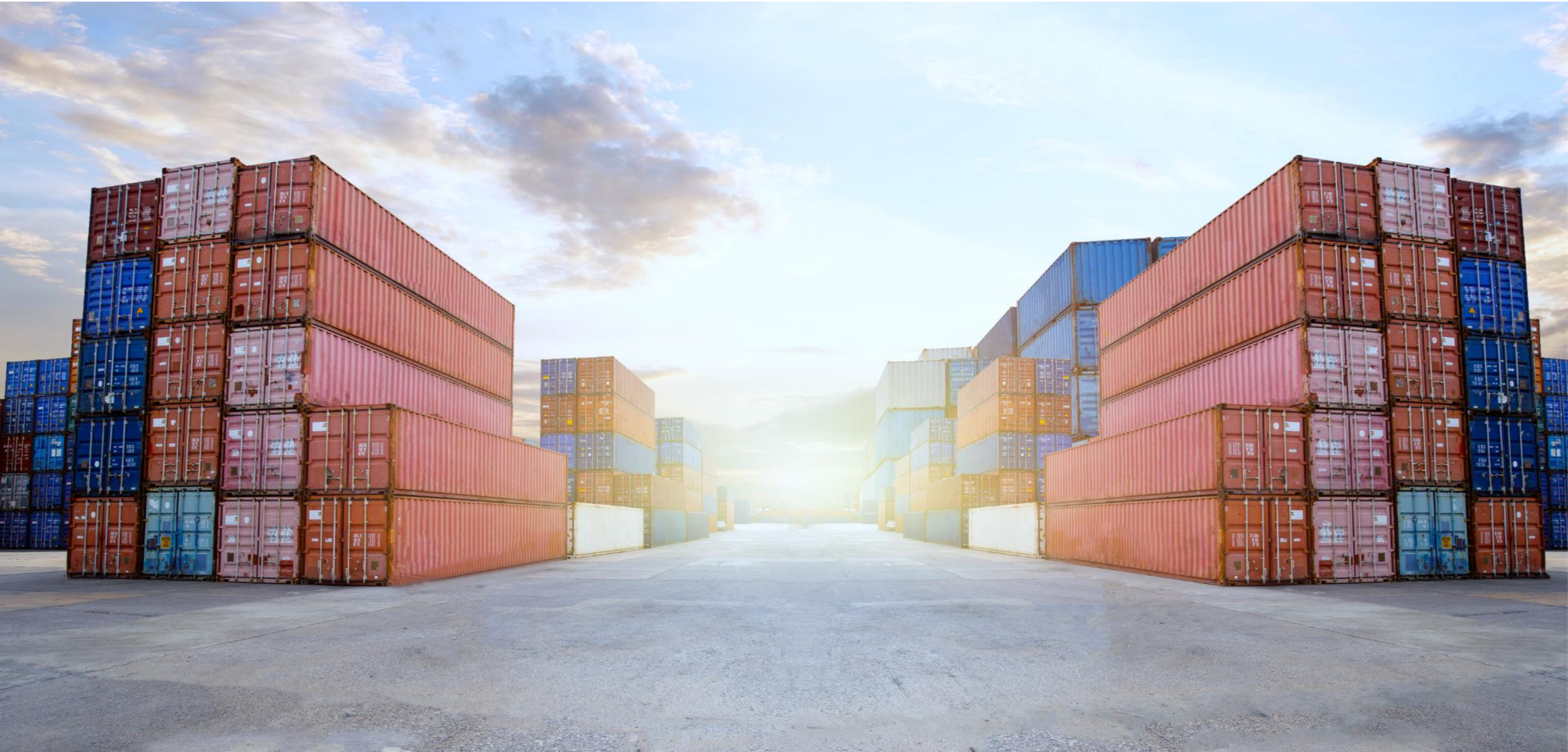
- Record 2025 demand; ~75% of 2025–2026 growth from emerging markets, especially Asia
- North America to supply ~85% of 2025 LNG growth, led by Gulf Coast projects
- U.S. gas output and exports to hit records per EIA; Texas leads with major LNG capacity additions
- Working gas storage in top 25% of 5-year range; contango signals higher price expectations

Productivity, Jobs, and Wages

- Rig productivity up in Permian (+3.9% y/y) and Eagle Ford (+2.5%), flat in Haynesville due to dry gas price cycles
- Texas oil & gas output rising despite fewer rigs; DUC completions limited in Permian

TXOGA QUARTERLY ENERGY ECONOMICS OUTLOOK

Global, U.S. and Texas Economies



Front-loading has shaped economic activity in 2025

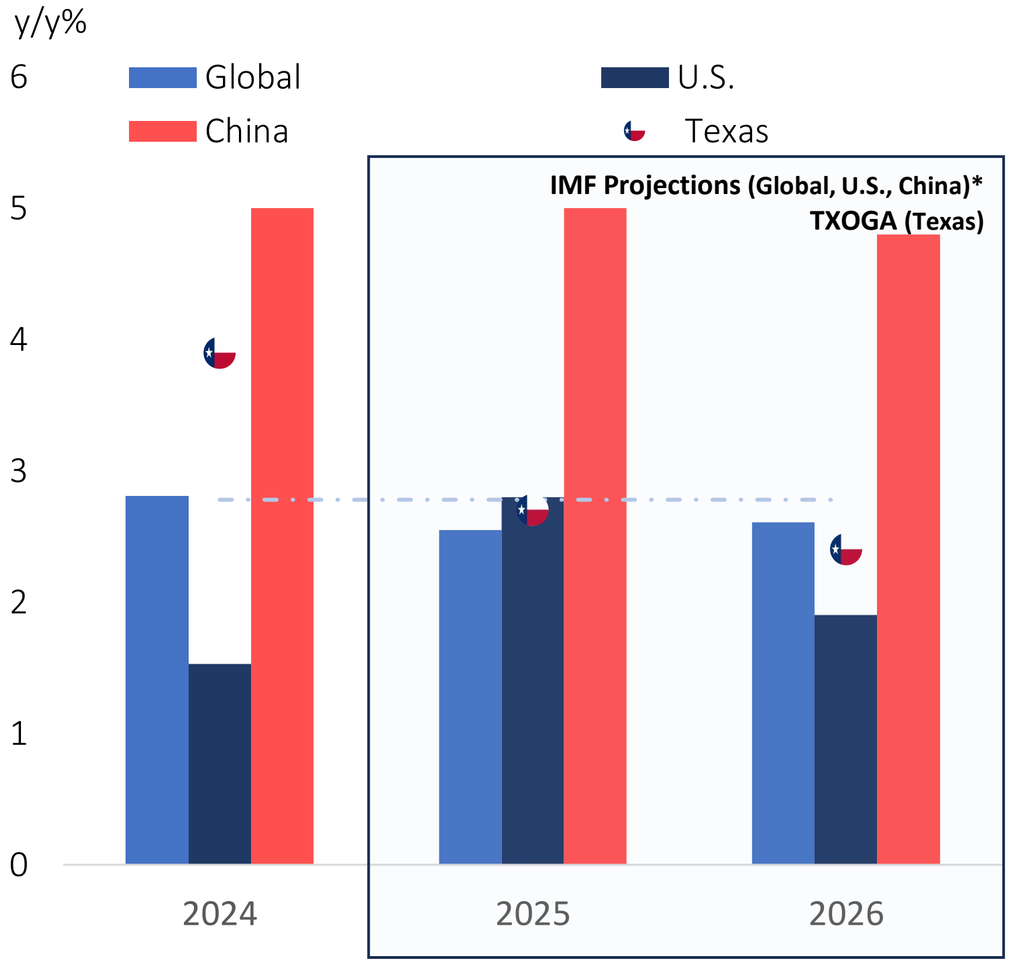
- At the end of July, the International Monetary Fund (IMF) **raised** its global real GDP growth projections **0.2%** to **2.6%** in 2025 and **2.5%** 2026, due to advanced international trade, lower-than-expected trade policy shocks (vs. April), and improvement in global financial conditions

- Growth this year remains uneven: **5.0%** in China, **1.9%** in the U.S., and **0.7%** in Japan. While a global recession is not the base case, a downturn could shave 0.5–1.0 percentage points from annual growth

- **Trade policy** appears to be the source of greatest uncertainty in the IMF's view, seconded by **geopolitical risks**—including ongoing Russia-related sanctions, Middle East uncertainties, and trade policy volatility with China — that have eased but continue to add complexity to the outlook for economics and energy markets

- **Fiscal vulnerabilities** – given a number of economies, including Brazil, France, and the United States, are projected to run large fiscal deficits – amid a backdrop of historically high levels of public debt could raise term premia, tighten global financial conditions, and increase volatility, especially if they interact with concerns about geoeconomic fragmentation and the future of the international monetary system centered on the dollar

Real GDP growth outlook*



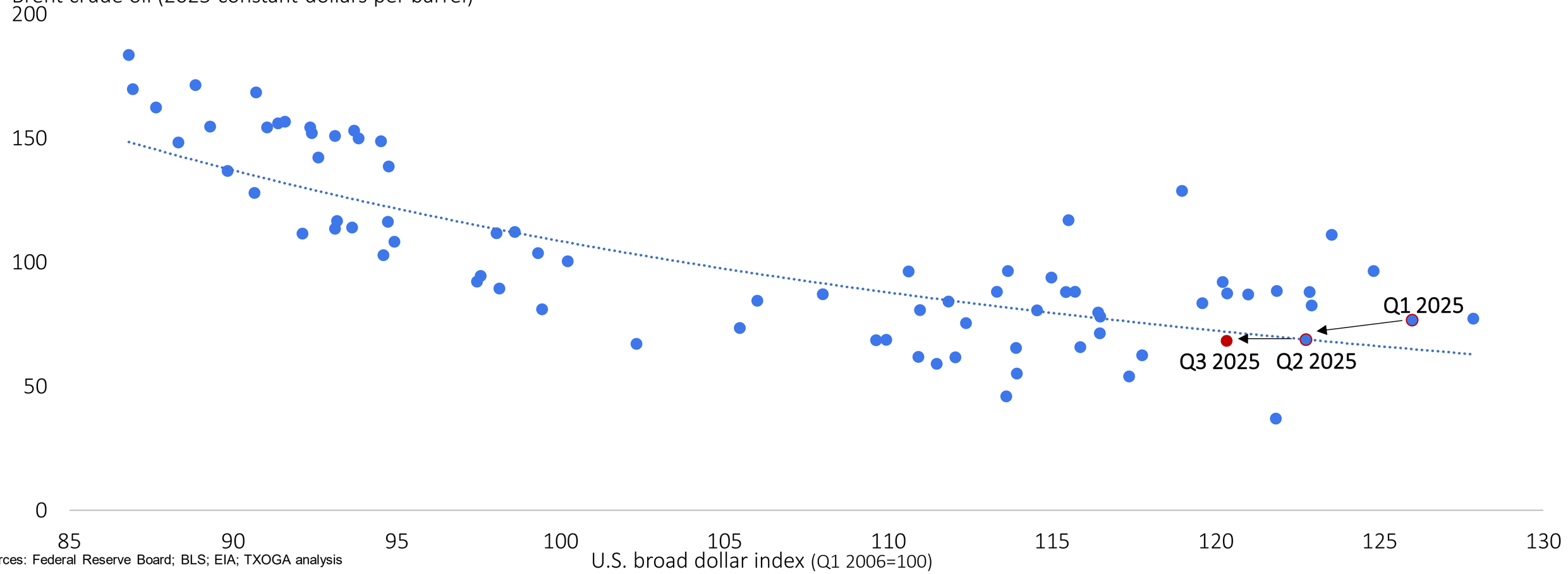
* Based on real GDP (2019 constant dollars) for 205 countries weighted on a market exchange rate basis
sources: International Monetary Fund; World Bank; TXOGA analysis

TXOGA QUARTERLY ENERGY ECONOMICS OUTLOOK

The historical relationship between U.S. dollar depreciation and upward oil price pressure has remained strong

- While many factors influence global oil prices, the U.S. dollar's strength has historically shown an inverse relationship with oil prices, given its central role in oil pricing, global commodity trading, trade balances, and monetary policy transmission
- A weaker dollar typically supports higher oil prices by reducing the cost of crude for foreign buyers and boosting demand—an established non-linear relationship that strengthened in Q2 2025

U.S. broad dollar index and Brent crude oil prices, Q1 2006-April 2025



sources: Federal Reserve Board; BLS; EIA; TXOGA analysis

TXOGA QUARTERLY ENERGY ECONOMICS OUTLOOK

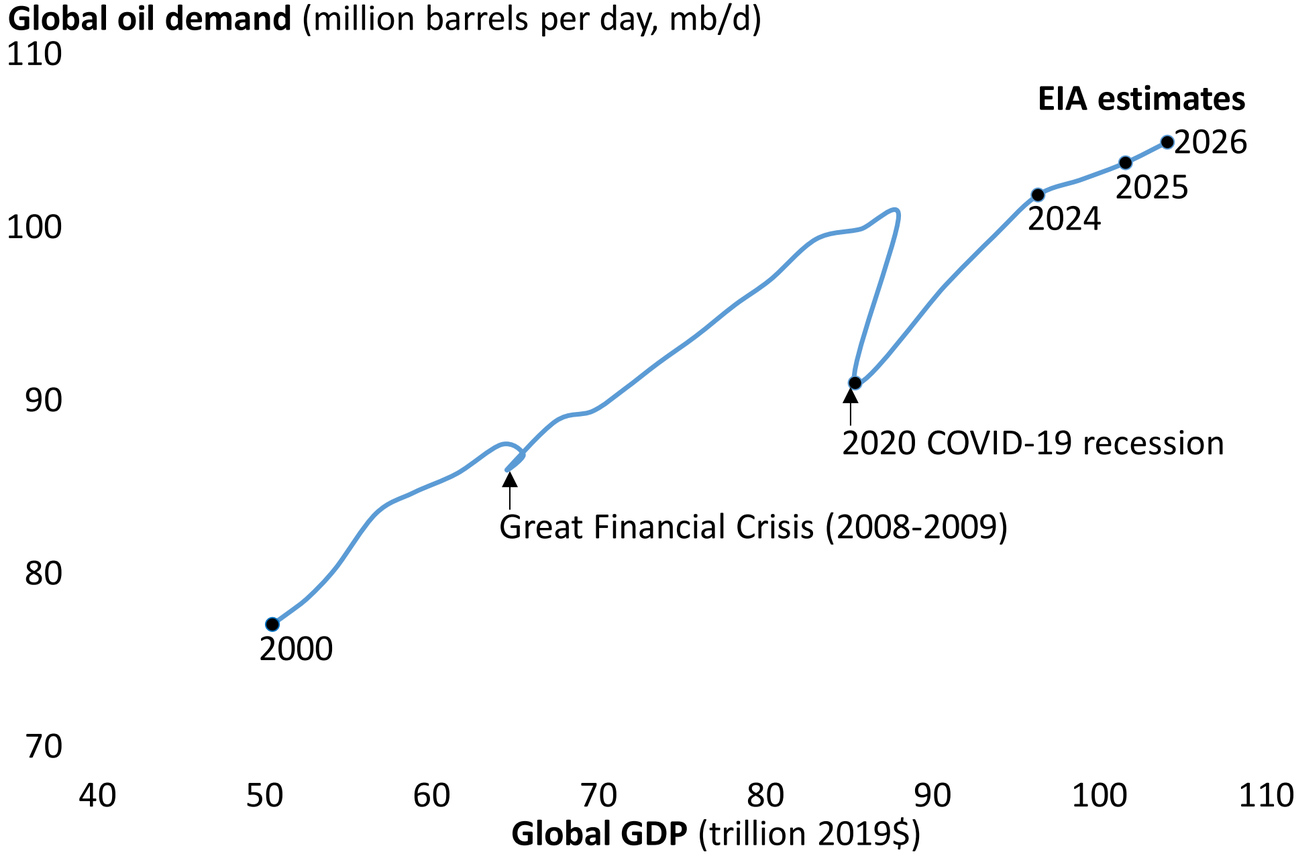
Oil Markets

EIA raises global oil demand forecast on stronger-than-expected economic performance

TXOGA QUARTERLY ENERGY ECONOMICS OUTLOOK

- In its August update, EIA raised its global oil demand forecast, now expecting a third consecutive record: 102.7 mb/d in 2024, 103.7 mb/d in 2025 (+0.2 mb/d vs. prior forecast), and 104.9 mb/d in 2026 (+0.3 mb/d)
- U.S. refined product demand rose 0.8% y/y through August 8, led by diesel and jet fuel. Gulf Coast crack spreads ($26.33 per barrel in mid-August) remain strong but are sensitive to export trends and global refining capacity shifts

Global oil demand vs. GDP



sources: U.S. Energy Information Administration (August 2025); TXOGA analysis

Global oil demand headlines

Why the oil market is tight despite big OPEC+ output hikes
Reuters, August 8, 2025

OPEC+ gets lucky as it brings back oil output amid uncertainty
Reuters, August 5, 2025

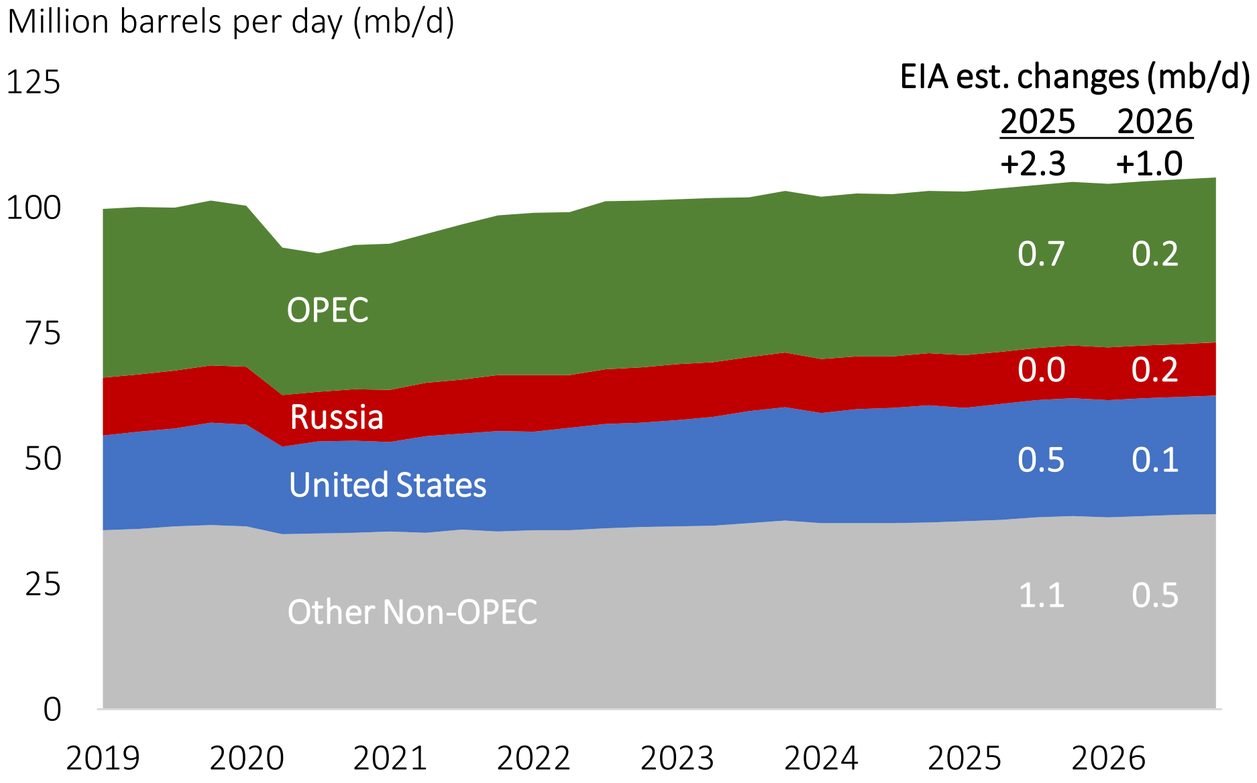
What if India and China stop buying Russian oil?
DW, August 7, 2025

Top Petrochemical Segments Driving Global Market Growth
imarc group, August 11, 2025

EIA and IEA project global oil supply growth to exceed demand growth

- EIA's August outlook raises 2025 supply growth to 2.3 mb/d, more than double its projected 1.0 mb/d demand growth — suggesting potential oversupply risks
- The U.S. and other non-OPEC producers account for 1.6 mb/d of the 2.3 mb/d global supply growth forecast for 2025, assuming only partial compliance with OPEC+ output targets

Oil production by region



Global oil supply headlines

OPEC lifts 2026 oil demand view and trims supply growth from rivals
Reuters, August 12, 2025

Global Oil Markets Face Record Supply Glut Next Year, IEA Says
Bloomberg, August 13, 2025

Russia to Spread Out Oil Cuts to Compensate OPEC+ Through 2025
August 13, 2025

Weaker Chinese Demand for Saudi Oil Signals Shift to Urals, EA Says
Rigzone, August 13, 2025

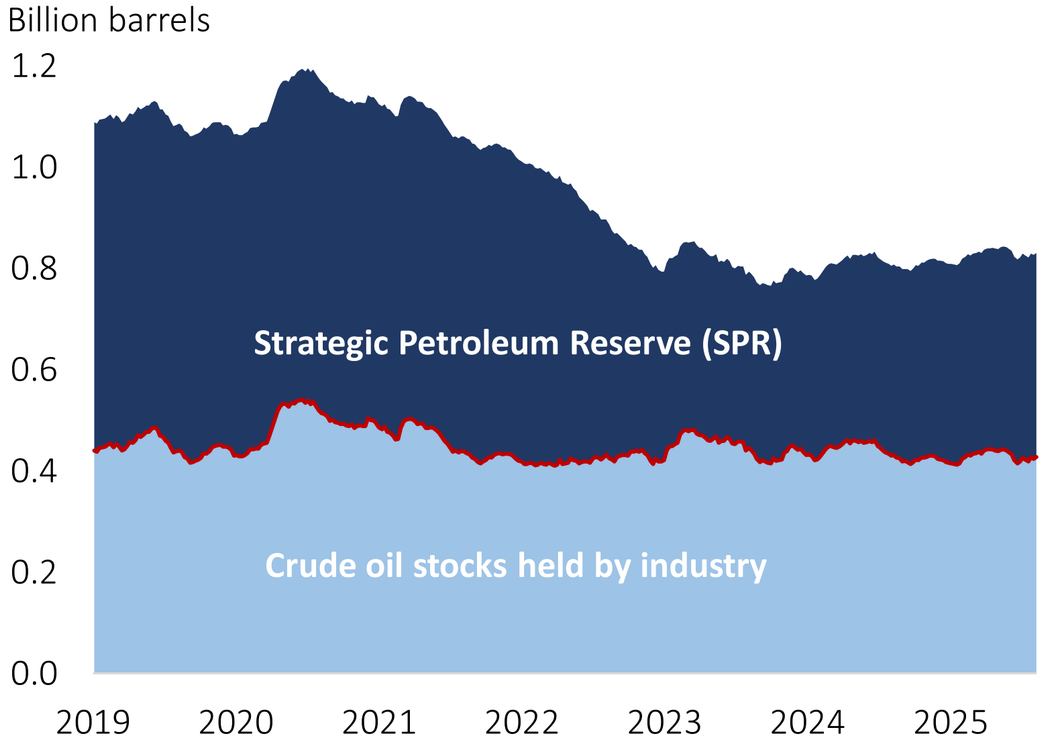
sources: U.S. Energy Information Administration (August 2025); TXOGA analysis

U.S. crude oil stocks remain low despite SPR replenishment

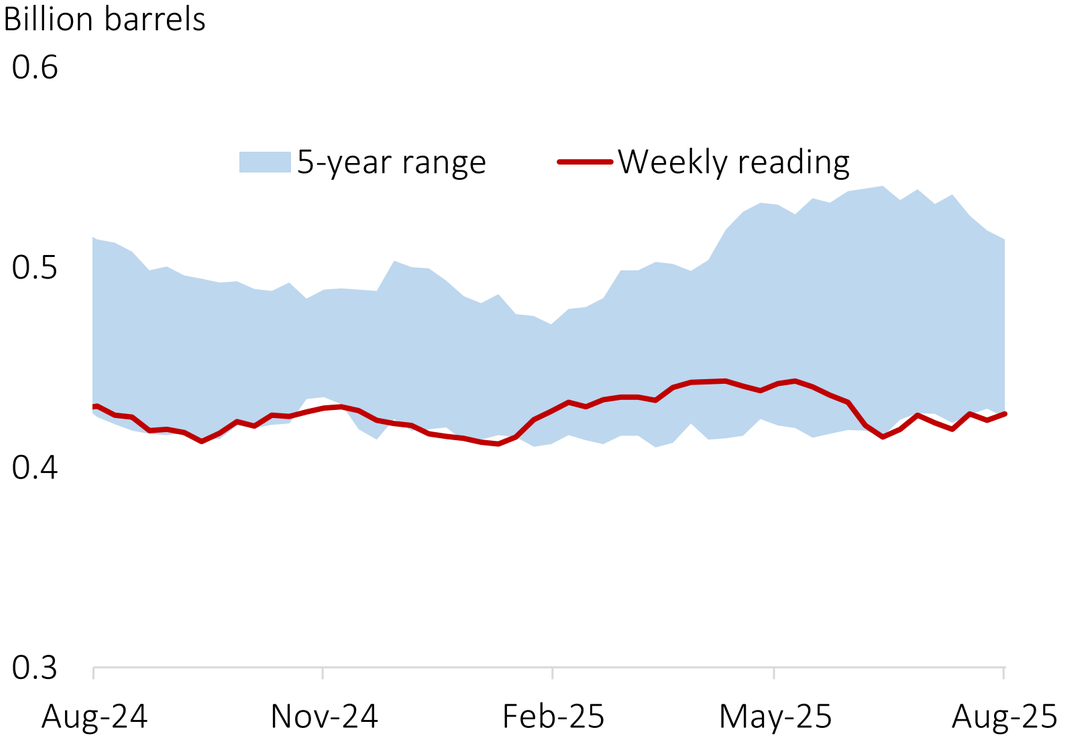
- Strategic Petroleum Reserve (SPR) volumes rose 26.7 million barrels (+7.1% y/y) as of August 8, 2025
- Industry-held crude stocks are 0.9% lower than a year ago (427 million barrels) and remain near the bottom of their 5-year range

U.S. crude oil stocks by type

Strategic Petroleum Reserve (SPR) vs. industry-held stocks



Industry crude oil stocks vs. 5-year range

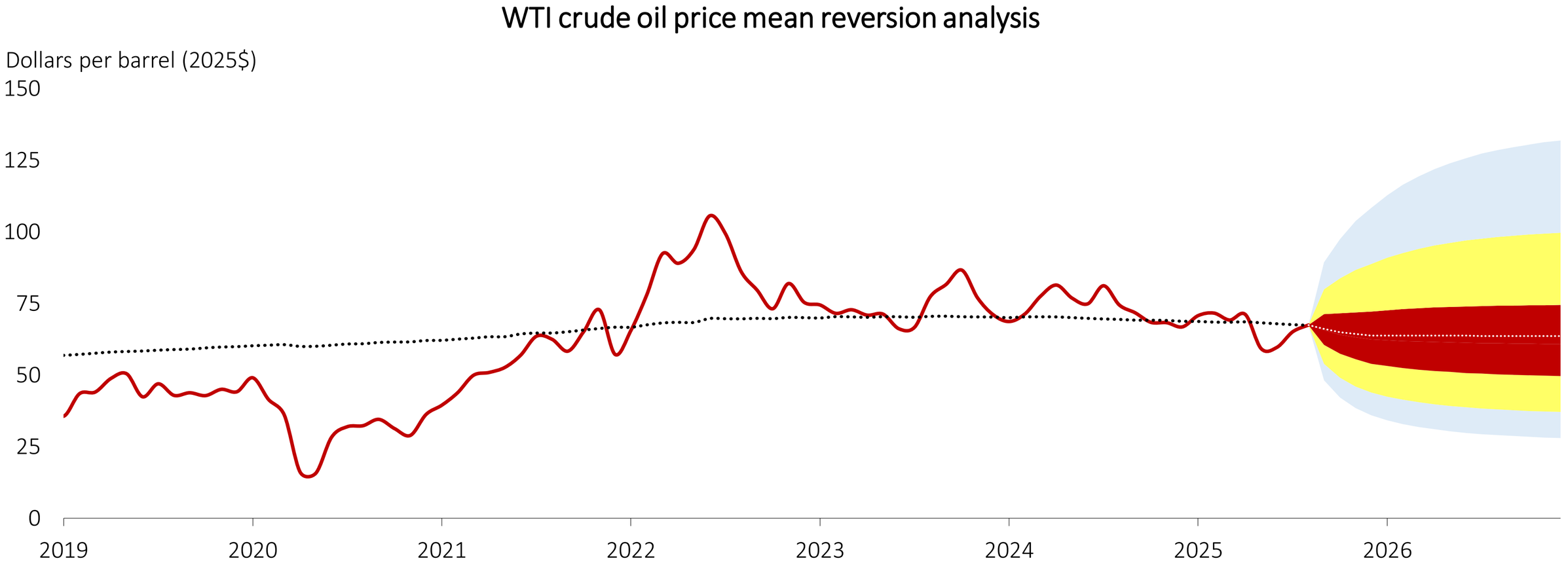


sources: U.S. Energy Information Administration (EIA); TXOGA analysis

TXOGA QUARTERLY ENERGY ECONOMICS OUTLOOK

Crude oil futures prices are currently in line with their historical mean-reversion threshold

- Futures curve remains in backwardation, with prices near historical mean reversion levels
- Confidence intervals based on past prices show the potential for greater upside than downside



sources: CME Group; Bureau of Labor Statistics; TXOGA analysis

TXOGA QUARTERLY ENERGY ECONOMICS OUTLOOK

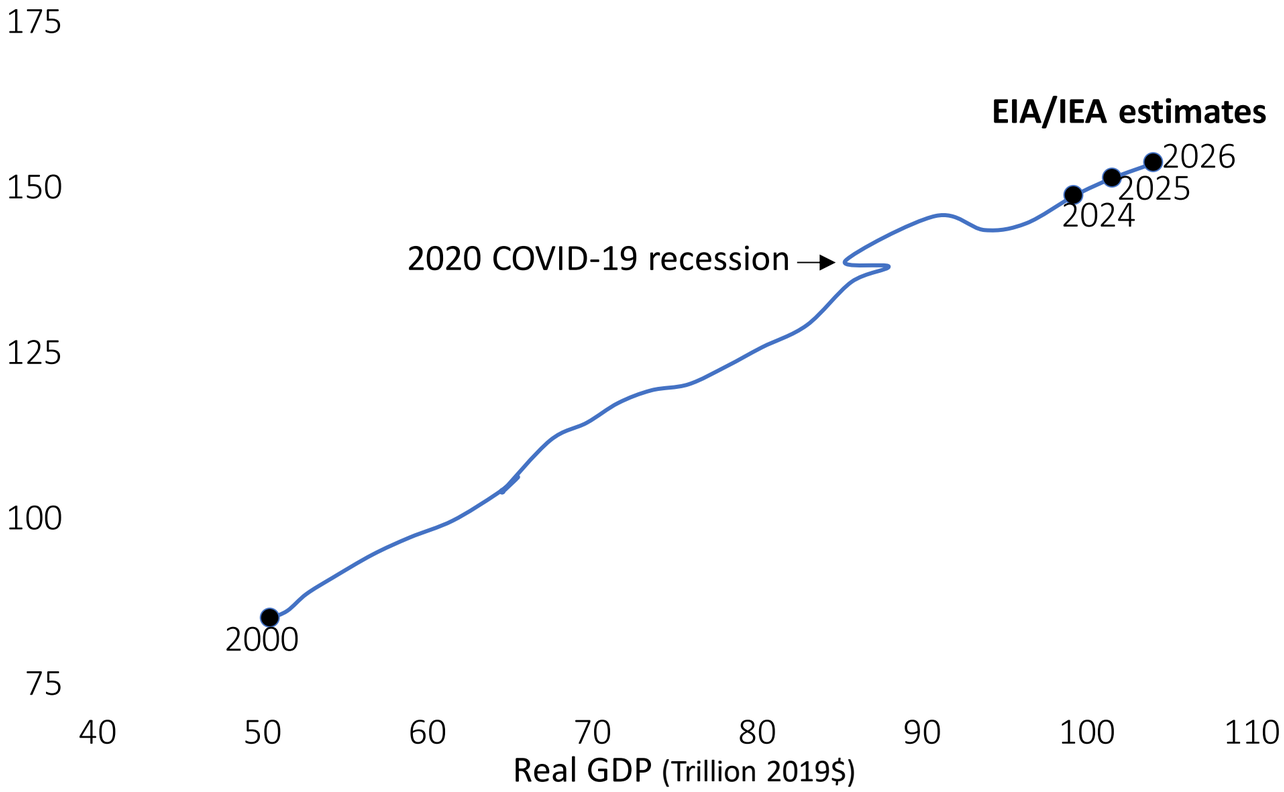
Natural Gas Markets

Record 2025 global gas demand projected, driven largely by emerging markets

TXOGA QUARTERLY ENERGY ECONOMICS OUTLOOK

- Global natural gas demand reached a record 148.7 trillion cubic feet in 2024 and is projected to rise by 1.8% in 2025 and 1.5% in 2026
- About 75% of global natural gas demand growth through 2026 is expected from emerging markets and developing economies. Continued LNG infrastructure expansion will be critical but remains subject to trade policy developments
- Much of this growth hinges on Asia, where a rebound in Chinese LNG demand and broader regional import capacity expansions are expected to drive the recovery

Global natural gas demand vs. GDP*



*Market exchange rate basis sources: EIA; IEA; IMF; TXOGA analysis

Global natural gas headlines

Sluggish Chinese LNG Demand Could Set Stage for Strong Rebound in 2026
Natural Gas Intelligence, Aug. 1, 2025

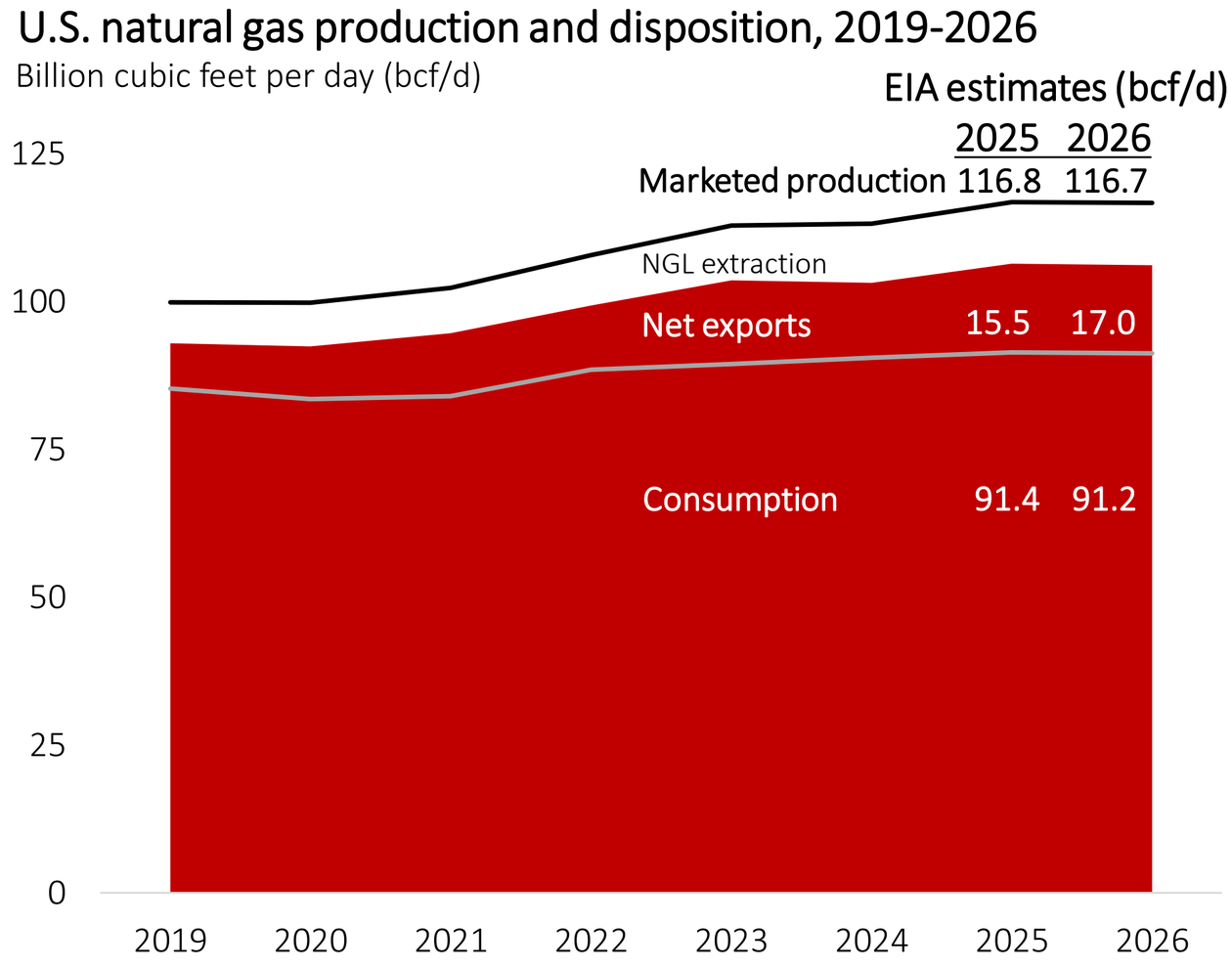
U.S. LNG Export Boom at Risk from Proposed Shipbuilding Rules
Global Trade Magazine, Aug. 11, 2025

Global natural gas demand growth set to accelerate in 2026 as more LNG supply comes to market
IEA, July 22, 2025

Structural risks in long-term LNG contracts indexed to Brent and Henry Hub | Daily Sabah
Daily Sabah, Aug. 12, 2025

U.S. natural gas production and exports set to reach consecutive records

- EIA now projects U.S. marketed natural gas production at 116.8 bcf/d in 2025 (+1.5% from prior estimate) and 117.0 bcf/d in 2026 (–0.2%)
- New LNG export capacity is expected to lift U.S. natural gas net exports to record highs — up 24% y/y to 15.5 bcf/d in 2025 and 9.7% y/y to 17.0 bcf/d in 2026
- Through July, Texas accounted for 34.3 bcf/d — 29.5% of total U.S. marketed natural gas production
- Texas' production leadership and expanding LNG export capacity — with 1.5 bcf/d being commissioned and 6.5 bcf/d under construction, per EIA — position the Lone Star State as a primary driver of U.S. LNG export growth to meet rising global demand

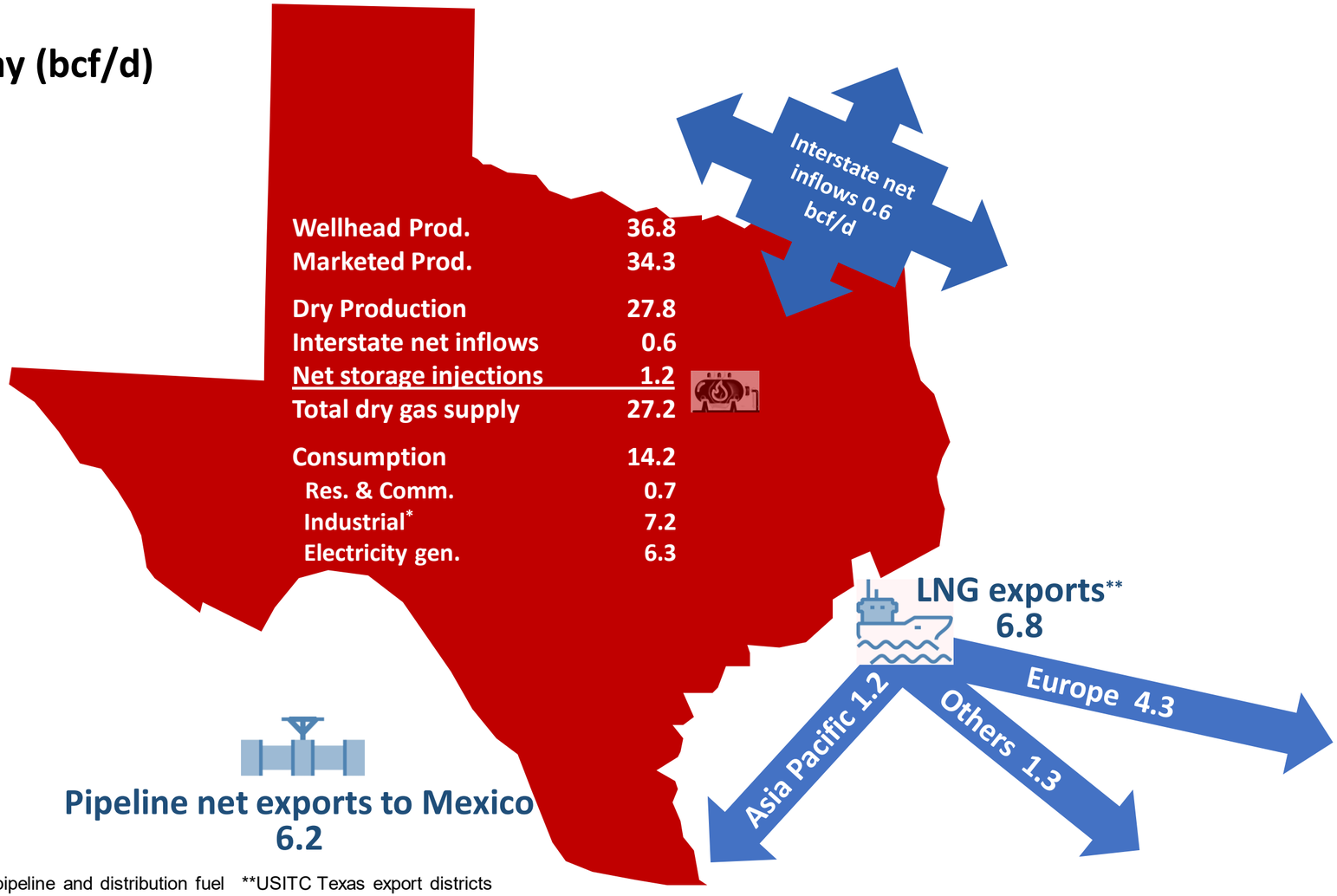


sources: U.S. Energy Information Administration (August 2025); TXOGA analysis

Texas' natural gas flows in June 2025

- According to TXOGA estimates, Texas produced 27.8 billion cubic feet per day (bcf/d) of dry natural gas
- Texas consumers used 14.2 bcf/d, with industrial demand and electricity generation the primary drivers
- Natural gas exports totaled 13.0 bcf/d, including 6.8 bcf/d as LNG, 63% of which was shipped to Europe, and 6.2 bcf/d via pipeline to Mexico

Billion cubic feet per day (bcf/d)



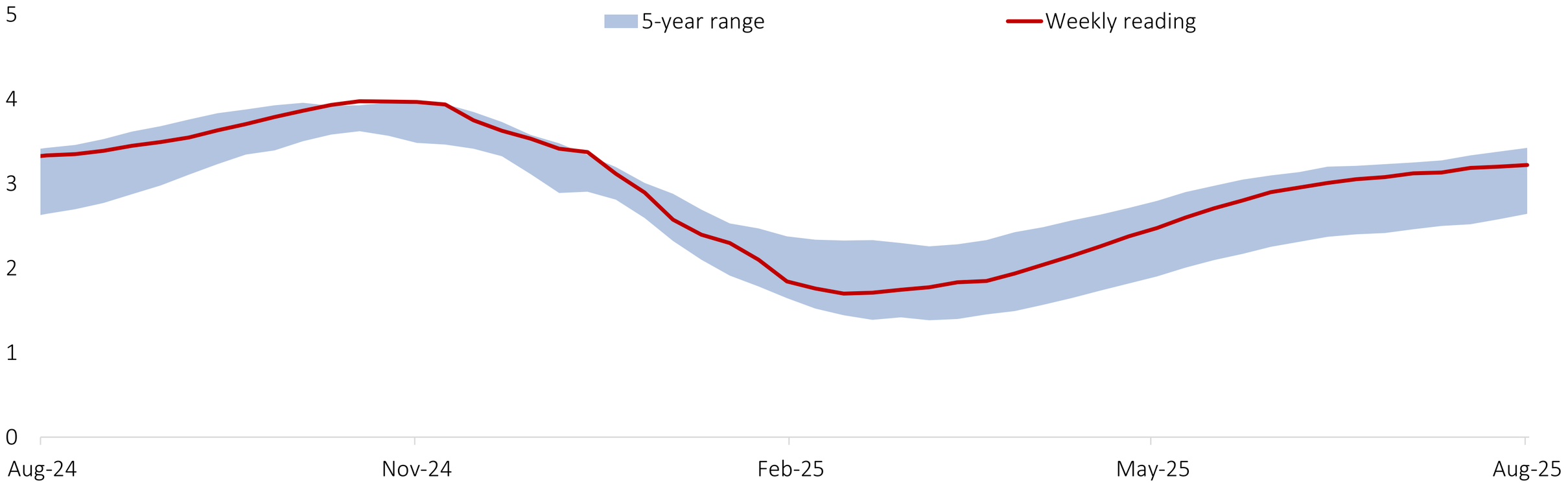
*Includes industrial end-use consumption plus lease, plant, pipeline and distribution fuel **USITC Texas export districts
sources: U.S. Energy Info. Admin.; U.S. International Trade Commission (USITC); TXOGA analysis

U.S. gas storage remains robust, in the top 25% of the 5-year range

- Strong working gas storage levels reflect economic and seasonal factors that are pressuring prices lower but do not eliminate winter volatility risks
- Underground storage rose 0.6% w/w to 3.22 tcf as of August 22, placing inventories in the top 25% of the 5-year range

U.S. weekly working gas storage

Trillion cubic feet (tcf)



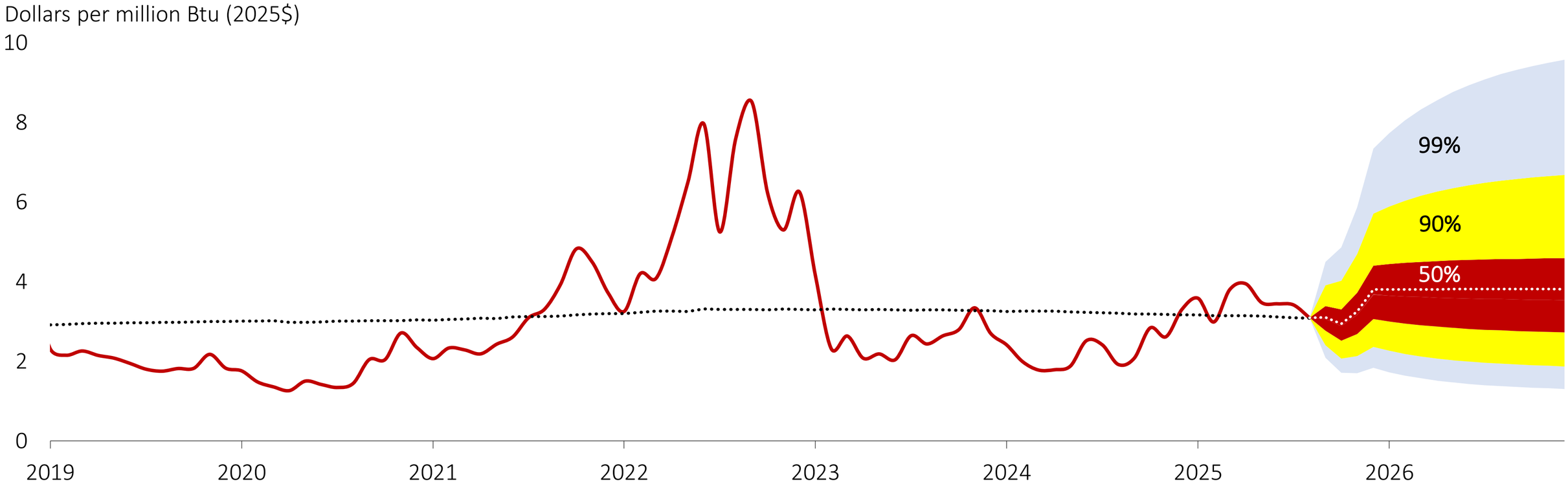
sources: U.S. Energy Information Administration; TXOGA analysis

Contango reflects market expectations for higher natural gas prices ahead

TXOGA QUARTERLY ENERGY ECONOMICS OUTLOOK

- Near-term futures recently rose to align with their historical mean reversion threshold
- Futures remain in contango — spot prices below futures prices — with historical confidence intervals suggesting greater upside potential than downside risk
- Summer inventories remained in the top 20% of the five-year range, but weather variability and LNG supply changes could still drive price swings

Natural gas price mean reversion and historically-based ranges*



*Colored bands represent estimated confidence intervals based on historical volatility
sources: U.S. Energy Info. Admin.; CME Group; Bureau of Labor Statistics; TXOGA analysis

TXOGA QUARTERLY ENERGY ECONOMICS OUTLOOK

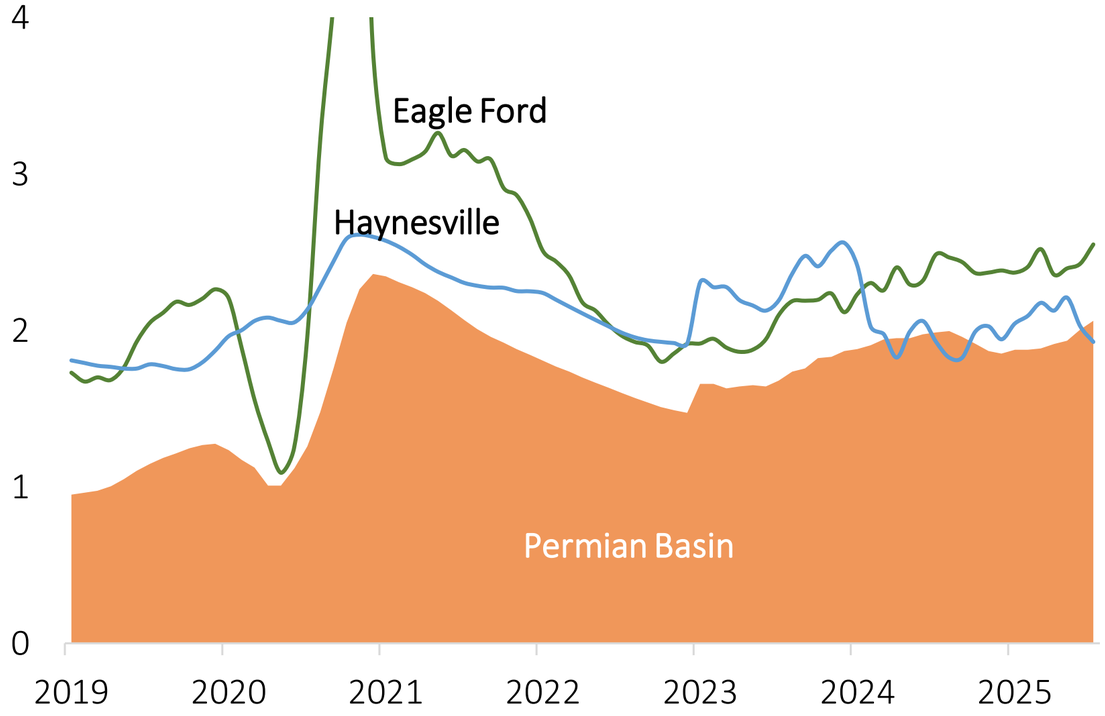
Productivity, Jobs, and Wages

Texas rig productivity rises in Permian and Eagle Ford, flat in Haynesville

- In July 2025, EIA estimates show rig productivity up 3.9% y/y in the Permian Basin and 2.5% y/y in the Eagle Ford, while holding steady in the Haynesville
- Productivity in the Permian and Eagle Ford has been relatively stable in recent years, whereas the Haynesville — a predominantly dry natural gas play — has seen larger swings due to historically low domestic gas prices and the resulting cyclical, selective drilling activity

Texas rig productivity by basin — new monthly production per rig

Thousand barrels of oil-equivalent per day (kb/doe)



source: Energy Information Administration (EIA); TXOGA analysis

Oil & Gas technology headlines

Sliding US rig count outpaces efficiency gains, threatening onshore oil output
Reuters, Aug. 5, 2025

Tight oil production in Permian drives growth in onshore U.S. Lower 48 states production
EIA, June 2, 2025

Is overlooked gas the new investor darling over oil thanks to AI?
Fortune, Aug. 9, 2025

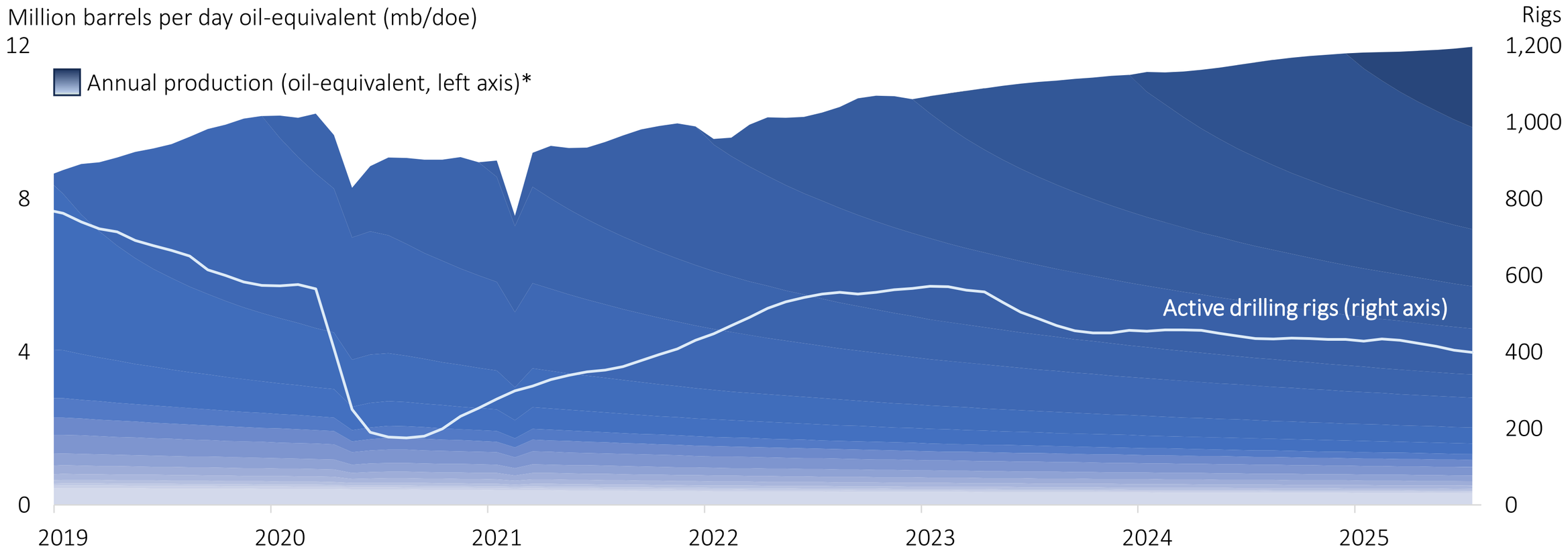
How AI drove data optimization for oil and gas capital projects
EY, Aug. 13, 2025

TXOGA QUARTERLY ENERGY ECONOMICS OUTLOOK

Texas oil and gas output rises despite fewer rigs, underscoring efficiency gains

- In July 2025, EIA estimates show oil and gas production up across Texas shale basins: Permian (+3.7% y/y), Eagle Ford (+1.4% y/y), and Haynesville (+11.1% y/y)
- Year-to-date through July, drilled but uncompleted wells (DUCs) have contributed to only 1% of Permian completions, compared with 9.8% in the Eagle Ford and 10.9% in the Haynesville, per EIA

Texas shale production and rig activity



*Crude oil, condensates, natural gas gross withdrawals from Texas' Anadarko, Eagle Ford, Haynesville, and Permian Basin production regions.
sources: Energy Information Administration; TXOGA analysis

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16th STS-AIChE Southwest Process Technology Conference

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