GULF COAST 2025 ENERGY OUTLOOK

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Release date: Fall 2024

LSU | Center for Energy Studies

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Acknowledgments

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1. Introduction

The annual GCEO is designed to provide stakeholders with an overview of the current trends and outlook for the region's energy industry and its various sectors. The GCEO is a work product of Louisiana State University's Center for Energy Studies (CES). All CES work products are supported by the Center's general state appropriation, underscoring Louisiana's commitment to independent energy-related research. CES is also grateful for its sustaining members seeking to assist LSU in disseminating timely information and analysis impacting the region's economy, environment, and citizenry. It would be difficult to produce the GCEO without both sources of support.

Unless otherwise stated, the "Gulf Coast" region specifically refers to the states of Texas, Louisiana, Mississippi, and Alabama. In some instances, the U.S. Department of Energy (DOE) reporting conventions require references to data collected at the Petroleum Administration for Defense District 3 (PADD 3) level, which includes Arkansas and New Mexico in addition to the four Gulf Coast states. Employment forecasts focus on Louisiana and Texas. Where not specified, the forecast horizon extends to the end of 2027, or approximately three years.

The remainder of this introduction will highlight the big-picture considerations and assumptions made in subsequent analysis and forecasting.

1.1 Presidential Election

Perhaps unsurprisingly, the November 5, 2024, presidential election has been front and center of GCEO discussions. This is especially true given how federal actions have materially impacted the energy sector over the past several years. Several overarching questions have come up regarding the implications of the national election, which are synthesized here. While GCEO does not provide answers to these questions, GCEO modeling is predicated on the assumption that the current policy regime will persist over the near-term even with a change in administration. Please keep in mind that the bulk of the GCEO modeling and writing occurred before the result of the 2024 presidential election was known.

Question 1: Will the federal programs and subsidies under the Infrastructure Investment and Jobs Act (IIJA) and Inflation Reduction Act (IRA) continue after the election? Regardless of the results of the election, GCEO considers a scenario where IIJA and IRA subsidies continue. This includes subsidies generally in the form of tax credits and grants for renewables (such as wind and solar); carbon capture, utilization and storage; hydrogen production and use; electric vehicles; and others. CES faculty have participated in discussions with stakeholders this past year, and this question has been raised in the context of several of these technologies. Specifically, state legislators and communities have expressed concerns that if a given project were to be built and a subsidy were subsequently removed or materially modified, this might leave that community with infrastructure that is uneconomical and thus may be "stranded." While it is certainly rational to consider decommissioning plans in the up-front buildout of any energy infrastructure, GCEO modeling scenarios are predicated on these programs and subsidies staying in place over the forecast horizon. To the extent that any specific subsidy materially changes, this could have implications for the outlook, especially capital spending on "transition" investments.

Question 2: Will a new administration impact international trade? A recurring theme of prior year GCEOs has been international trade risk to the Gulf Coast energy industry and, in particular, to continued industrial expansions. Trade relations with China continue to be a source of risk for capital investment in the Gulf Coast region. Increasingly, the region is transforming itself into an exporter of energy and chemical products (derived from hydrocarbons) and has increasingly become a transfer point or hub for global energy transactions. The U.S., for instance, was exporting about five million barrels of petroleum products per day pre-COVID-19, most of which were leaving a Gulf Coast port. So far in 2024, the U.S. has exported on average over 6.5 million barrels per day. Liquified Natural Gas (LNG) exports over this time have also increased from 6.5 bcf/d in 2020 to 11.6 bcf/d thus far in 2024.

During President Trump's first term as president, one of his significant actions (as was promised on the campaign trail) was the implementation of various tariffs on products manufactured in China. In response, in 2019 China increased its tariff on natural gas coming from the U.S. in the form of LNG from 10 percent to 25 percent.[1] The 2020 GCEO reported that at least one announced LNG project had been postponed. President Trump and President Xi Jinping signed Phase 1 of a trade deal that went into effect in February 2021.[2] The 91-page agreement included six chapters covering topics such as intellectual property, technology transfer, trade in food and agricultural products, financial services, macroeconomic policies, and expanding trade.

Due to the end of the Trump presidency, Phase II of this trade deal was never signed. As a candidate for president at time of writing, President Trump has publicly stated that China has failed to honor the trade deal, and that if re-elected, he would raise the matter with Chinese President Xi Jingping.[3] Although the rhetoric of President Biden was subdued relative to President Trump, some have commented that Biden's trade policies towards China have not been substantially different. In fact, China filed a complaint with the World Trade Organization (WTO) over IRA tax credits.[4]

GCEO considers a scenario where the current trade policies with China persist. If another "trade war" were to begin, this could negatively impact the industrial outlook, in particular.

Question 3: Would a Harris Administration have doubled down on supply restrictive policies? Another consistent theme of prior year GCEOs has been policies to reduce fossil fuel supply. Economists might refer to these as "supply restrictive policies." Examples include the temporary discontinuation of offshore leasing pursuant to President Biden's Executive Order in January 2021,[5] as well as a pause on pending decisions on exports of LNG to countries that do not have a free trade agreement (FTA) with the U.S.[6] Conversations with industry representatives suggest that the day-to-day regulatory environment under the Biden administration was more impactful than these larger policies for slowing investments and projects. GCEO modeling does not explicitly consider supply restrictive policies or further permitting delays, but if planned projects are unable to move forward or are slowed due to future federal actions, this may significantly impact the outlook. With the result of the presidential election, the implementation of supply restrictive policies seems unlikely.

[1]Reuters. Factbox: How China tariffs on U.S. commodities, energy stand after Phase 1 trade deal. January 15, 2020.
[2]Economic And Trade Agreement Between The Government Of The United States Of America And The Government Of The People's Republic Of China. Signed January 15, 2020.
[3]Various media reports.
[4]World Trade Organization. Dispute Settlement DS623: United States – Certain Tax Credits Under the Inflation Reduction Act. Panel requested July 26, 2024.
[5]Executive Order on Tackling the Climate Crisis at Home and Abroad. January 27, 2021.
[6]FACT SHEET: Biden-Harris Administration Announces Temporary Pause on Pending Approvals for Liquified Natural Gas Exports.

The results of the national elections occurred concurrently with the finalizing of the GCEO. As in all prior GCEOs, the current policy regime is assumed to continue until the policy changes. For example, this year's GCEO modeling assumes IIJA and IRA tax credits and subsidies will continue with the new administration. Further, GCEO assumes no major change to international trade policies.

1.2 Economic Outlook

During an election year, it can sometimes seem difficult to receive high quality and non-politically motivated information on the state of the economy.

During the drafting of last year's GCEO, many national forecasters were anticipating a recession beginning in 2023; however, a recession in the U.S. has not yet occurred. Since the pandemic-induced recession in the first quarter of 2020, the U.S. economy has continued to expand. Estimated U.S. employment in September 2024, the most recent month available, continued to show increases, and current employment levels are approximately three percent above the pre-pandemic peak achieved in February 2020. With the unemployment rate at less than four percent, the U.S. economy is at "full employment."

However, employment growth has been accompanied by inflation. Last year, GCEO discussed a "perfect storm" of at least three factors driving higher inflation: (1) an economy already operating at full employment; (2) high energy prices facilitated by industry-related challenges and geopolitical tensions; and (3) considerable federal fiscal stimulus driven in part by two major spending programs injecting funding into an already "hot" economy. The Federal Reserve responded by raising interest rates beginning in early 2022 aimed at reducing the rate of inflation. At time of writing, the Federal Funds rate is just under five percent, up from essentially zero percent in early 2022. Two years ago, we reported the most worrying economic data was that U.S. wage growth was not keeping up with inflation, and thus real hourly earnings had decreased by approximately three percent in the year preceding the 2023 GCEO release.

This year, there is good news to report. Wages are now outpacing inflation, and employment is continuing to expand within the United States. While GCEO is not in the business of forecasting recessions, our models implicitly consider a scenario where real wage growth and employment growth continue through the forecast horizon. Of course, a business cycle contraction would reduce the demand for products, and thus a recession will impact the outlook if it occurs in the forecast horizon.

Internationally, economic growth has persisted, with the U.S., China, and India all continuing to experience real GDP growth per the most recent data available at time of writing.[7] As will be discussed further throughout, we continue to see announcements for export-oriented projects, as economic opportunities for the U.S. energy sector continue to be driven by international demand.

This year's GCEO modeling assumes that wage growth will continue to outpace inflation, and demand for energy globally will continue to rise. GCEO, much like years past, anticipates that long-run energy demand growth will lead to increased U.S. energy exports, especially to the growing developing world.

[7]Notably, the 27 countries within the European Union (in sum) and Japan, the other largest global economies, have experienced relatively flat real GDP over the past decade.

1.3 Decarbonization Efforts: Balancing Cost Competitiveness and Emissions Reductions

Decarbonization, particularly industrial decarbonization, continues to be a major consideration of industrial activities in the Gulf Coast. In August 2022, the U.S. passed its most comprehensive climate legislation to date: the Inflation Reduction Act (IRA). During his second term, then-Louisiana Governor John Bel Edwards committed Louisiana to GHG emissions reduction targets of 25 to 28 percent by 2025 and complete carbon neutrality by 2050. Under Louisiana's new governor, Jeff Landry, who took office in January 2024 agencies such as Louisiana Economic Development (LED) and the Department of Energy & Natural Resources (DENR) have stressed the importance of striking balance of continuing to produce carbon emissions intensive products that Louisiana sells globally, while acknowledging that customers and investors from all around the world are increasingly expecting emissions to be documented and low relative to competitors.

We are still in the beginning phases of the IRA's 10 years of investment in technologies and projects that will enable emissions reductions that was signed into law in August of 2022. The legislation has three core components: (1) corporate tax increases, (2) health care and (3) energy and climate. Notably, energy and climate account for 84 percent of the bill's projected cost. In last year's GCEO, we highlighted some of the specific provisions included in the bill.

Three facts continue to be relevant to the Gulf Coast's decarbonization strategy when speaking with companies. These will be shown throughout this document in more detail but are highlighted here. First, overall U.S. energy demand has been relatively flat over the past decade, and this trend is expected to continue.[i] On one hand, economic growth increases energy demand. On the other, increased efficiency reduces energy demand. In net, for the U.S. these two effects are approximately in balance. Second, U.S. oil production has increased by 73 percent,[ii] natural gas production by 54 percent,[iii] and renewable energy production by 28 percent over the same 10 years.[iv] Thus, domestic energy *demand* has been relatively flat while energy *supply* has increased. Third, this increase in energy production has been facilitated by exports of hydrocarbon-based products, including liquid fuels, chemical products, fertilizers and polymers.

Increasingly, companies are indicating that their customers from around the world are asking them to (1) credibly document lifecycle greenhouse gas (GHG) emissions and (2) reduce those emissions. Investors, again from all over the world, are increasingly considering carbon intensity when deciding where to deploy capital. To attract capital and sustain demand, hydrocarbon-based manufacturers are balancing two objectives: First, companies must remain cost-competitive. If they invest too heavily in reducing GHG emissions, their products could become too expensive for the global market. But second, companies also seek competitive emissions profiles. If the manufacturing sector ignores this call to decarbonize and exclusively focuses on cost, the sector might also find itself at a competitive disadvantage in the future.

However, industrial decarbonization is slated to be expensive in many cases depending on the nature of a company's operations. Companies are therefore trying to utilize federal dollars through the IRA and IIJA to make upfront capital investments that can assist with reduced emissions in the future. Companies are asking questions such as: *How much can I reduce emissions with a given technology? Will the global market pay a premium for lower carbon intensity products in the future? What*

current subsidies are available through the IRA and how can they be best utilized for my specific circumstances and operations? GCEO views striking this balance as a challenge that creates both a significant opportunity and a significant risk to our regional economy in the long term.

> **Decarbonization will continue to challenge existing Gulf Coast energy manufacturing but will also create an opportunity for regional leadership in the development of the production capacity for liquid fuels, chemicals, plastics, fertilizers, and other products historically derived from fossil fuels with lower GHG emissions. Companies are actively considering the most efficient ways to achieve meaningful GHG emissions reductions given the subsidies that are currently available under the IRA. Over the forecast horizon, the GCEO sees decarbonization creating considerable regional capital investment opportunities. Longer-term effects of decarbonization on the region will be determined by the cost to achieve emissions reductions alongside the global market's willingness to pay a premium for less emission intensive products.**

1.4 A New Era of Electric Demand Growth?

As mentioned in Section 1.3 above, GCEO projections are predicated on continued international demand growth, while total energy use in the U.S. continues to be relatively flat. Increasingly, there are discussions of significant demand growth emerging, with a focus on electricity. This section briefly describes GCEO's thoughts on whether domestic energy demand is projected to grow, both in total and in the form of electricity.

There are three commonly cited sources of potential electricity demand growth in the U.S.; (1) electric vehicles (EV), (2) heat pumps, and (3) data centers. EV and heat pump sales have both followed an increasing trend over the past decade and are clearly sources of incremental electricity demand. Data centers, especially with the advent of Artificial Intelligence (AI) being incorporated into common user applications, are also large electricity users. Over the last 12 to 18 months, new and expanded data centers have emerged as a significant source of electricity sales growth in some parts of the U.S.

To assess whether these three drivers change our long-standing projection of relatively flat total energy usage domestically, we consider three extreme hypotheticals to put these into perspective. Please note that these calculations are a thought exercise—not a projection of what will or even may occur in the future nor when. Results of this "back of envelope" style analysis are presented in Table 1.

Table 1: Theoretical potential impact on electricity and energy usage

Theoretical Potential Impact on Electricity and Energy Usage		
	% Δ in Electricity (TWh)	*% Δ in Energy (quads)*
Electric Vehicles	29.5%	-9.0%
Heat Pumps	11.2%	-4.0%
Data Centers	5.9%	0.9%

Note: These are meant to be illustrative only, not a projection of future changes.
Sources: EV scenario uses data from EIA, FHWA, and DoE. Heat pump scenario uses data from NREL's ResStock policy simulations Data center scenario uses data from EPRL.

First, we consider a scenario where every single light-duty vehicle in the U.S. is suddenly replaced by an EV. We estimate this would increase electricity usage by 1,267 TWh per year, or about 30 percent of U.S. electric sales. In Q2 2024, EVs made up about 1.3 percent of light duty vehicles on the road[v] and 7.3 percent of new car sales.[vi] If EV adoption accelerates, this will increase electricity demand. Interestingly, though, because EVs require fewer BTUs of energy per mile traveled due to inherent efficiency advantages, in a scenario where all light-duty vehicles in the U.S. are EVs total energy use would actually *decrease* by 8.5 quadrillion BTUs, or 9 percent of U.S. energy consumption. Thus, if light-duty transportation were to be fully electrified, this would *increase* electricity usage but *decrease* total energy use.[vii]

Second, we consider a scenario where every home in the U.S. suddenly begins using a heat pump (in lieu of using natural gas, propane, fuel oil, or other forms of electric heating). We estimate this would increase electricity usage by 475 TWh per year, or about 11.2 percent of U.S. electric sales. Similar to the EV hypothetical, in this scenario total BTUs would also *decrease* by 3.77 quadrillion BTUs, or 4 percent of U.S. energy consumption. Thus, if heating of residential buildings were 100 percent electrified through use of heat pumps, this would *increase* electricity usage but *decrease* total energy use.

Finally, we consider data centers. There is no comparable hypothetical for data center growth to the EV and heat pump examples, so we instead consider a recent report by the Electric Power Research Institute (EPRI) and choose the most aggressive scenario for growth of data centers in the U.S. EPRI's most aggressive scenario estimates that data center electricity consumption will grow by about 252 TWh by 2030, equivalent to 5.9 percent of U.S. electric sales in 2023.[ix] This would account for 0.9 percent of total BTUs used in the U.S.

The key theme is that each of these three drivers has the potential to increase the *share of energy coming from electricity* domestically, but they are unlikely in sum to materially increase the *total amount of energy used* domestically. Thus, GCEO continues to take the view that long-run energy demand growth will lead to increased U.S. energy exports, especially to the developing world, while domestic energy demand growth will remain relatively flat. Electricity, though, is likely to increase its

relative share of total energy usage in the U.S. as consumers and businesses adopt EVs and electrify heating, air conditioning and ventilation (HVAC) systems and other types of equipment and new, especially hyperscale data centers are constructed.

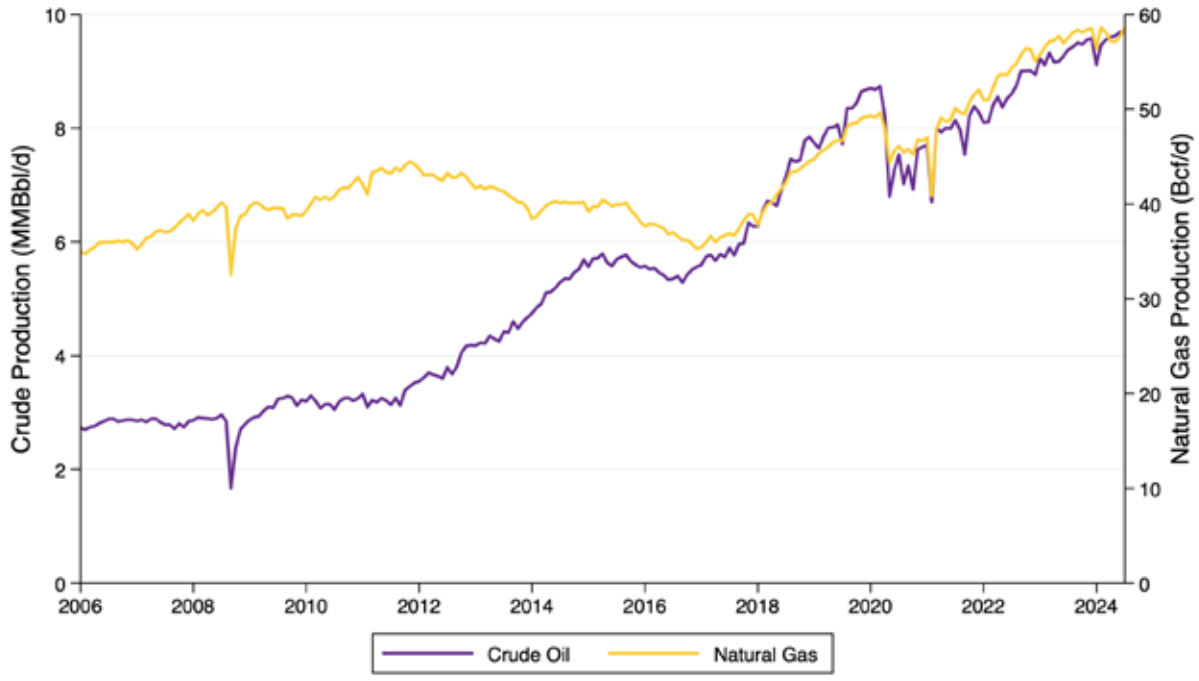
GCEO anticipates the share of energy in the U.S. economy from electricity to increase over the coming decade, but that much like years past, anticipates that long-run energy demand growth will lead to increased U.S. energy exports, especially to the growing developing world.

2. Crude Oil and Natural Gas Production and Prices

2.1 Crude Oil and Natural Gas Production

U.S. oil production surpassed its pre-pandemic peak of approximately 13 million barrels per day (MMbbl/d) in August 2023. Natural gas production continues to set new highs and is currently approximately 126 billion cubic feet per day (Bcf/d), or about seven percent above the pre-pandemic peak, after reaching an all-time peak of 129 Bcf/d in December 2023. Gulf Coast oil and gas production are shown in Figure 1. Gulf Coast oil and gas production rebounded even more quickly than the nation as a whole post-pandemic and today Gulf Coast oil production is approximately 11 percent above the pre-pandemic peak. Gulf Coast natural gas production is 18 percent higher.

Figure 1: Gulf Coast crude oil and natural gas production

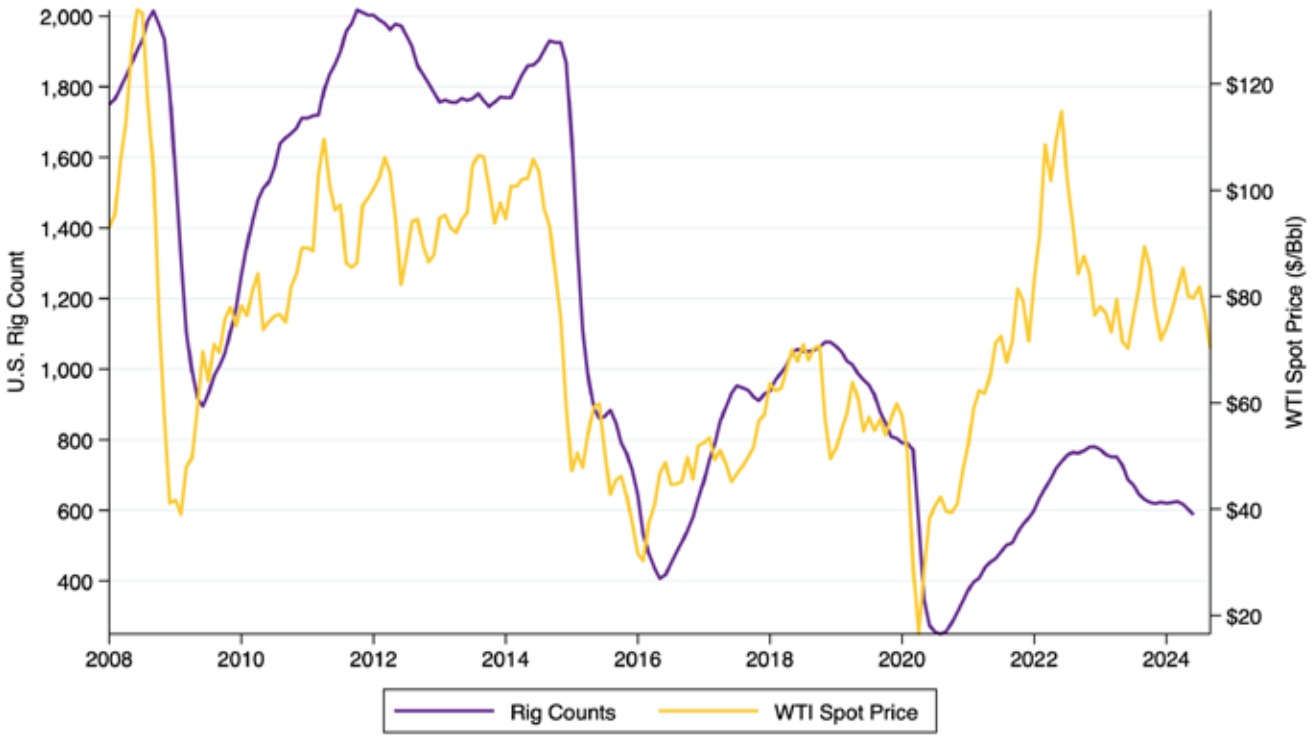


Source: U.S. Energy Information Administration. Petroleum & Other Liquids. Crude Oil Production. Natural Gas Gross Withdrawals.

Figure 2 highlights the relationship between U.S. rig counts and oil prices. Baker Hughes reported 250 active rigs in August 2020. Unsurprisingly, this rig count drop mirrored the drop in the West Texas Intermediate spot price that bottomed out at less than $17 per barrel in April of 2020. Rig counts then rebounded to a peak of 780 in December of 2022. Although this was more than triple the pandemic's trough, rig counts are still significantly below the levels experienced in 2018 and 2019. Throughout 2023, rig counts have gradually declined and in the most recent month of available data at the time of this writing (June 2024), rig counts are now below 600. This decline has mirrored the drop in oil prices (with a lag). As will be discussed in Section 7, the GCEO anticipates that oil and gas production

will continue to increase, although fewer rigs will be needed to produce more hydrocarbons. Thus, the industry is expected to continue producing more with fewer inputs, a sign of continued efficiency improvements. Although not shown in the figure, Gulf Coast rig counts move in tandem with U.S. rig counts and thus exhibit a similar pattern when compared with oil prices.

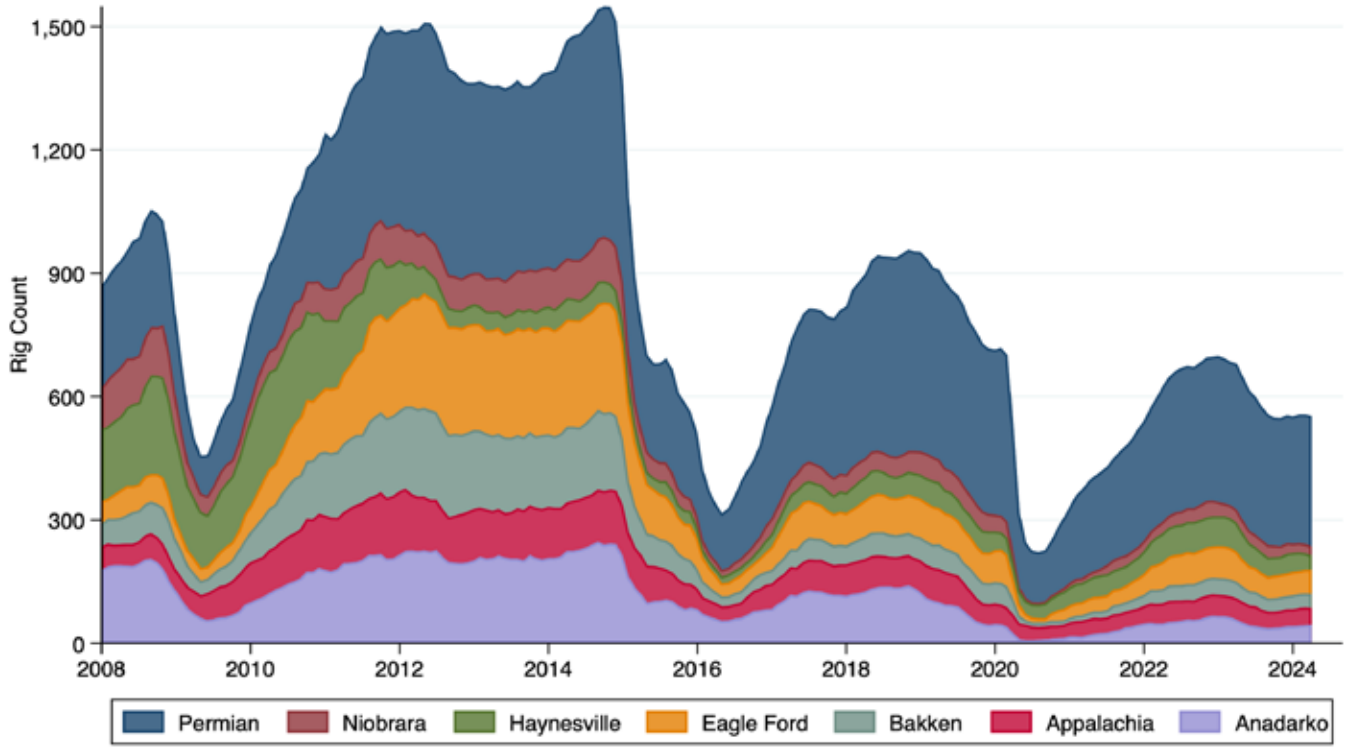
Figure 2: U.S. crude oil prices and rig count



Source: U.S. Energy Information Administration. West Texas Intermediate Spot Price. Baker Hughes Rotary Rig Counts.

Figure 3 displays rig activity levels in seven major U.S. shale plays, as defined by EIA's *Drilling Productivity Report*. For the past several years, GCEO has noted that the Permian Basin had been the predominant U.S. shale play and this continues. The Permian basin continues to account for more than half of all active rigs in shale plays. All seven of the basins shown in Figure 3 have experienced reductions in rig counts since the beginning of 2023, thus the slowing of drilling activity is a common theme across regions. Since the publication of the last GCEO, rig counts across major shale basins have held steady at approximately 550. More focus on Gulf Coast oil and gas production specifically will be provided in Section 2.3 below.

Figure 3: Rig counts in major shale basins



Source: U.S. Energy Information Administration. Drilling Productivity Reports.

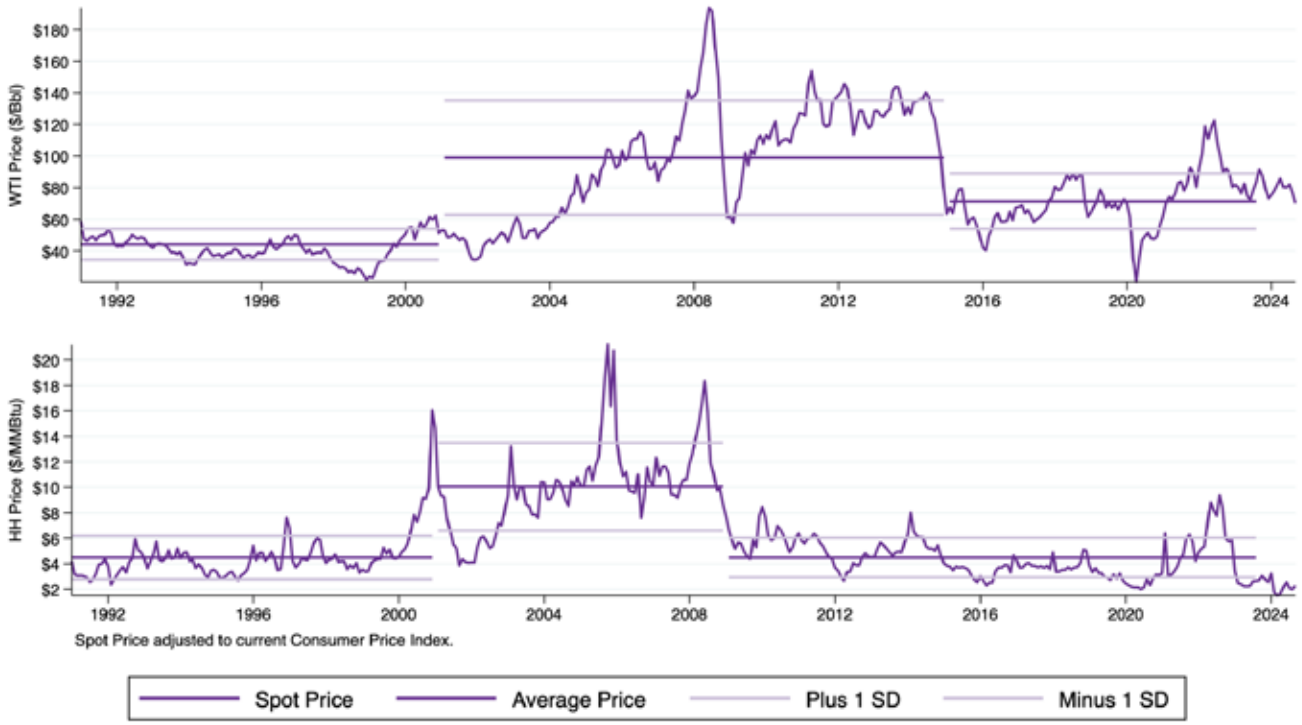
2.2 Commodity Pricing

Figure 4 shows recent trends in both crude oil and natural gas commodity pricing. The top panel shows historic trends, and pricing "epochs," whereas the bottom panel presents historic trends for natural gas pricing.

Historic natural gas pricing shows three separate epochs: (1) the period spanning the 1990s; (2) the period starting with the natural gas supply/pricing crisis of the 2000s; and (3) the post-recession period to current. These epochs differ in both their levels and variability.[8] The relevant question that was posed in last year's GCEO was whether natural gas prices had entered a new epoch that reflects a greater integration of U.S. natural gas markets to global markets. Prior to the advent of LNG exports, U.S. markets faced limited pricing exposure to changes in global markets. Last year GCEO commented that the Russo-Ukrainian war and the resulting sanctions on Russian natural gas alongside the fact that the U.S. is now the largest producer and exporter of natural gas would have likely resulted in substantially more, but still not total, integration. Interestingly, we have not observed to date a departure from this third "epoch" of natural gas prices, with current natural gas prices actually lower than average throughout this third epoch.

[8]Variability is shown as the standard deviation in the change in average monthly prices.

Figure 4: Historical inflation-adjusted oil and natural gas prices

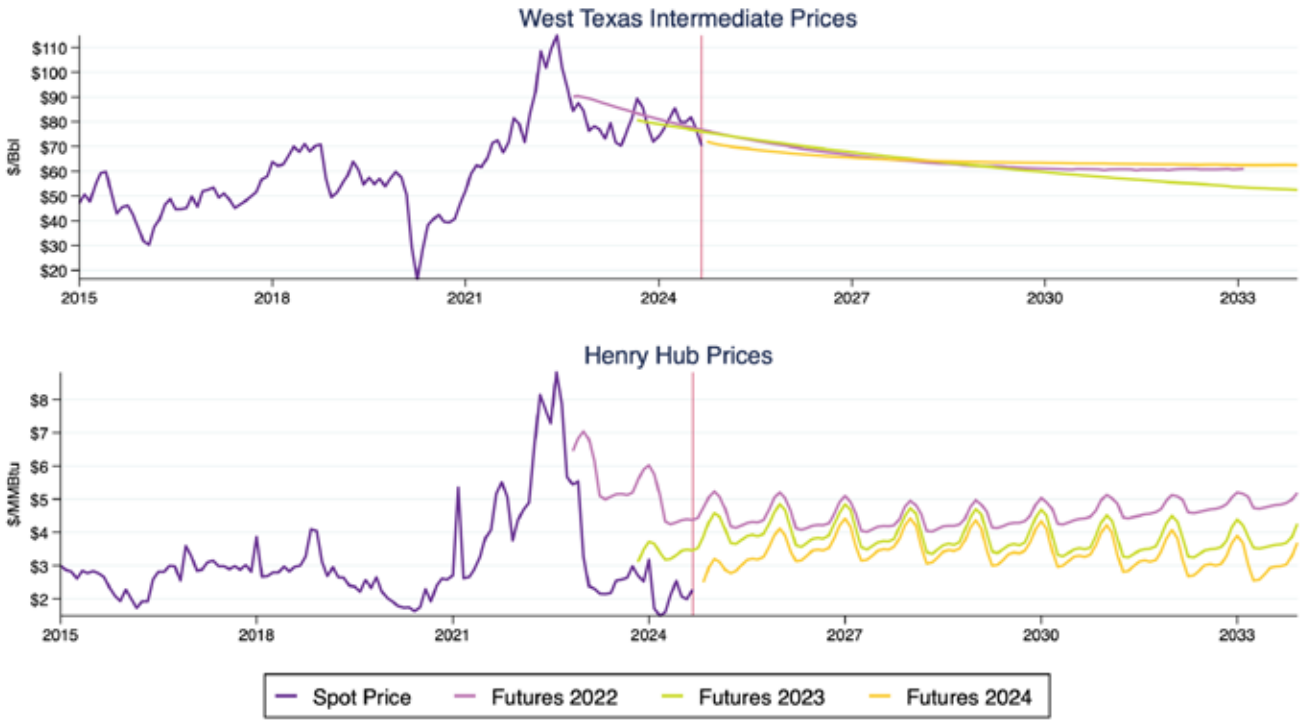


Source: U.S. Energy Information Administration. Henry Hub Natural Gas Spot Price (top) and West Texas Intermediate Spot Price (bottom). Inflation adjustment based on U.S. Consumer Price Index sources from the Bureau of Labor Statistics.

The trends in inflation-adjusted crude oil pricing continue to underscore how the unconventional revolution has led to dramatically reduced volatility relative to past pricing epochs. Pre-pandemic crude oil prices are shown in the middle range of the third epoch. The pandemic, quite simply, crashed crude oil prices in ways never experienced in the past. Crude oil prices bottomed out at a monthly average of less than $17 per barrel in April 2020, but quickly rebounded. But like natural gas, the global economic recovery alongside the war in Ukraine put significant upward pressure on oil prices in 2022. Although oil prices have climbed a bit over the past several months, they are still within the range of this third epoch and, as will be discussed next, are anticipated to decline into the future.

Figure 5 compares historical prices and futures for both the West Texas Intermediate (WTI) crude oil price (top panel) and Henry Hub natural gas price (bottom panel). Unlike Figure 4, both energy commodity prices are shown in nominal dollars (i.e., no inflation adjustment). Also, futures prices are shown for the most recent data available, alongside the futures prices listed in the two prior editions of the GCEO to illustrate how futures markets have evolved over the last several years.

Figure 5: Oil and natural gas price outlook



Source: New York Mercantile Exchange Henry Hub Futures Price. Sources from S&P Global Market Intelligence. Red vertical line represents August of 2024. Most recent futures price as of October 18, 2024.

There are several notable observations based on Figure 5. First, markets continue to anticipate that oil prices will converge in the long run to around $60 per barrel with a slight uptick from the last two years' futures prices. When prices shift outside of this range due to a shock (e.g. pandemic, geopolitical tensions, etc.), markets continue to anticipate convergence to a similar long-run price. At the time of this writing, oil prices are in backwardation, with prices anticipated at about $78 per barrel by the end of 2024.

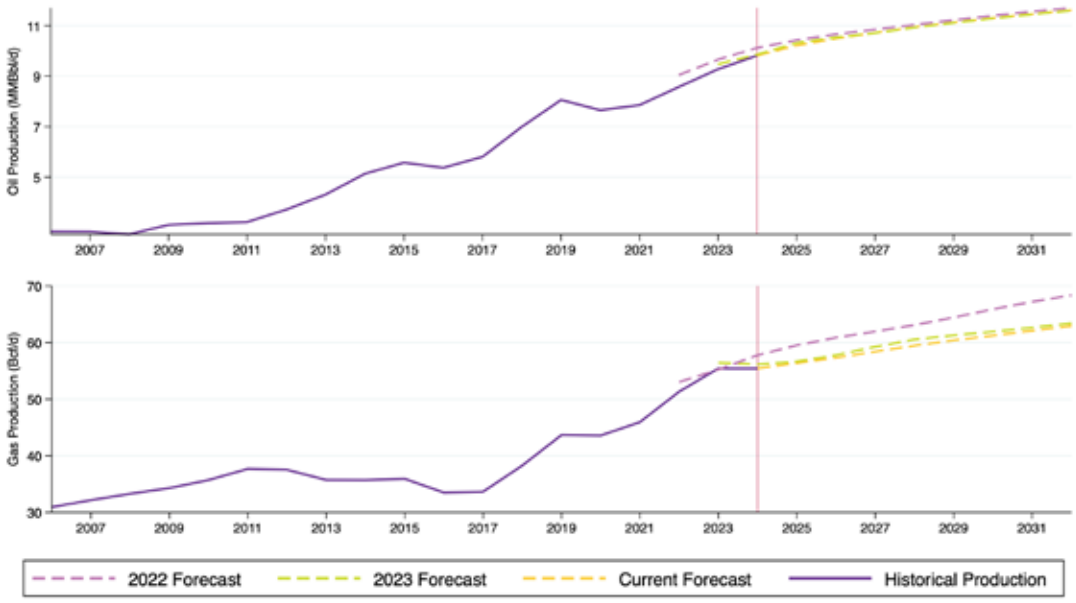
Natural gas prices are illustrated in the bottom panel of Figure 5. Interestingly, natural gas prices are significantly lower than anticipated last year at this time, and as shown in Figure 4 natural gas prices are at the low end of the prices experienced over the past decade. It is incredible to see how quickly U.S. natural gas prices have converged back to long-term norms in the wake of the global supply disruption that came from the Russian invasion of Ukraine in early 2022 and resulting sanctions. In the long run, futures markets anticipate natural gas prices to oscillate between about $2.50 to $4.50 per MMBtu. As will be discussed later, European and Asian markets have not experienced the same rapid convergence to pre-Russian invasion of Ukraine norms, and this has created a comparative advantage for the Gulf Coast in attracting capital for projects in the processing and exporting of hydrocarbon-based products from the Gulf Coast region.

2.3 Outlook: Crude Oil and Natural Gas Production

Figure 6 shows crude oil and natural gas production forecasts for the Gulf Coast based on the Enverus ProdCast model.[9] Following tradition, both figures show the current forecast as well as those in the past two years' GCEOs.

Gulf Coast crude oil production forecast is anticipated to increase over the forecast horizon.[10] For perspective, in 2023 regional crude oil production averaged 9.3 MMbbl/d. In calendar year 2024, which at the time of this writing is partially completed, ProdCast estimates Gulf Coast oil production to average 9.8 MMbbl/d, or an increase of approximately 6 percent. By 2032, Gulf Coast oil production is forecasted to reach 11.6 MMbbl/d. This oil production forecast remains essentially unchanged from last year's GCEO. As with prior years, there is plenty of oil in the ground to sustain a decade of production growth. Although not shown here, Prodcast also estimates U.S. oil production to increase 12 percent by 2032.

Figure 6: Gulf Coast oil and natural gas production forecast



Source: Enverus ProdCast.

Figure 6 also shows that Gulf Coast natural gas production is also anticipated to continue to grow over the next decade.[11] In 2023, Gulf Coast natural gas production was about 55.4 Bcf/d. Prodcast maintains its forecast of natural gas production at 55.4 Bcf/d in 2024. By 2032, ProdCast estimates Gulf Coast natural gas production to reach around 63 Bcf/d. Thus, both oil and natural gas production in the region are anticipated to experience a decade of growth even though oil and natural gas prices are both in backwardation. Although not shown graphically, both U.S. oil and natural gas production are also anticipated to grow over the coming decade.

[9]We thank Enverus for providing access to this model.
[10]Note that the definition of the Gulf Coast region in the Enverus Prodcast model differs slightly from political boundaries, due to the inherently geological nature of the model.
[11]Ibid.

3. Midstream Constraints and Pipeline Activity

Geographic differences in crude oil and natural gas prices often drive pipeline development. If prices at "Point A" are higher than "Point B" at a given time, firms have the incentive to develop transportation resources to capture this price differential (or "basis").

As in prior year GCEOs, Figure 7 compares differences in prices of West Texas Intermediate (WTI) and Louisiana Light Sweet (LLS). Three vertical lines are drawn. The first vertical line marks pricing levels as of January 2007, the date at which the EIA began tracking crude oil and natural gas unconventional production in its *Drilling Productivity Report*. The second line marks pricing levels as of May 2012, when the Seaway pipeline was reversed. Seaway initially moved crude from Freeport, Texas, on the Gulf Coast, to Cushing, Oklahoma, where WTI is priced. After Seaway was reversed, the pipeline carried crude produced in the Mid-Continent to Gulf Coast refineries. This line divides a regime of increasing internal shipping constraints from a regime where those constraints were relieved. The third line marks pricing levels as of December 2015, when the U.S. government lifted the crude oil export ban.

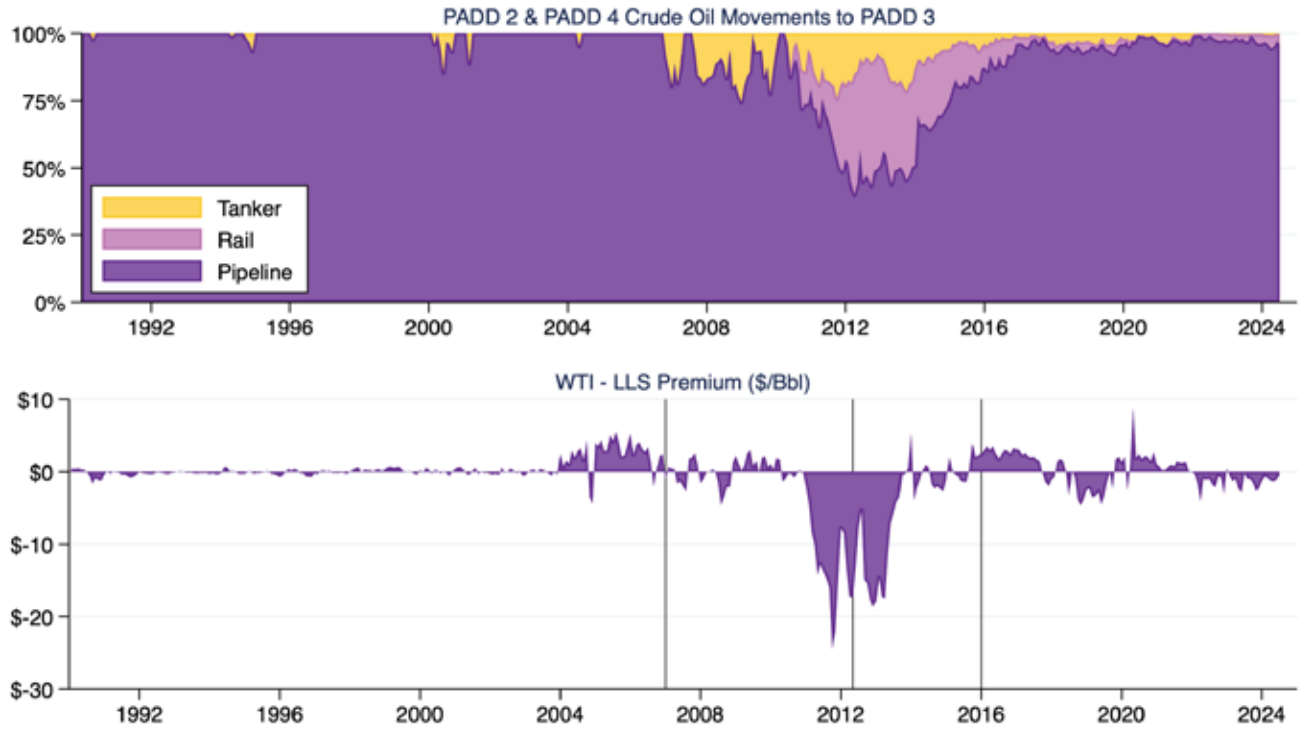
The top panel of Figure 7 shows the share of crude oil transported from PADD 2 and PADD 4 in the Mid-Continent (states in the Rocky Mountain and Midwestern regions) to PADD 3 on the Gulf Coast. From 1990 to 2007, almost all crude was transported from the mid-continent to the Gulf Coast via pipeline. Shippers used pipelines because rail and tankers were more expensive on the margin. During this time WTI and LLS moved in lockstep. In fact, by April 2012, more than half of the crude shipped from the mid-continent to the Gulf Coast went via high-cost barge and rail, as pipelines were at full capacity. Almost immediately after the reversal of the Seaway pipeline, this trend stopped, and the share of crude shipped via pipeline began to recover.

The LLS-WTI premium closely mirrors changes in the mode of transport over the 2007-to-2015 time period. This close correlation between shipping and prices can explain between one-half to three-quarters of relative price movements. Prior empirical research has investigated the degree to which refinery composition, captured by API crude oil gravity, can explain these differentials.[12] Evidence of shipping constraints, but not refining constraints, is observed.

For the past five years or so, crude markets have remained relatively balanced, with a small premium to LLS in the more recent years. The GCEO anticipates this small premium to persist over the forecast horizon and that more than 95 percent of crude shipped from the Mid-Continent to the Gulf Coast will continue to come from pipelines. Although oil production is anticipated to increase, due to the investment in pipeline infrastructure over the past decade, the need for increased barge and rail shipments is unlikely at this time. Last year's GCEO questioned whether pipeline additions could become necessary once U.S. oil production reached pre-pandemic levels. Now that production has marginally surpassed those levels and reached historical highs, time will tell whether pipeline constraints will become prevalent in the future. Currently, markets appear to be in balance, with a small share of oil shipped via tanker and rail and price differences being minimal across space. If oil production continues to grow, GCEO will keep watch on whether price differentials emerge sending the price signal for additional pipeline capacity.

[12]Agerton and Upton, 2019. Decomposing Crude Price Differentials: Domestic Shipping Constraints or the Crude Oil Export Ban? *The Energy Journal*, Vol. 40, No. 3.

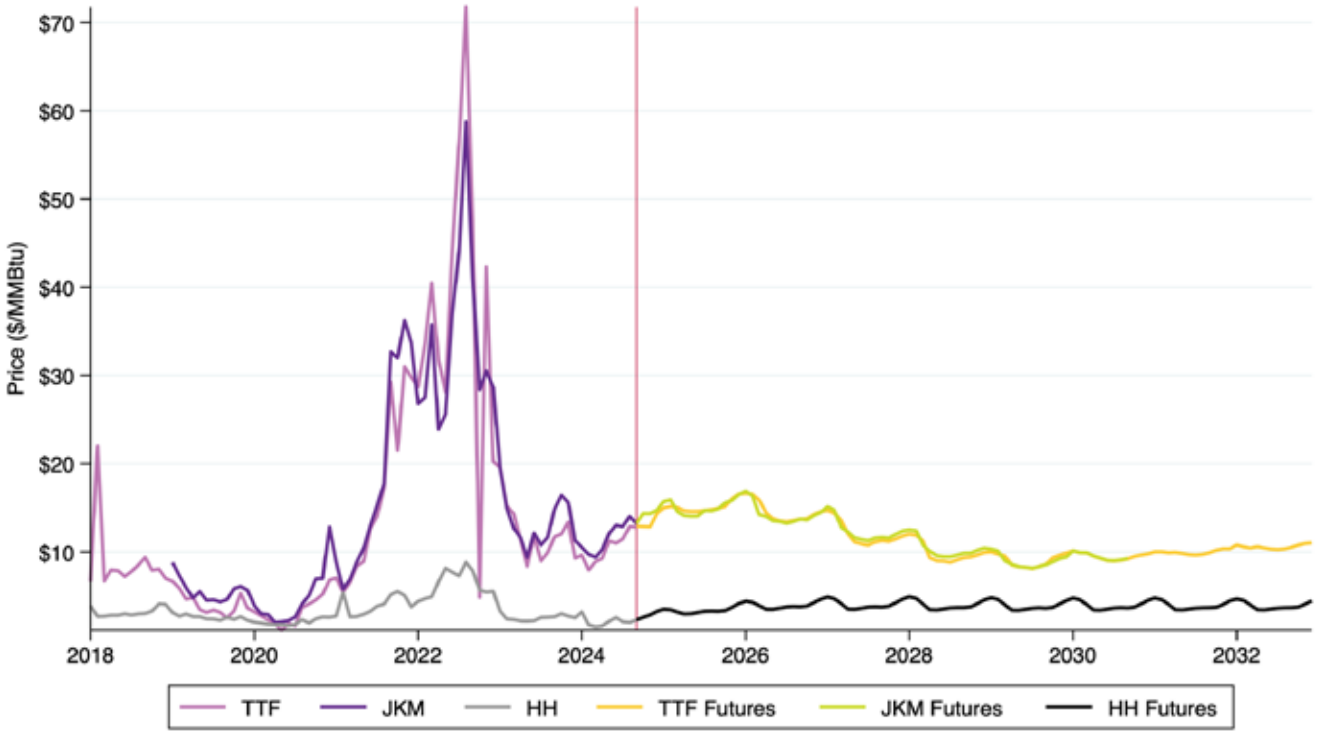
Figure 7: PADD 3 crude oil movements by transportation type



Source: U.S. Energy Information Administration, West Texas Intermediate Spot Price and Light Louisiana Sweet First Purchase Price. Movements between PADD Districts, by pipeline, tanker and barge, and rail.

The more notable spatial price differences instigating mid-stream investment are natural gas prices internationally. Figure 8 shows historical series for Henry Hub (Gulf Coast of U.S.), Title Transfer Facilty (TTF—European benchmark), and the Japan Korean Marker (JKM—Asian benchmark). As recently as 2020, natural gas was trading at a similar price (within ~$0.50 per MMBtu) in the U.S., Europe, and Asia. But this has changed dramatically over just a few years. In the most recent full month of data available, September of 2024, natural gas prices in Asia (represented by JKM) were approximately 480 percent more expensive than the Gulf Coast, while natural gas prices in Europe (represented by TTF) were approximately 460 percent more expensive. Thus, the mid-stream constraints for natural gas are between *international* locations; not as much within the U.S. While not shown here, international oil prices do not vary nearly as much as natural gas, with Brent (in Europe) trading at less than $4 per barrel more than West Texas Intermediate (in the U.S.).

Figure 8: Henry Hub (HH), Japan Korean Marker (JKM) and Title Transfer Facility (TTF) natural gas prices



Source: Bloomberg Terminal.

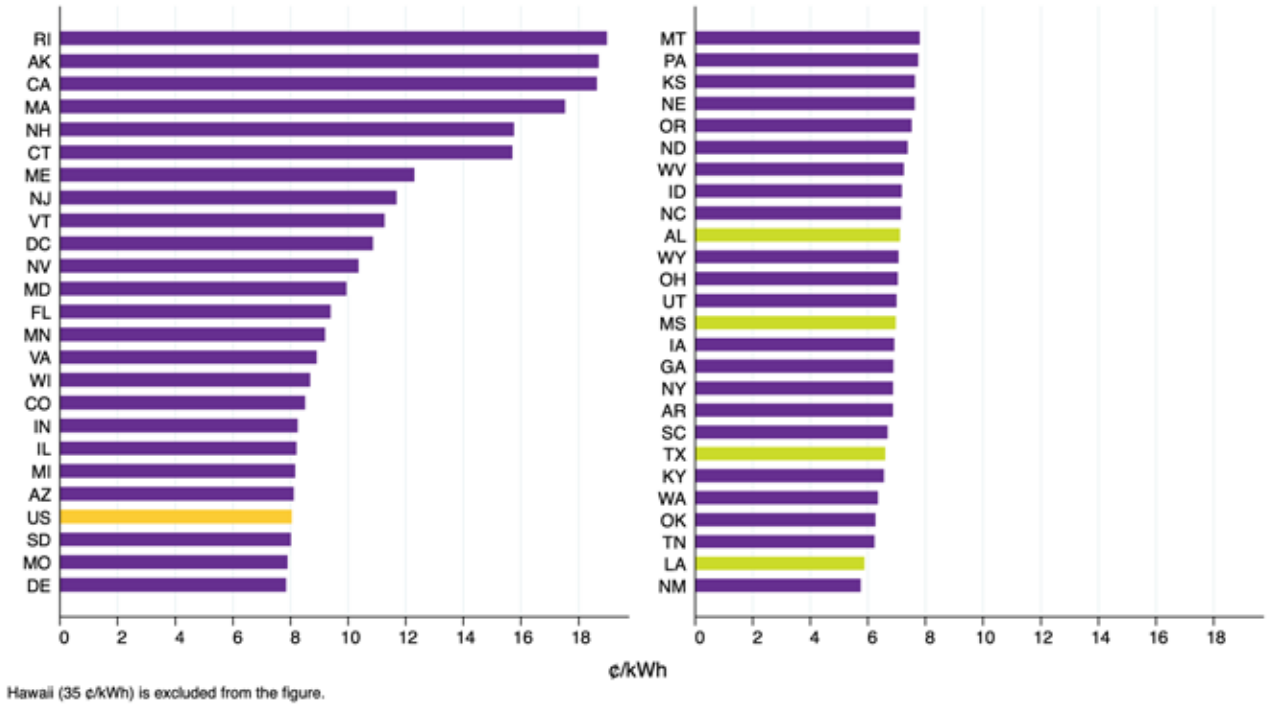
4. Power Sector

4.1 Average Retail Prices

Electricity is a key input for manufacturing, and for certain energy-intensive operations, power can comprise as much as 75 percent of total variable operating costs. As such, electricity price competitiveness is important in regional economic development. The Gulf Coast continues to have competitive industrial retail electricity rates, particularly the State of Louisiana. Figure 9 shows recent (2023) average industrial retail electricity prices for the U.S. and each state.

The U.S. average industrial electricity rate in 2023 was 8.0 ¢ per kilowatt-hour ("kWh"), which is considerably higher than the Gulf Coast weighted regional average of 6.6 ¢/kWh, giving the region an 18 percent cost advantage. All Gulf Coast states are below the national average industrial retail price, with Louisiana having the lowest regional retail electricity industrial price at 5.9 ¢/kWh, the second lowest in the U.S. The average industrial retail rate in Texas in 2023 was 6.6 ¢/kWh, about 11 percent higher than Louisiana.

Figure 9: Average retail industrial electricity prices



Source: U.S. Energy Information Administration (EIA) 861 annual data.
Retail sales of electricity to ultimate consumers. Hawaii (35 ¢/kWh) is excluded from the figure.

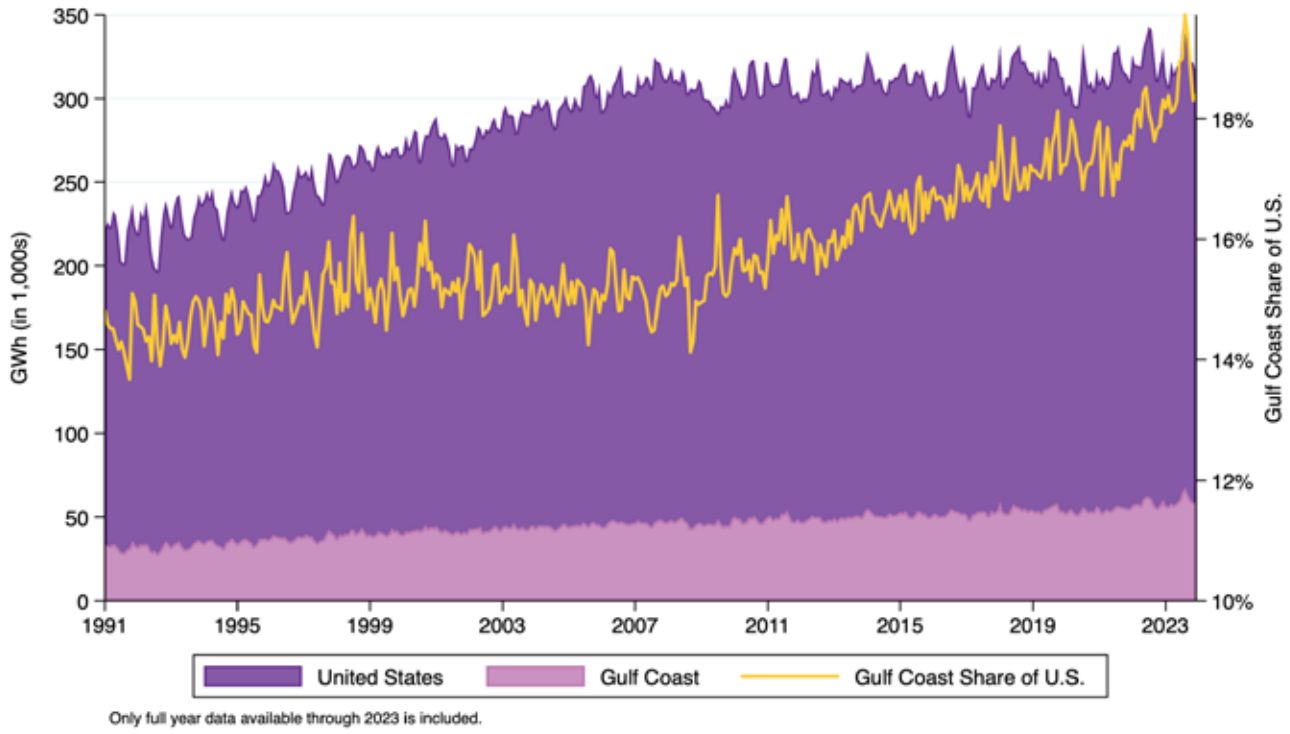
The Gulf Coast has been competitively priced relative to the national average for the last decade. Average industrial prices also decreased in the Gulf Coast region in 2023 relative to 2022 due to lower natural gas and wholesale market prices. During the 10-year period from 2014 to 2023, the Gulf

Coast average industrial electricity price increased only 6.3 percent versus the U.S. average industrial electricity price increase of 13.2 percent. Note that both the Gulf Coast and U.S. average industrial price changes are well below the change in the Producer Price Index during the same 10-year period. Additionally, the Gulf Coast saw significant growth in industrial electricity sales during the past 10 years at 25.8 percent versus U.S. average growth of only 1.2 percent. 2023 industrial electricity sales in Alabama and Mississippi actually fell from 2014 by 9.8 percent and 4.1 percent, respectively, while Louisiana saw a 14.8 percent increase, and Texas experienced 45.0 percent growth.

4.2 Sales Growth

Figure 10 shows trends in both U.S. and regional electricity sales. First, total U.S. electricity sales growth has been relatively flat over the last 10 years, increasing by only 2.3 percent. In fact, U.S. industrial electricity sales have yet to reach their 2007 peak, whereas the Gulf Coast region has seen significant growth at 25.8 percent led by Louisiana and Texas. Although not reflected in the chart, the Gulf Coast's growing share of U.S. overall electricity sales is driven largely by growth in industrial sales. The Gulf Coast region accounted for 20 percent of U.S. industrial sales in 2014 and, at time of writing, accounts for almost 24 percent of nationwide industrial sales. This growth in industrial sales has been largely spurred by energy manufacturing activity, which will be discussed further in Section 5.

Figure 10: U.S. and Gulf Coast electricity sales

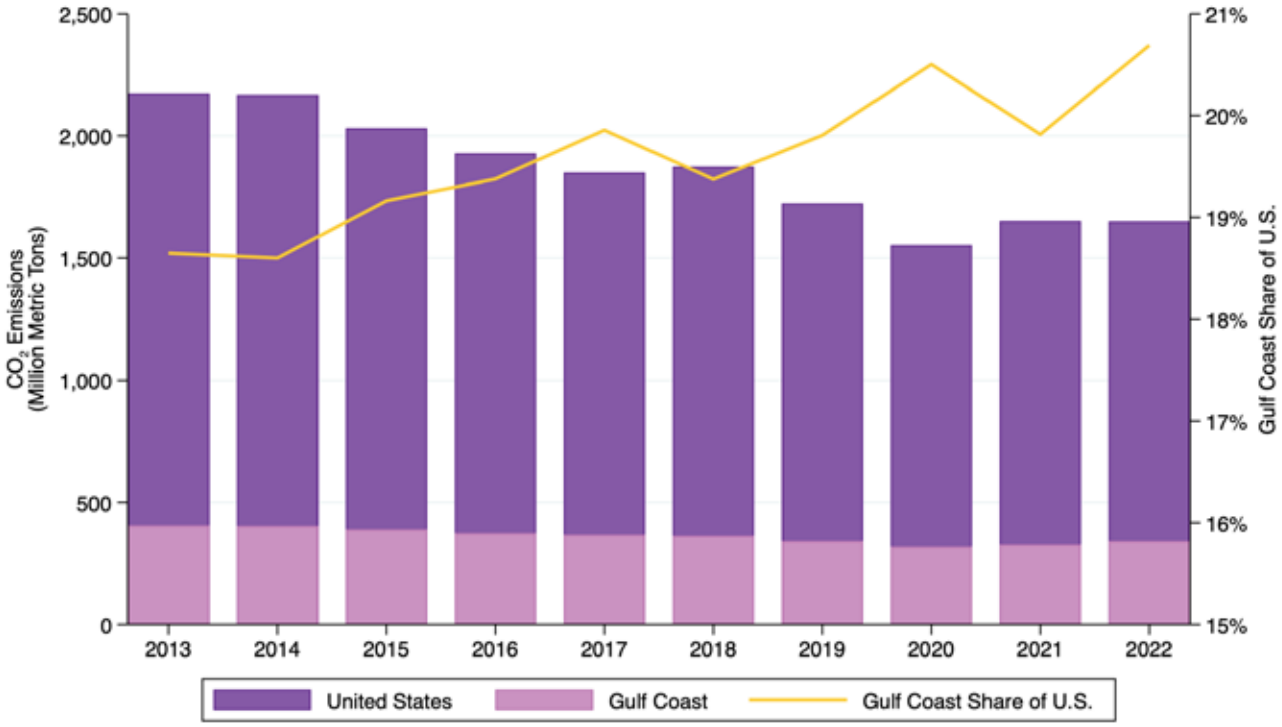


Source: U.S. Energy Information Administration 861 monthly data.
Retail sales of electricity to ultimate consumers.

4.3 Carbon Dioxide Emissions

Carbon dioxide (CO_2) emissions associated with power generation are provided in Figure 11. Note that this data is available with a lag, and thus is only available until the calendar year 2022. Between 2013 and 2022, U.S. and Gulf Coast power-generation-related GHG emissions decreased by 24 percent and 16 percent, respectively. These decreases are attributable to retirement of coal and less efficient gas-fired steam generation, growth of utility-scale renewable energy (mainly wind and solar PV), and thermal efficiency gains by the region's utilities, mainly through investment in efficient combined cycle gas turbine (CCGT) generation. However, emissions of CO_2 did increase both nationwide and in the Gulf Coast between 2020 and 2022, largely due to higher natural gas prices that led to greater utilization of coal-fired power plants. Preliminary 2023 data from the EIA indicates that CO_2 emissions declined in 2023. Given pending retirements of certain coal units and growth of renewable energy in the region, particularly large-scale solar PV projects and hybrid projects that incorporate energy storage, GCEO anticipates a continued trend of reduced power sector CO_2 emissions.

Figure 11: U.S. and Gulf Coast CO_2 emissions from electricity generation



Source: U.S. Energy Information Administration. Electricity. Emissions by plant and by region.

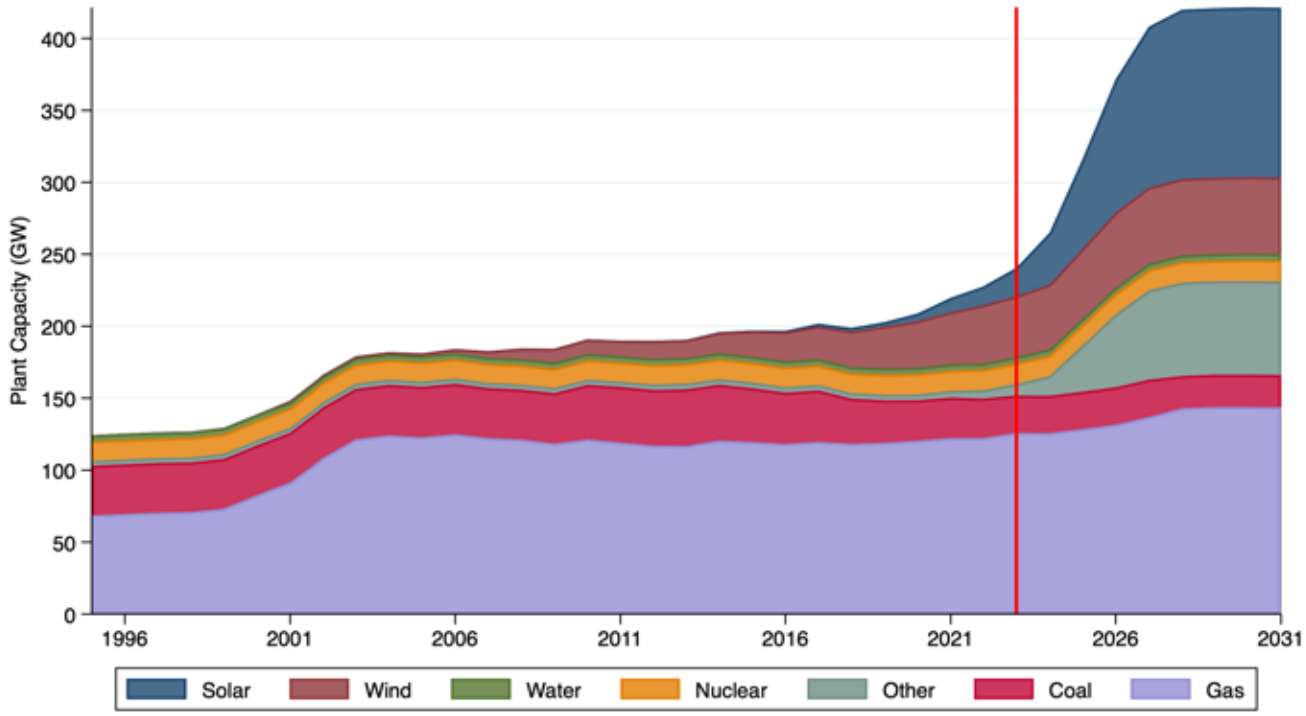
4.4 Generation Capacity Investment

Figure 12 shows historical and projected power generation capacity by fuel source for the Gulf Coast region. According to projections developed by S&P Global Market Intelligence, approximately 82,000 MW of solar PV generating capacity is currently in the planning phase or under construction

in the Gulf Coast region. In the MISO wholesale market alone, Louisiana currently has approximately 34,750 MW of solar PV, wind, energy storage, or hybrid renewable plus energy storage capacity in the interconnection queue with 30,000 MW coming from solar. This number is over 40 percent more than the approximately 21,200 MW of solar capacity reported in last year's GCEO and represents more than a twofold increase over the past two years. For perspective, the solar PV capacity was less than 200 MW in the four-state Gulf Coast region as recently as 2011. Figure 12 also shows over 8,000 MW of wind capacity in the planning phase, much of that within the Texas ERCOT wholesale market. Additionally, approximately 18,000 MW of natural gas capacity is currently being planned in the region.

Note that Figure 12 shows installed capacity, not share of electricity generated. For perspective, in 2023, natural gas accounted for 43 percent of electricity generated nationwide, nuclear for 19 percent, coal for 16 percent, wind for 10 percent, and solar for 4 percent.[13] Total carbon-free generation in the U.S. accounted for approximately 40 percent of total electricity used in 2023. Renewable energy's share of electricity generation is likely to increase, but natural gas will continue to be the largest fuel source for electricity generation for the foreseeable future.

Figure 12: Gulf Coast power generation capacity and outlook



Source: S&P Global Market Intelligence, Historical and Future Power Plant Capacity.

[13] U.S. Energy Information Administration. Electricity Data Browser, 1.1 Net generation by energy source: total – all sectors and 1.1.a Net generation by renewable sources: total – all sectors for 2023.

4.5 Future Electricity Growth and Resource Adequacy

From 2000 to 2020, U.S. electricity sales growth slowed from about 2 percent annually to about 0.5 percent annually as U.S. manufacturing declined in many areas and investments in energy efficiency in homes and buildings reduced usage. In the aftermath of the 2020 pandemic, U.S. electricity sales are projected to grow at a higher rate. The combination of onshoring of some U.S. manufacturing (the Gulf Coast "industrial renaissance"), significant investments in clean energy technology facilities (EVs, batteries for EVs, solar panels, etc.) triggered by IIJA and IRA tax and other incentives, rapid growth of hyperscale cloud and AI data centers, and electrification of transportation and buildings are increasing forecasted electricity sales growth. For example, Entergy Corporation forecasted in June 2024 that its five regulated utilities will see total electricity sales grow by 30 TWh annually in 2028 versus 2023 led by industrial MWh sales growing between 8 and 9 percent annually.[14] Similarly, American Electric Power (AEP), which serves portions of Northwest Louisiana through its SWEPCO subsidiary, forecasts 15 GW of company-wide incremental load growth led by strong data center demand along with approximately $43 billion of capital investment planned for 2024 through 2028.[15] Cleco Power has also touted electricity sales growth opportunities tied to its electrification and decarbonization efforts in shareholder presentations.[16]

The potential for sales growth, coupled with recent and pending retirements of older fossil fuel generating plants in the Gulf Coast states and the U.S. more broadly, may present challenges to ensuring on-going resource adequacy (i.e., having sufficient generating capacity available to meet peak load plus a target reserve margin). In areas experiencing growth, it is reasonable to expect that utilities and independent generators will respond with investments in new firm, dispatchable generating capacity as well as renewable resources. Hybrid projects that add energy storage also have the potential to grow in the future. Utility regulators and policymakers will also play a role. For example, the Louisiana PSC adopted new rules in June 2024 requiring that utilities subject to the PSC's jurisdiction meet a minimum percentage of their MISO-assigned annual capacity obligation[17] and recently expanded its integrated resource planning (IRP) rules to apply to the state's electric cooperatives.[18]

[14]Presentation made at Entergy Analyst Day held June 7, 2024; available at www.entergy.com under Investors.

[15]Presentation made at Wolfe Utilities and Clean Energy Conference held September 30 - October 1, 2024; available at www.aep.com/investors/.

[16]Cleco Power Holdings LLC Investor Presentation November 2023; available at www.cleco.com/about/investor-information.

[17]Louisiana PSC Docket No. R-36263; In re: *Consideration of Whether the Commission Should Adopt Minimum Physical Capacity Threshold Requirements for Load Serving Entities.*

[18]Louisiana PSC Docket No. R-36262; In re: *Possible Modification of the Commission's Integrated Resource Planning Rules to Remove the Exemption for Electric Cooperatives.*

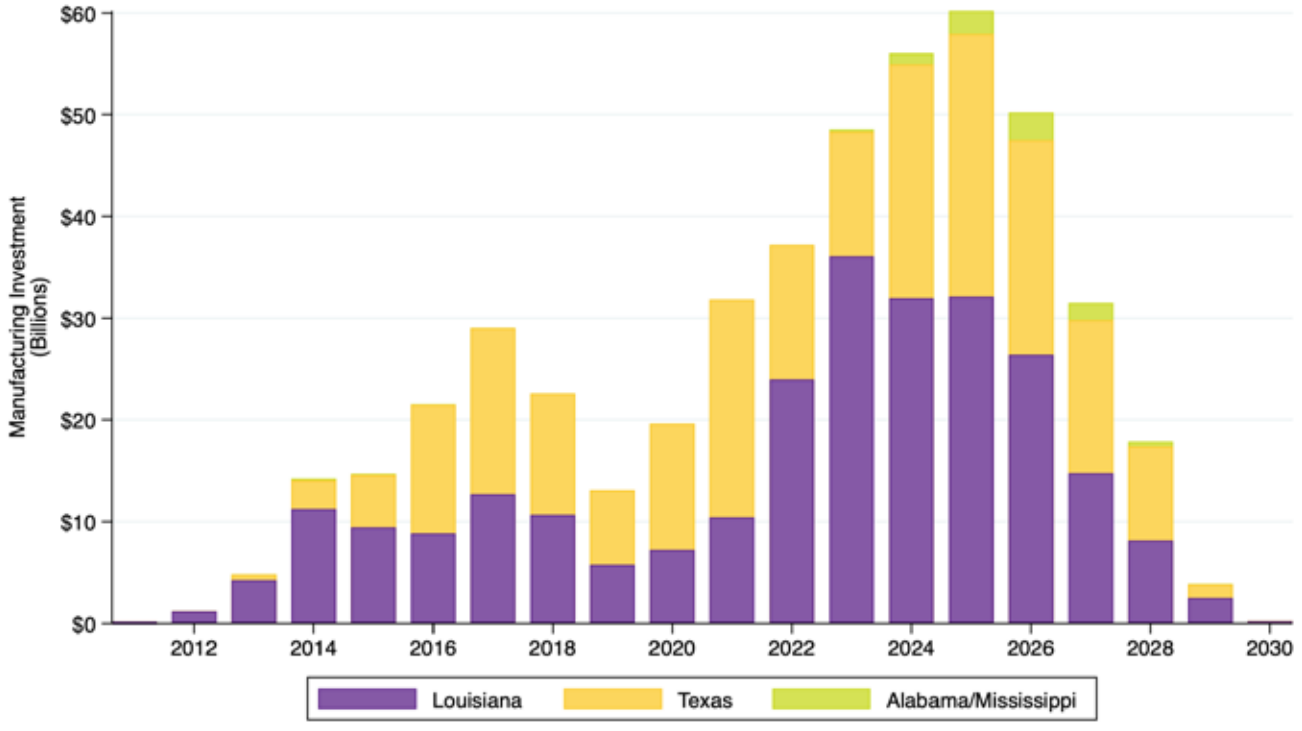
5. Energy Manufacturing

5.1 Energy Manufacturing Trends

GOM energy manufacturing investment continues to see relatively strong and healthy growth as illustrated in Figure 13. Since 2011, the region has seen as much as $258 billion in energy manufacturing-specific investment. Most of this investment ($142 billion, or 55 percent of the GOM total) is located in Louisiana, whereas the remaining amount of the announced investment is located in Texas ($116 billion, 45 percent of the GOM total).[19]

The big difference between Louisiana and Texas investment over the past decade or so has been related to LNG development along the Gulf Coast where Louisiana has seen more announced development activity than Texas. Louisiana has seen as much as $86 billion in historic announced LNG investment relative to the $42 billion in LNG facility development estimated to be made in Texas. Non-LNG energy manufacturing investment in Texas, however, has been larger at $70 billion relative to Louisiana's $49 billion share. Although Mississippi and Alabama are included in GCEO analysis, they make up a relatively small share of the total investment (as will be highlighted further below).

Figure 13: GOM energy manufacturing investments by state ($ billions)



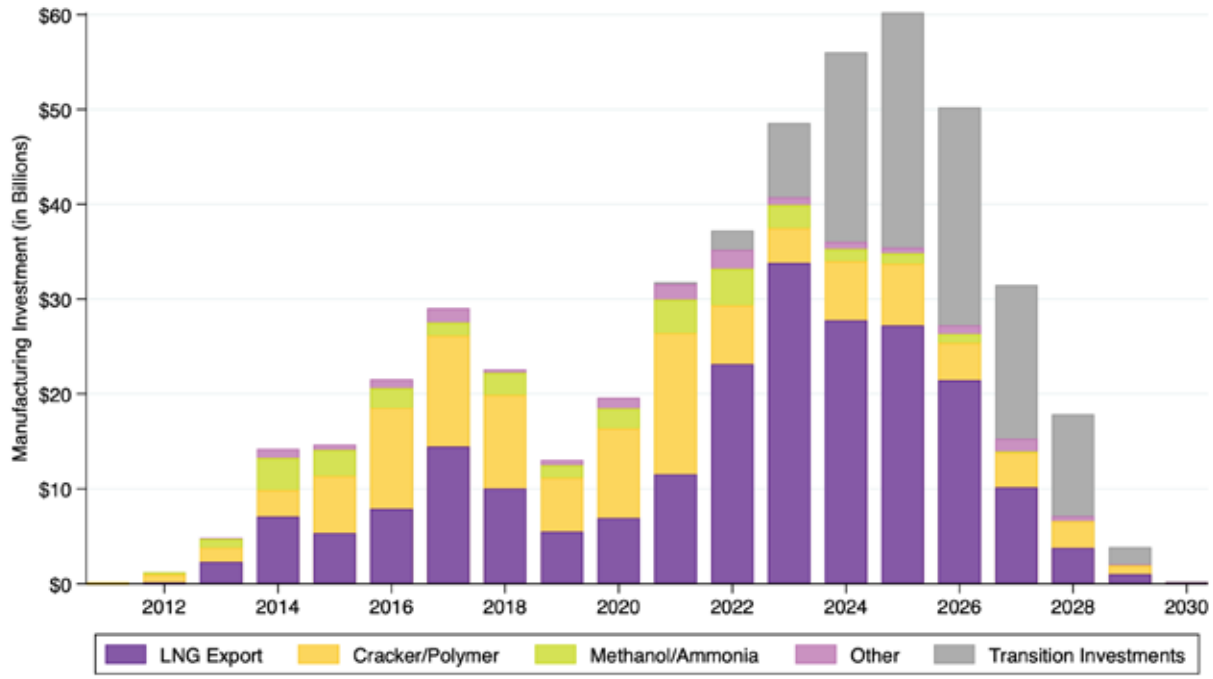
[19] The GCEO estimates annual investment levels based on project announcements and does not make any additional subjective adjustments on the capital expenditure levels, the announced commercial operations date ("COD"), or characterization of the project. For instance, if a project claims that it is a "green ammonia" project that includes renewable generation and electrolysis, the GCEO accepts such an announcement at face value. Where data is missing or incomplete, the GCEO estimates investment levels for those projects with missing information based on the average unit investment of a comparable type of investment such as the typical cost per BCF/d of export capacity for an LNG facility or average investment per ton of productive capability for an ammonia facility. Note that annual dollars are also based on anticipated project expenditure profiles: if a project has an anticipated three-year construction duration, those dollars are "spread" across a three-year period using a standard industry S-curve capital expenditure profile.

The growth of GOM energy manufacturing investments has been irregular and has generally followed trends in the broader global economy. Most of this energy manufacturing development corresponded with the boom in low-cost, abundant natural gas feedstock availability, changing energy markets in the U.S. and abroad. The GCEO estimates that from the period 2011-2018, annual regional energy manufacturing investment peaked in 2017 at $29 billion. The last decade also reflected a period of strong export growth opportunities and strong annual GDP growth in Asia, particularly China who at the time was averaging GDP growth in excess of six percent per year.

The trade tensions of 2018 during the Trump Administration and slowing pre-COVID industrial growth are reflected in that year's annual investment numbers, which cooled to a level of around $22 billion: a healthy clip, but far below the prior year all-time peak of $29 billion.

Most energy manufacturing along the GOM is dedicated to international trade, particularly those investments in LNG and commodity chemicals like methanol. Thus, the Chinese economic cooling of 2019, coupled with the onset of COVID in Asia in late 2019, had deleterious impacts for GOM energy manufacturing investment announcements which fell to a level of $13 billion. These lackluster regional investment levels continued into the peak of the COVID-related economic shut-down of 2020 at $19 billion. Since this time, energy manufacturing investment levels have been on a tear, surging to a new all-time high in 2021 of $32 billion and continuing to climb since that time due to (a) continued global economic recovery and (b) a renewed interest in energy manufacturing, particularly in those sectors oriented to cleaner "energy transition" investments such as clean ammonia, hydrogen, and underground carbon capture and sequestration (CCS).

Figure 14: GOM energy manufacturing investments by sector ($ billions)



Over the last two years, actual GOM energy investment levels are estimated[20] to be running lower than prior GCEO expectations. For instance, 2023 and 2024 GOM energy manufacturing investment levels are now estimated to be around $48.6 and $56.0 billion, respectively. These investment levels are below prior-year GCEO levels by about six percent and four percent, respectively. In the current year (2024), the GCEO estimates $56 billion in total regional energy manufacturing investment, $28 billion of which will be dedicated to LNG investments, about $20 billion in transition investments, and $8.3 billion in other mostly commodity chemical investments.

5.2 Energy Manufacturing Outlook

The 2025 GCEO continues to see strong energy manufacturing investment levels at the regional and state level in 2025 (Table 2). Note that these numbers represent project announcements, and are thus not necessarily projections of actual dollars spent within a year, but do illustrate the significant amount of activity likely on the horizon. Total GOM investment announcements are $60 billion in 2025 and then fall to $50 billion in 2026. Announcements are split almost evenly between LNG development ($27 billion) and energy transition projects ($25 billion). Those other investments announcements, mostly in the chemical and refining sectors, account for around $8 billion. For perspective, total 2025 investment announcement levels in this year's GCEO are about $5 billion higher than those presented in last year's GCEO.

Table 2: Total announced GOM energy manufacturing investments ($ billions)

Year	Texas				Louisiana				Other GOM				Total GOM			
	LNG	Non-LNG	Transition	Total	LNG	Non-LNG	Transition	Total	LNG	Non-LNG	Transition	Total	LNG	Non-LNG	Transition	Total
	(million $)															
2024	9,346	5,514	8,164	23,024	17,516	2,626	11,799	31,941	889	-	29	918	27,751	8,289	19,991	56,032
2025	11,505	4,941	9,389	25,835	13,501	3,261	15,335	32,097	2,226	-	55	2,281	27,232	8,203	24,779	60,213
2026	10,122	1,763	9,239	21,124	8,683	4,035	13,668	26,387	2,634	-	55	2,689	21,439	5,799	22,962	50,200
2027	4,226	1,363	9,483	15,073	4,320	3,738	6,687	14,745	1,624	-	30	1,654	10,171	5,101	16,200	31,472
2028	352	559	8,375	9,285	2,962	2,785	2,375	8,122	471	-	3	474	3,785	3,343	10,753	17,881
2029	-	118	1,242	1,360	966	908	600	2,474	33	-	-	33	999	1,026	1,842	3,866
2030	-	8	30	38	70	66	41	178	-	-	-	-	70	74	71	216
Total	**$ 35,551**	**$ 14,267**	**$ 45,921**	**$ 95,739**	**$ 48,019**	**$ 17,419**	**$ 50,505**	**$ 115,943**	**$ 7,878**	**$ -**	**$ 172**	**$ 8,050**	**$ 91,447**	**$ 31,835**	**$ 96,598**	**$ 219,880**

If all announced projects were to move forward, both Louisiana and Texas would reach record capital investment levels in energy manufacturing. Louisiana 2025 investment announcements are $32 billion whereas Texas announcements are $26 billion. Importantly, for the first time since the GCEO's inception, Louisiana energy manufacturing investments dedicated to energy transition projects will surpass those dedicated to LNG by as much as $1.8 billion in 2025, $5.0 billion in 2026, and $2.4 billion in 2027. This is an important finding and underscores how the Louisiana energy economy is becoming increasingly focused on decarbonization goals.

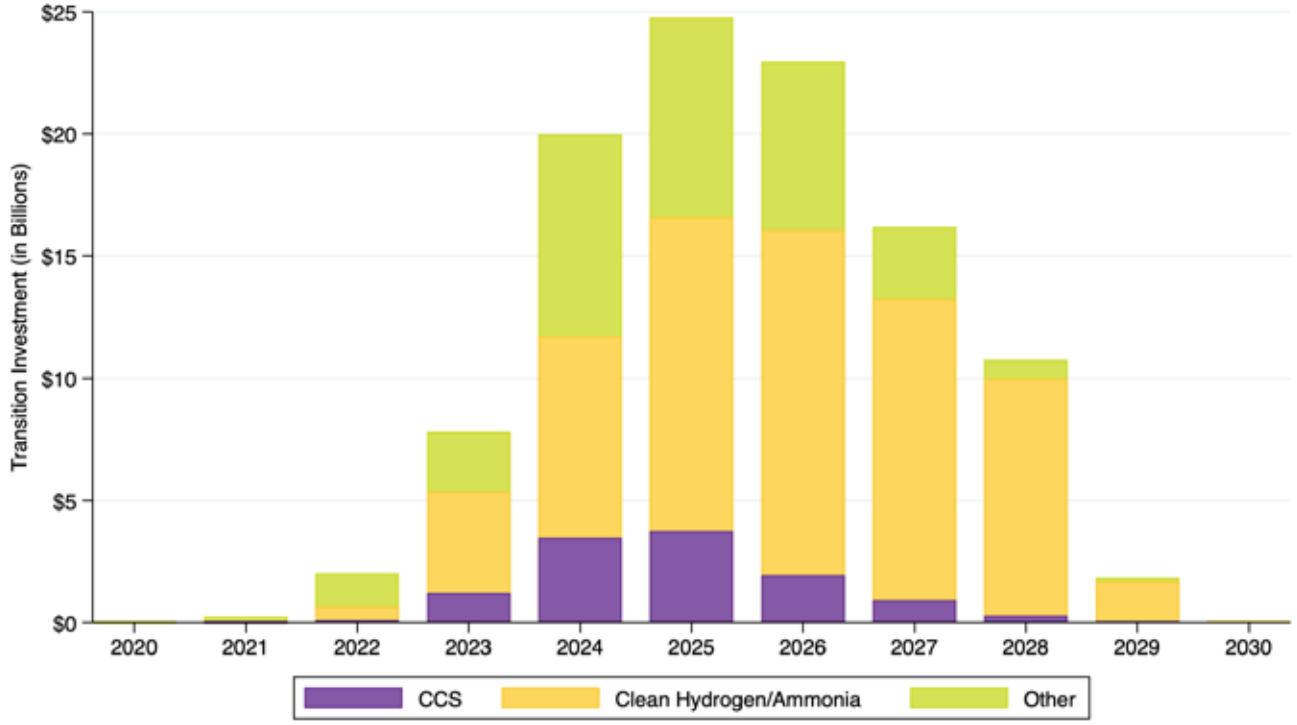
In sum, announced regional investments total nearly $220 billion from 2024 through 2030. Summing historical investment dollars plus the current announcements, the region could reach a cumulative $478 billion. By 2030, the region could see as much as $219 billion in total LNG investment, $151

[20]Note, "actual" investment levels themselves are GCEO-based estimates of projects that can be verified as having been developed based on originally announced project investment levels. Actual investment information is not reported nor required to be reported in any GOM state. Actual investment level estimates, particularly over the past several years, are likely to be understated since most projects have seen supply-chain and inflation-related project cost overages that rarely get reported and certainly do not get reported in any detail nor in any degree of consistency (across time, projects, or developers).

billion in chemical and refining and other traditional industry investments, and $107 billion in energy transition investments.

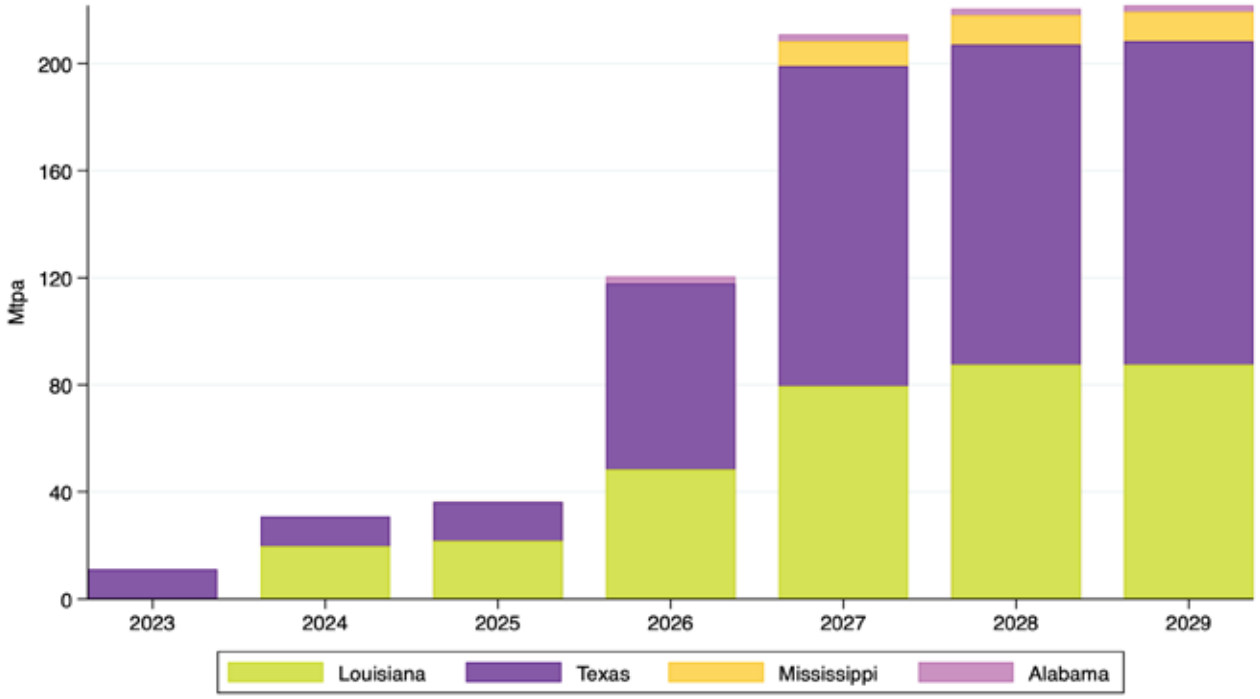
Regional energy transition investments continue to represent a fast-growing sector of the region's energy economy. There are currently a record $25 billion in announcements for the region in 2025 and $23 billion in 2026. Figure 15 shows that the overwhelming bulk of these investments are in clean hydrogen and ammonia projects in the region that could add an additional $51 billion in capital investment from 2025 through 2030 if completed. Another $19 billion in "other" transition investments are also announced that include those made in battery energy storage manufacturing, various types of biofuels and other clean synthetic fuels, among other smaller clean energy investments. Lastly, the development of CCS project announcements such as underground carbon storage projects and direct air capture (DAC) projects sum to $7 billion from 2025 through 2030.

Figure 15: Energy transition investment detail ($ billions)



Lastly, CCS investments have captured considerable attention in the Gulf Coast region over the past several years, particularly with the recent U.S. EPA primacy determination in favor of Louisiana. On a forward-going basis, Louisiana will be able to assess and permit wells and storage facilities dedicated to carbon capture. The region has seen considerable development activity over the past several years. To date (from 2023 to current) there is as much as 121 million metric tons per year ("Mtpa") of storage capacity from announced CCS projects in Texas. Louisiana follows closely behind with close to 88 Mtpa of projects (Figure 16). Mississippi and Alabama have, collectively, about 14 Mtpa of projects announced mostly in the southern parts of both states.

Figure 16: Regional CCS project announcement capacities by state (Mtpa)



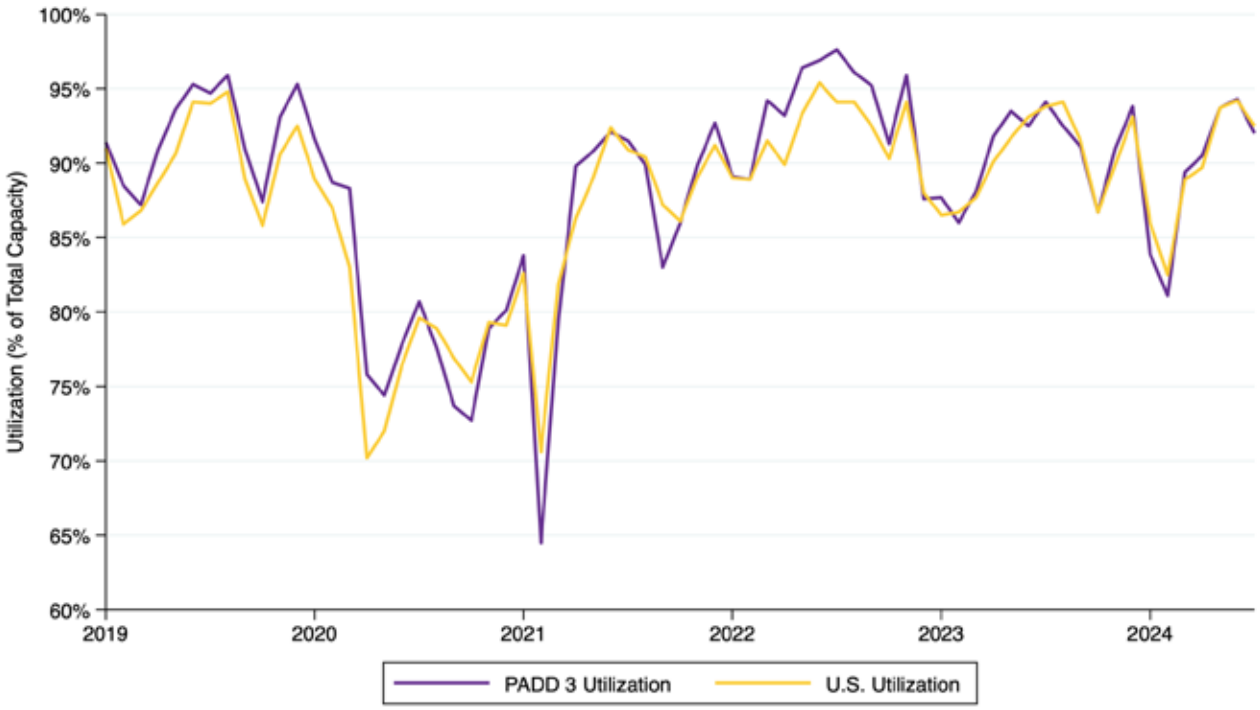
6. Energy Exports

6.1 Refined Products

Despite some challenges during the beginning of 2024, the Gulf Coast region's refining sector continues to benefit from export opportunities arising from the geopolitical uncertainties in Eastern Europe, and the Middle East. While both U.S. and regional refining capacity utilizations have rebounded from their pandemic-induced low in the spring of 2021, the recent drop in utilization reflects refineries' vulnerability to extreme cold weather, which had the largest operational impacts on refineries in the PADD3 region.

As shown in Figure 17, refinery utilization rates fluctuated between 85 and 95 percent through 2023, before experiencing a decline to just above 80 percent in early 2024. The tropical activity in 2024 further impacted refining capacity and utilization rates, with Calcasieu Refining temporarily shutting down its 135,500 b/d Lake Charles facility. While the refinery landscape overall has remained relatively stable, LyondellBasell's announcement to close its 268,000-Bbl/d Houston refinery by the first quarter of 2025 signals potential challenges ahead,[21] despite the region's important role in meeting global energy export requirements.

Figure 17: U.S. and PADD 3 monthly refining utilization

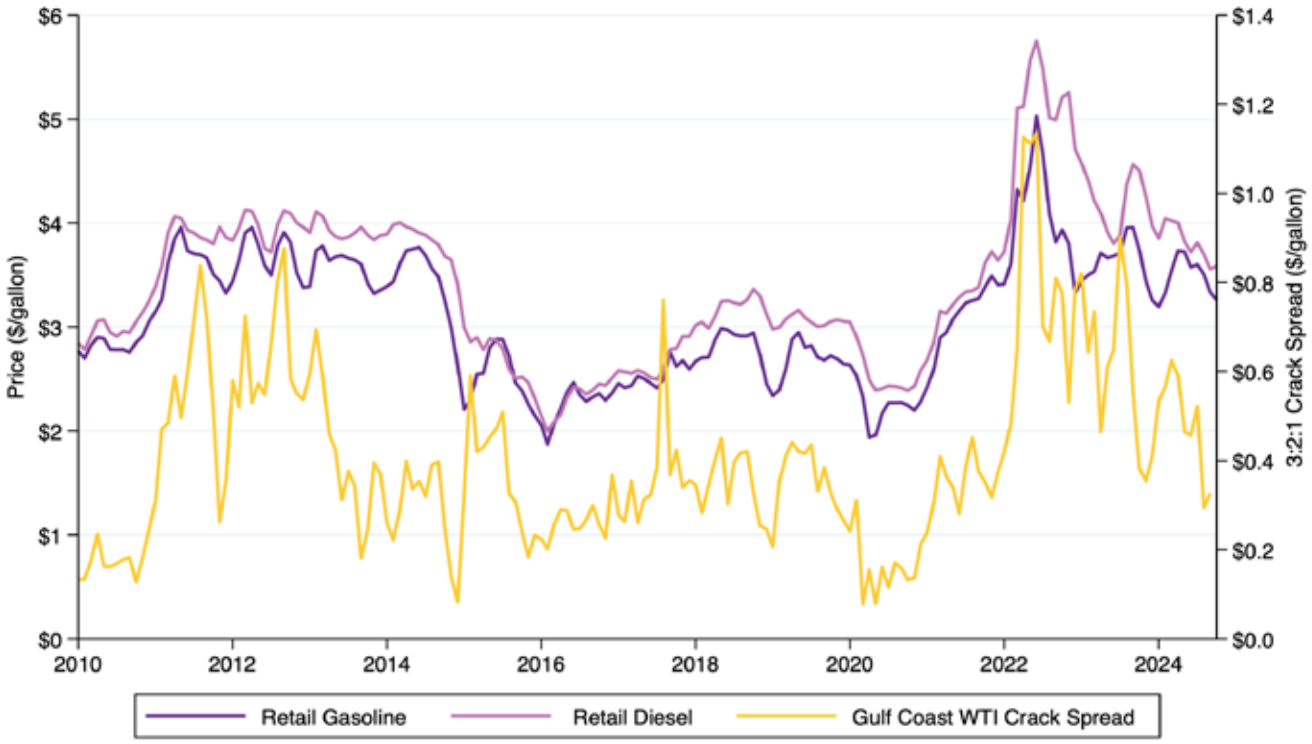


Source: U.S. Energy Information Administration. Petroleum & Other Liquids. Refinery Utilization and Capacity.

[21] Phillips 66 recently announced the shutdown of its Los Angeles-area refinery by late 2025. https://investor.phillips66.com/financial-information/news-releases/news-release-details/2024/Phillips-66-provides-notice-of-its-plan-to-cease-operations-at-Los-Angeles-area-refinery/default.aspx

As illustrated in Figure 18, overall refining profitability has moderated from the peaks seen in 2022 as crack spreads across all major refined product types have decreased. Last year's GCEO noted sustained regional spreads due to improving U.S. economic conditions. However, refining margins have fallen to their lowest level since 2021 but are now at levels more comparable to levels observed between 2015 and 2020.

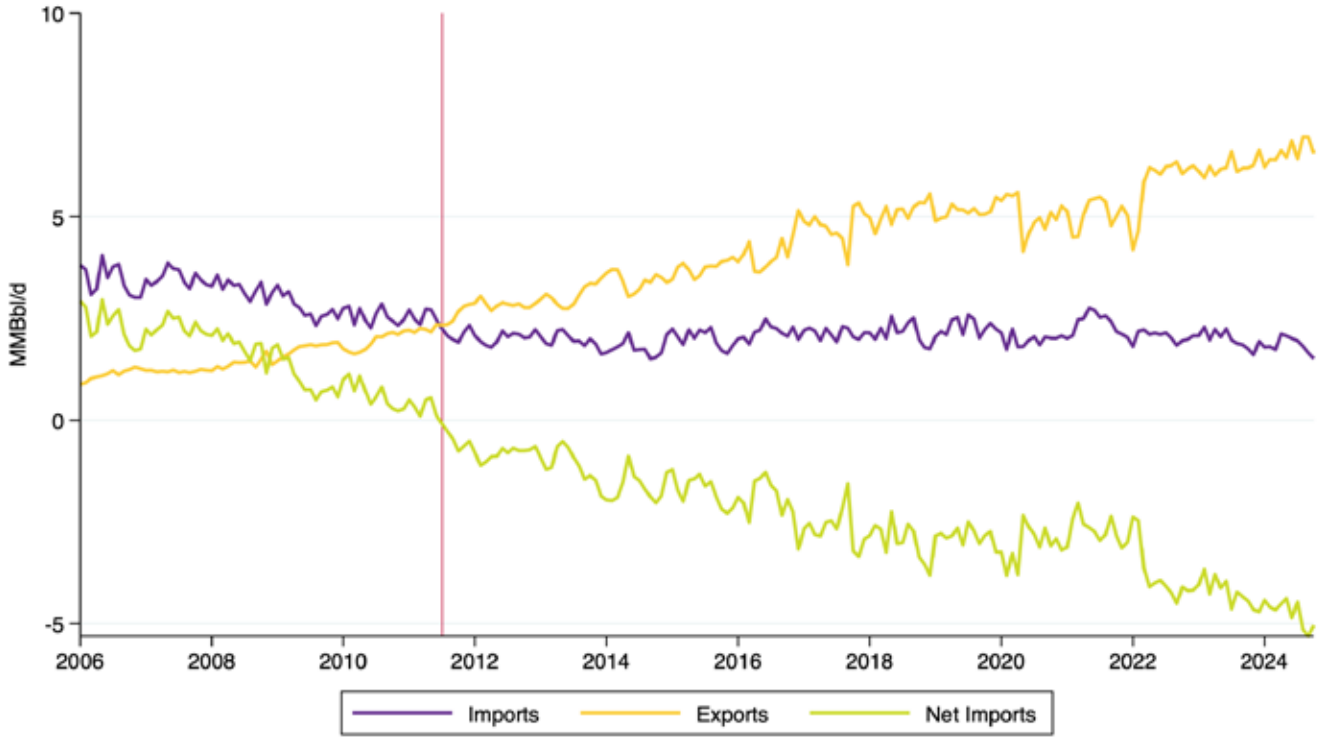
Figure 18: Retail gasoline, diesel prices, and refinery crack spread



Source: EIA, Bloomberg Terminal, and authors' calculations. Gasoline prices are for all grades and all formulations, and diesel is based on U.S. No. 2 retail price.

As shown in Figure 19, refined product trade trends observed over the last few years' GCEO continue to strengthen as U.S. net exports grow. While imports have remained steady around 2 MMBbl/d since 2012, exports have more than doubled from 3 MMBbl/d to almost 7 MMBbl/d, pushing net exports to over 5 MMBbl/d for the first time in 2024. Disruptions and uncertainties in global energy markets will likely reinforce the U.S.'s export position in global markets, with potential for modest growth opportunities.

Figure 19: U.S. refined products trade

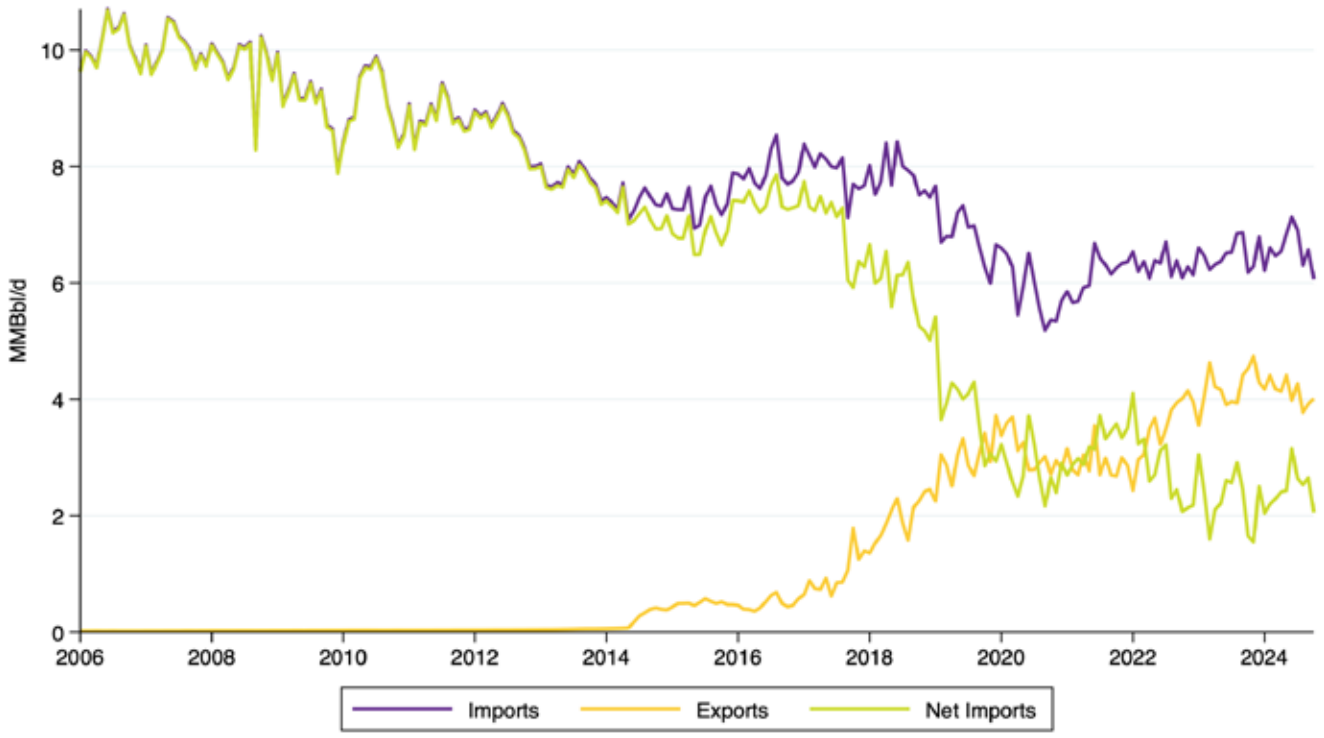


Source: U.S. Energy Information Administration

6.2 Crude Oil

U.S. crude oil exports are shown in Figure 20. While the U.S. is still a net importer of crude oil, it has been expanding its position in global crude oil trade dating back to the middle part of the last decade, when U.S. exports surged from around six percent of total global crude oil supply, to as much as 12 to 14 percent. U.S. crude oil trade has expanded rapidly since the lifting of the oil export embargo in 2015, particularly along the Gulf Coast which accounts for almost all crude oil leaving U.S. shores. The supply sources for a good part of these crude oil exports also originate from the region, particularly the Permian basin, and to a much lesser extent the Eagle Ford. Crude oil exports continue to grow from an average of around 3 MMbbl/d to levels that now average 4 MMbbl/d. The 2025 GCEO sees this trend continuing with 4 MMbbl/d likely being the new “floor” on overall exports levels.

Figure 20: U.S. crude oil exports and imports

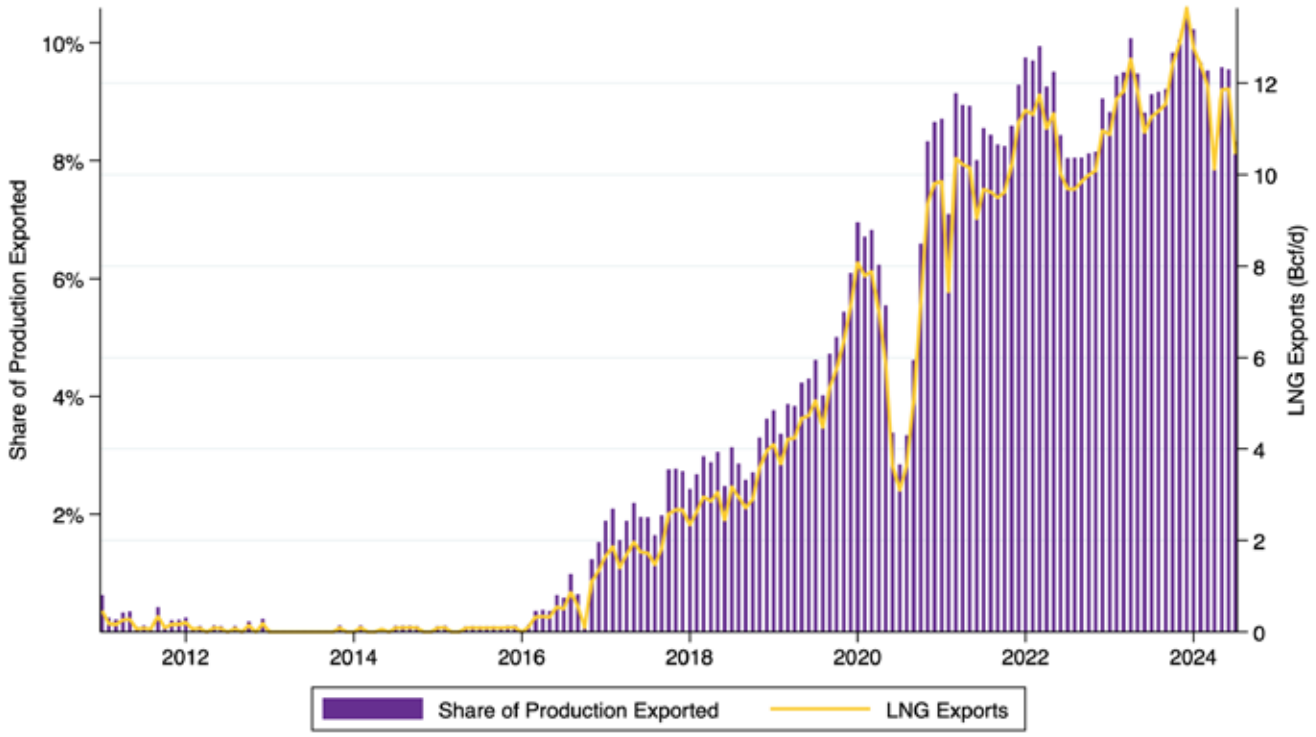


Source: U.S. Energy Information Administration. Petroleum & Other Liquids. U.S. Imports and Exports of Crude Oil.

6.3 Liquefied Natural Gas Exports

Global LNG trade has benefited considerably from the geopolitical uncertainties and conflicts that are ongoing in Eastern Europe. Natural gas volumes leaving U.S. shores continue to expand with regional export availability and capacity. However, events over the last three years (2022-2024, inclusive) have shown how vulnerable these export volumes can be to capacity availability. In June 2022, for instance, Freeport LNG in Texas, the second largest export facility along the Gulf Coast at 2 billion cubic feet per day (Bcf/d), experienced a fire, shutting down the facility for nearly a year. As shown in Figure 21, an unplanned outage at the same facility in January 2024 followed by reduced capacity because of maintenance work shows the significant impact of these outages on export volumes.

Figure 21: U.S. liquefied natural gas exports



Source: U.S. Energy Information Administration.

The outlook for LNG exports is affected by both infrastructure expansion and market uncertainties. The U.S. has emerged as the world's leading LNG exporter in 2023 with average volume at approximately 11.6 Bcf/d. Five Gulf Coast projects under construction could potentially add another 9.7 Bcf/d in the next three years. However, President Biden's January 2024 pause on new LNG export project approvals to non-FTA countries pending economic and environmental review creates some uncertainty. This pause was subsequently stayed by the U.S. District Court for the Western District of Louisiana in July 2024. The regulatory environment remains complex, however, as also illustrated by FERC's February 2022 attempt to implement stricter environmental guidelines for review of projects involving LNG export, which was later walked back due to political pressure and Russia's invasion of Ukraine.

The first half of 2024 also saw a significant drop in the U.S. LNG shipments to Europe, which can be attributed to a significant growth in renewable energy, improved efficiency standards and aggressive climate objectives. However, this could all change with a cold European winter or new and unexpected geopolitical tensions. The 2024 GCEO noted potential restrictions on natural gas appliances in the U.S., though subsequent federal efficiency standards maintained most existing gas stove technologies while targeting broader energy efficiency improvements.

7. Employment Outlook

7.1 Employment Forecasts

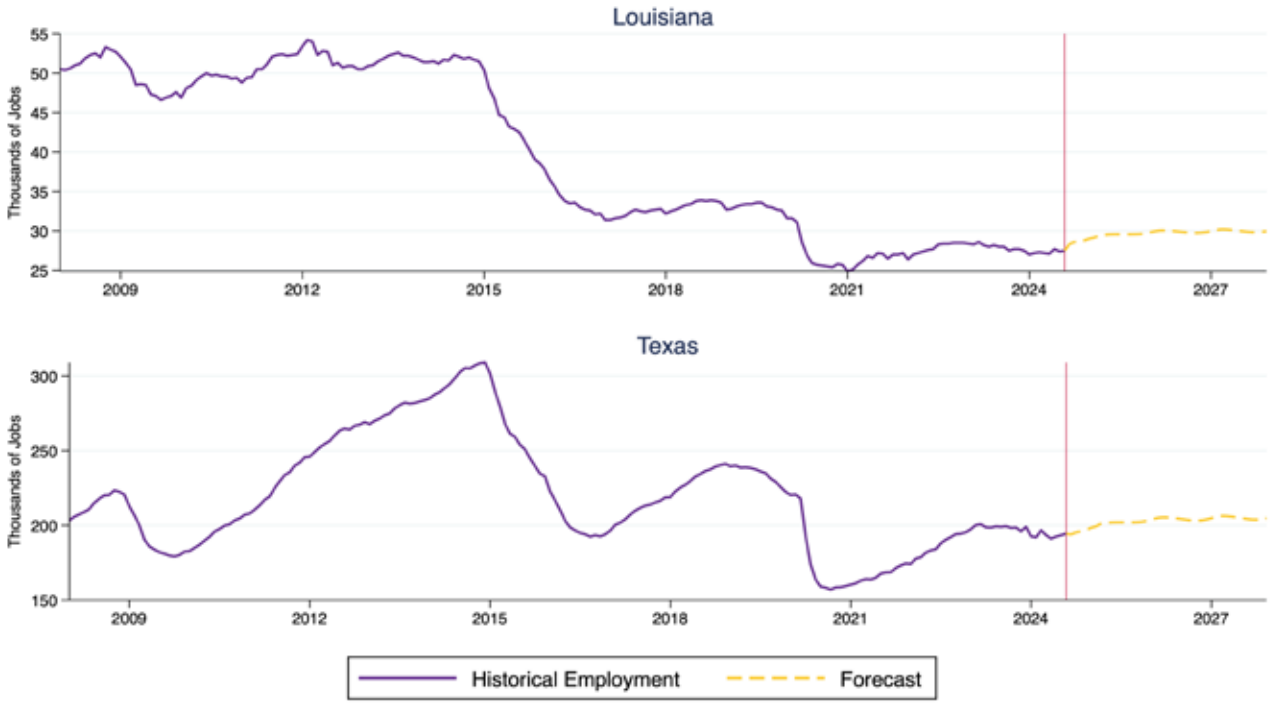
In this final section of the GCEO, prior sections are synthesized into employment forecasts. Employment is forecast within two broad sectors: (1) upstream oil and gas extraction and services and (2) refining and chemical manufacturing. Sectors are identified based on the North American Industry Classification System (NAICS). Upstream oil and gas is defined as including oil and gas extraction (NAICS sector 211) and support activities for mining (NAICS sector 213). Refining and chemical manufacturing employment includes petroleum and coal products manufacturing (NAICS sector 324) and chemical manufacturing (NAICS sector 325).[22] Employment forecasts are produced for each of these aggregated sectors for Texas and Louisiana. Note that recent historical data is subject to future revisions by the U.S. Bureau of Labor Statistics (BLS). Also note that each data series comes out with a lag. The most recent month of complete data available is March 2024. Thus, part of the "forecast" has already occurred; we just have not observed the labor market data. Please also note that past data is revised, and so historical observations themselves can change as revisions become available.

Upstream oil and gas employment for both Louisiana and Texas exhibit three key patterns in historical data shown in Figure 22. The first key pattern is that Louisiana employment growth, pre-2015, was modest relative to the rapid growth in Texas employment. Both states, however, saw a collapse in upstream employment in 2015, when crude oil prices also collapsed, as did rig counts (see Figure 2 in Section 2.1). During the 2015 crash, Texas lost more than 100,000 upstream jobs from peak to trough. Louisiana lost about 18,000 over the same time period. After the 2015 crash, Texas employment climbed back slowly through approximately the end of 2018 before beginning a modest decline. Louisiana upstream employment was approximately flat over this same time period.

The third shock began in early 2020 in response to the COVID-induced economic downturn. Comparing the peak employment experienced in 2019 relative to the post COVID-trough, Louisiana lost ~8,700 jobs in total while Texas lost ~83,000 jobs. On a percentage basis, Louisiana and Texas lost 26 percent and 35 percent, respectively. Thus, not only did Texas lose more jobs, but it also experienced a larger percentage drop relative to Louisiana. As of the most recent estimates (August 2024), the employment levels are still almost 20 percent lower than the pre-pandemic peak in 2019 for both Louisiana and Texas after gaining back ~2,600 and ~37,000 jobs, respectively.

[22] Chemical manufacturing includes many product types, including resins, pesticides, pharmaceuticals, paints, soaps, and others.

Figure 22: Upstream employment forecast



Source: U.S. Bureau of Labor Statistics, Current Employment Statistics. Authors' forecast.

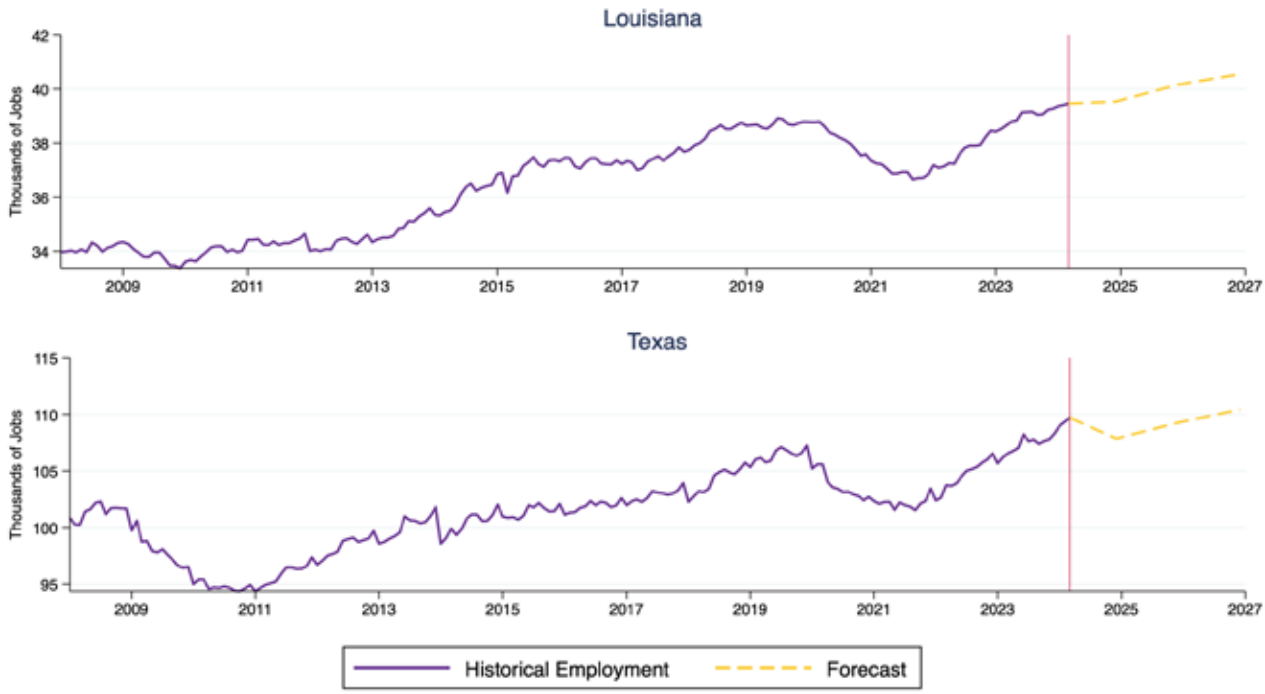
Figure 22 also shows the forecasted employment in the upstream oil and gas sectors for Louisiana and Texas, respectively. Econometric forecasts are based on a combination of the futures markets for oil and natural gas shown in Figure 5, alongside the Enverus ProdCast model outputs shown in Figure 6.

Overall, Louisiana upstream oil and gas employment is forecasted to be flat over the forecast time horizon which extends to the end of 2027. From January to August 2024, current employment data suggests that the sector gained approximately 500 jobs, or about a 1.9 percent increase. The forecast suggests that employment will continue to increase gradually through about the second quarter of 2025, and then start to gradually decline. This is due to the lagged effect of production and prices in coming months. But because prices are in backwardation for both oil and gas, this is anticipated to then lead to a flattening and ultimately slowing of employment through the end of the forecast horizon at the end of 2027. Interestingly, employment at the end of the forecast horizon (December 2027) is about 220 jobs higher than the most recent month of data available (August 2024). Thus, while the forecast shows ups and downs empirically, we interpret this as a relatively flat employment forecast for upstream oil and gas employment in Louisiana through the forecast horizon.

Texas upstream oil and gas has a similar outlook to Louisiana. Employment has grown in 2024 thus far by about 1 percent, and the forecast for Texas also anticipates a peak in Q2 of 2024, before gradually declining, again driven by prices being in backwardation. By the end of the forecast horizon (end of 2027) we anticipate that Texas will actually have 5,000 less jobs, or about a 2.6 percent reduction relative to current levels.

Note that oil and gas production in the Gulf Coast region is anticipated to continue to increase through the forecast horizon while the Texas and Louisiana upstream employment forecasts are relatively flat and even declining through the end of the forecast horizon. This illustrates the continued expected efficiency improvement of the sector.

Figure 23: Refining and chemical manufacturing employment forecast



Source: U.S. Bureau of Labor Statistics, Quarter Census of Employment and Wages. Authors' forecast.

Historical data on refining and chemical manufacturing employment are shown in Figure 22. Both states exhibit two notable trends. First, pre-COVID, both states experienced approximately a decade of growth in these sectors. As discussed throughout, GCEO attributes this employment growth to the investment in these sectors that has facilitated the exporting of products around the globe. Second, both states experienced reductions in refining and chemical manufacturing employment due to the COVID-induced recession, but these employment losses were not as large, both in terms of total numbers and as a share of employment, as experienced in the upstream sector (or the economy overall). From peak to trough, Louisiana and Texas lost approximately 2,300 and 5,700 refining and chemical manufacturing jobs. This is about a 5-to-6 percent reduction in both states (compared to more than 25 percent job losses in upstream employment in each state).

Figure 23 also shows the forecasted employment in the refining and chemical manufacturing sectors. For both Louisiana and Texas, the GCEO forecast is based on the historical relationship between capital expenditures and employment growth alongside our baseline capital expenditures presented in Section 5.

For Louisiana, GCEO anticipates refining and chemical manufacturing employment continues its upward trajectory. The employment level rebounded back to pre-pandemic peak in June 2023 and added approximately 500 additional jobs as of the most recent monthly estimate (March 2024). We estimate 1,200 new jobs have been gained in 2024, an increase of about 3 percent due to continued investment. From 2025 to 2027, GCEO estimates between a 0.7 and 1.2 percent increase in jobs each year; thus, we expect continued growth but at a slower clip than experienced this past year.

Texas refining and chemical manufacturing employment exhibits a similar pattern to Louisiana. As of the most recent estimates, Texas refining and chemicals employment surpassed the pre-pandemic peak, by 2,400 jobs or approximately 2.3 percent. Texas refining and chemical employment is forecasted to increase by approximately 700 jobs in 2025, 1,300 jobs in 2026, and 1,500 jobs in 2027.

8. Conclusions

The 2025 Gulf Coast Energy Outlook (GCEO) presents a cautiously optimistic forecast for the Gulf Coast energy sector. While crude oil and natural gas production are expected to continue growing, decarbonization initiatives, supported by federal subsidies under the IRA and IIJA, offer both opportunities and risks for regional energy manufacturers, especially as global demand for lower-emission products grows. Additionally, electricity's increasing share of energy use and industrial expansion in the Gulf Coast are anticipated to sustain the region's competitive edge.

In Louisiana, upstream oil and gas employment is projected to increase gradually through the second quarter of 2025 from its current levels before declining through the end of the forecast horizon. By December 2027, employment is expected to end up 220 jobs higher than current levels. Texas shows similar early growth patterns but is projected to lose approximately 5,000 jobs (2.6% reduction from current employment) by the end of 2027.

For the refining and chemical manufacturing sectors, both Louisiana and Texas are expected to continue on an upward trajectory. Louisiana's employment in this sector is projected to increase by approximately 3% in 2024, adding around 1,200 new jobs. This growth is expected to continue at a steady, albeit slower, rate of 0.7–1.2% annually from 2025 through 2027. Texas also shows positive trends, with refining and chemical manufacturing employment projected to grow by about 700 jobs in 2025, followed by increases of 1,300 jobs in 2026 and 1,500 jobs in 2027.

The Gulf Coast will continue to be an important regional hub for the manufacturing of hydrocarbon-based products such as liquid fuels, chemicals, polymers, and fertilizers. Oil and gas production will continue to increase, but there will be less workers needed to support this increased production as technology continues to advance. This continued growth will be influenced by growing demand in the developing world and the Gulf Coast region's ability to balance providing these products at competitive cost while also achieving greenhouse gas emissions reduction.

Endnotes

[i] U.S. Energy Information Administration. Annual Energy Outlook 2023. Table 1. Total Energy Supply, Disposition, and Price summary. Total consumption (in quads) in 2033 is anticipated to be within five percent of 2023 total consumption (in quads).

[ii] U.S. Energy Information Administration. U.S. Field Production of Crude Oil (Thousand Barrels per Day). Sourcekey: MCRFPUS2. Comparison of 2023 and 2013.

[iii] U.S. Energy Information Administration. U.S. Natural Gas Gross Withdrawals (MMcf). Sourcekey: N9010US2. Comparison of 2023 and 2013.

[iv] U.S. Energy Information Administration. U.S. energy facts explained. U.S. Primary energy production by major sources, 1950-2023. Renewables accounted for 6.6 quadrillion British Thermal Units in 2013 and 8.4 quadrillion British Thermal Units in 2023, an increase of 28 percent.

[v] Experian Information Solutions. Q2 2024 Automotive Market Trends Report.

[vi] Argonne National Laboratory. Light Duty Electric Vehicles Monthly Sales Updates – Historical Data.

[vii] Energy Information Administration. 2022 Electric Power Annual. Electric Power Monthly Table D.3 Estimated State and Regional Consumption of Electricity from Light-Duty Vehicles, Annual. Federal Highway Administration. Annual Vehicle Distance Traveled in Miles and Related Data – 2022. Assumes 0.37 kWh/mile for short wheelbase vehicles (based on Ford Mustang Mach-E), 0.48 kWh/mile for long wheelbase vehicles (based on Rivian R1T) taken from fueleconomy.gov, and 0.88 charging efficiency factor (according to Car and Driver). Assumes a conversion factor of 0.003412 quadrillion BTU per TWh. Fuel efficiencies of 30 miles/gallon for short wheelbase vehicles (based on a Toyota RAV4) and 19 miles/gallon for long wheelbase vehicles (based on a Ford F-150), as well as a conversion factor of 35.23 kWh/gallon of gasoline, were used to estimate energy usage by internal combustion engine vehicles.

[viii] National Renewable Energy Laboratory (NREL) ResStock Model. Comparison of Baseline and ENERGY STAR heat pump with electric backup scenarios. Assumes a conversion factor of 0.003412 quadrillion BTUs per TWh.

[ix] Electric Power Research Institute. Powering Intelligence: Analyzing Artificial Intelligence and Data Center Energy Consumption. May 2024.

The Center for Energy Studies

The Center for Energy Studies conducts, encourages, and facilitates research and analysis to address energy-related problems or issues affecting Louisiana's economy, environment, and citizenry. The Center's goal is to provide a balanced, objective, and timely treatment of issues with potentially important consequences for Louisiana.

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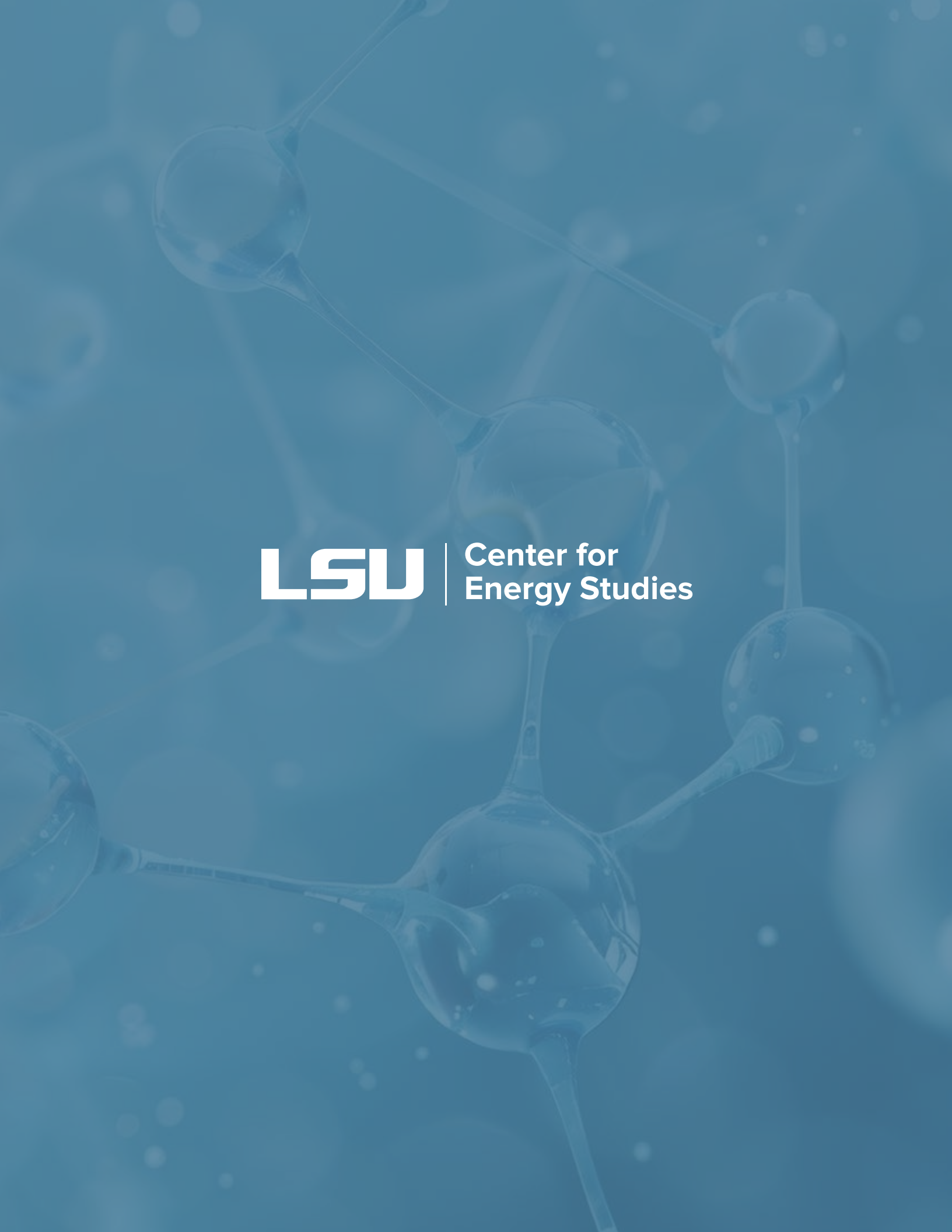
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