

The Declining Significance of the Petrochemical Industry in Louisiana

Tom Sanzillo, Director of Financial Analysis, IEEFA
Suzanne Mattei, Energy Policy Analyst, IEEFA
Abhishek Sinha, Energy Finance Analyst, IEEFA



Contents

Key Findings.....	4
Executive Summary	5
Background.....	7
Louisiana Needs to Build a Stronger Economy	14
Household Income in Louisiana.....	14
Louisiana Demographics: Race and Health.....	15
The Oil, Gas and Petrochemical Industry is Not the Top Economic-Growth Driver in Louisiana That It Once Was	17
The Louisiana Energy Sector, Once a Long-Standing Employment Engine, Now Faces Job Losses.....	23
Louisiana Cannot Rely on the Petrochemical and Oil-and-Gas Sector for Robust Growth: The Sector is Fraught with Increasing Risk.....	25
Risks in Louisiana’s Ethylene and Methanol Markets.....	31
Ethylene’s Central Role in the U.S. Petrochemical Industry Makes It a Useful Bellwether for the State of the Industry—and the Warnings for Louisiana Should Be Heeded	31
Louisiana Ethylene Capacity Faces Under-Utilization.....	34
Producing Methanol From Fossil Fuels in Louisiana is Not a Good Bet.....	38
Petrochemical Policy Priorities in a Time of Shrinking Markets: Federal/State Incentives Are Not Well- Designed to Promote Clean Industry or Local Fiscal Health.....	46
State and Local Tax Breaks	47
Federal Tax Breaks	47
Planning for a Just Energy Alternative	49
Conclusion.....	51
Appendix I: 2020 Existing Capacity, Plus 2030 Louisiana Expansion and 2030 Industry Projection without Louisiana Expansion.....	52
Appendix II: Background on the Petrochemical Industry	53
Appendix III: Ten-Year Tax Relief Calculation	55
About IEEFA.....	57
About the Authors	57

Figures

Figure 1: Map of Louisiana Parishes.....	8
Figure 2: Personal Income Composition.....	15
Figure 3: Louisiana Racial Demographics, 2023.....	15
Figure 4: Share of Louisiana GDP from oil and gas extraction and fossil fuel manufacturing.....	18
Figure 5: Louisiana Economy as a Percentage of United States GDP	18
Figure 6: Louisiana Gross Domestic Product Composition.....	19
Figure 7: Mining, Quarrying and Oil and Gas as a Percentage of Total Louisiana State GDP.....	20
Figure 8: Louisiana Oil Production.....	21
Figure 9: Louisiana State Budget and Mineral Revenues.....	22
Figure 10: Energy Employment in Louisiana, 1970-2018.....	23
Figure 11: Mining, Quarrying & Oil/Gas Extraction Jobs as Percentage of Employment in Louisiana (1997-21).....	24
Figure 12: Global Installed Capacity and Operating Utilization Rates.....	35
Figure 13: Methanol Uses, 2020	39
Figure 14: NAM Cash Costs vs. NEA Spot Prices	45

Tables

Table 1: Selected Companies, Investments in and Tax Exemptions for Petrochemical Projects (2010-2024).....	11
Table 2: Type and Value of Chemicals Investments in Louisiana since 2010	13
Table 3: Ethylene Crackers in Louisiana.....	16
Table 4: Ethylene Actual and Projected Capacity: United States, China and Rest of World (2010 to 2050)	33
Table 5: Principal Current Uses of Methanol, Percentage of Market Share and Emerging Alternatives.....	40
Table 6: Methanol Capacity Trends 2014-2029 with Growth Rates for 2014-2023 and 2023-2029...	42
Table 7: Speculative Industry Capacity Additions to Louisiana Methanol Market through 2030.....	43

Key Findings

Louisiana, once among the nation's most economically strong states, now ranks 49th in GDP and population growth.

The petrochemical industry, once 33% of the state economy, is now 14% and facing an uncertain future.

The two most important drivers of the state's petrochemical industry—ethylene and methanol—are areas that are being proposed for expansion, even as demand is slowing and risk factors mount.

Louisiana needs a new partnership with the private sector that can benefit from the energy transition.



Executive Summary

The decades-long partnership between the state of Louisiana and petrochemical producers is unravelling. The state's economy is showing clear signs of weakness related to petrochemical market deterioration. Global markets are slowing. Lower demand and market shrinkage is certain. Construction costs are higher. Credit agencies have issued warnings, and the number of petrochemical project cancellations and delays is growing. If this misalignment of policy and market direction continues, it is likely to waste billions in taxpayer subsidies, useful land, and other community assets. It is also likely to crowd out development strategies to promote more beneficial, growing business sectors and to address climate change and cut toxic pollution.

Coal, oil and gas, and petrochemical industries were once major contributors to Louisiana's economy, but times have changed. The findings of this report tell the story:

- At the turn of the 21st century, Louisiana had one of the country's fastest-growing economies, placing sixth among the states for five-year average GDP growth. Today, Louisiana ranks 49th out of 50 states in GDP growth. It also ranks 49th in population growth and 45th in median household income.
- In the 1960s, the oil and gas industry accounted for 60% of the state's total revenues. During the late 1990s, it made up 40%. Today, it provides only 4.5% of state funds.
- The oil and gas and petrochemical industry accounted for 33% of the state's GDP at the turn of the century. Today, the percentage figure has dropped by more than half, to 14%.
- The industry has declined in terms of growth, jobs, income and tax revenue. Service-oriented and white-collar employment, rather than the oil and gas and petrochemical industry, is now the leading driver of the state's GDP.
- Development of petrochemical facilities in Louisiana is heavily concentrated in African-American communities. Along the "River Parish corridor" that runs between Baton Rouge and New Orleans, residents have higher incidences of cancer and asthma, and their communities are often collectively dubbed "Cancer Alley."

These trends, signs of deterioration, are likely to continue for several reasons:

- The state economy faces a portfolio of risks from the oil and gas and petrochemical sector.
- Fossil fuel-driven growth is in decline.
- Increases in sustainable products that take the place of fossil fuel-based products are growing.
- Trade disruptions from new geopolitical realignments and increased concerns over environmental and climate factors have driven oil production down.
- China's economic plans will affect U.S. exports. The United States was the second-largest exporter of ethylene in 2022, principally sending to China and Belgium. But China has

already reduced its ethylene imports by roughly 40% since 2018 and is expected to cut imports more.

- Although fracked gas volumes have increased due to more efficient technologies, more fracked gas has neither turned into more profits for companies and investors nor improved Louisiana's fiscal position.

Relying on fossil fuels for future revenues and employment is an increasingly risky proposition. Louisiana business growth over the last decade has shifted from manufacturing to services. As a policy matter, however, the state remains overly reliant on petrochemicals when a more diversified set of policies and incentives is warranted.

Despite the warning signs, Louisiana's economic development tools continue to prop up the industry. Recent governmental and industry pronouncements in Louisiana reveal dozens of expansions and new fossil fuel-driven petrochemical investments. IEEFA has found sufficient information to identify 24 companies with new or expanding projects. IEEFA's list builds upon a list published by the chemical industry. The 24 companies' investments collectively amount to \$82 billion and have benefited from a total of \$6.8 billion in tax exemptions.¹

IEEFA's analysis finds most of these projects are misaligned with markets and risk wasting substantial amounts of taxpayer dollars.

The ethylene and methanol markets are two large areas of proposed expansion and new build projects (accounting for 61% of all companies and projects covered in this report). They illustrate the same downward trend as the Louisiana economy. The ethylene market is the bellwether for the petrochemical industry. It is currently oversupplied, faced with new competitive business lines and technologies, as well as new, complicated and disruptive global geopolitical and trade patterns. The methanol market, a building block industry, faces the same set of risks, plus an advanced set of more mature sustainable competitive alternatives.

A recent report on the state's credit rating by Moody's Ratings made clear that the No. 1 credit need that would increase Louisiana's rating is an economic development direction that would bolster GDP growth.² Moody's also makes clear that although the energy transition is creating decline in fossil fuel development—putting the state government's budget at short-term risk—it is also creating new business opportunities to support new growth.

Louisiana has not yet positioned itself to take full advantage of those opportunities. The state needs a vigorous new economic plan to boost its sagging GDP growth profile.

This paper provides a background description of major trends in the Louisiana economy, including GDP growth, the changing composition of the Louisiana economy, median household income, the

¹ For methodology behind this number see Appendix II: Ten-Year Tax Relief calculation.

² Moody's. State of Louisiana, Credit Opinion. April 1, 2024.

state's fiscal condition and job growth. Section I discusses major risks facing the petrochemical market broadly and where Louisiana fits into the picture. Section II considers the two most important drivers of Louisiana-based petrochemical industry growth plans—ethylene and methanol. Section III sketches a framework for managing decline in the oil and gas and petrochemical sectors, and how the state can work with the private sector to create new partnerships to benefit from the energy transition.

Background

Petrochemicals refer to the broad range of raw materials, commodities, intermediate compounds and finished products that are produced through industrial processes using coal, natural gas or crude oil derivatives as feedstock. Thousands of petrochemical products are typically distributed through commodity markets throughout the globe. (For more background on the industry, see Appendix B.)

With the emergence of sustainability plans by petrochemical and other corporations, a vast array of alternatives to petrochemical end products and replacements for fossil fuels in the production process are growing.³ Renewable energy in the form of wind and solar is beginning to add a critical “green” ingredient to the petrochemical production process. More renewable energy in the petrochemical production process should reduce the carbon emitted by petrochemical production. As explained below, Louisiana's largest electricity consumer is the industrial sector—and its largest source of electricity is natural gas.

Feedstock alternatives to fossil fuels are at varying levels of maturation. It is nevertheless safe to say that almost every petrochemical product that currently relies upon fossil fuels is experiencing competition from sustainably driven fossil-free producers and their product lines. In many instances, petrochemical companies are heavy investors in the processes to grow the alternatives market alongside the fossil-fuel sector's traditional compounds and end products.⁴ Several of these alternatives are discussed in this report, since they have direct bearing on petrochemical companies doing business in Louisiana.

³ IEEFA. [Petrochemical producers remain on a business as usual path in the face of international criticism](#). January 2024.

⁴ Bloomberg. [Exxon will use wind and solar to produce crude oil in Texas](#). November 29, 2018.

Figure 1: Map of Louisiana Parishes

Source: [GIS Geography](#)

Financially, Louisiana benefited handsomely from the growth of the coal, oil and gas, and petrochemical industries through the 1960s. The industry made an enormous contribution not only to Louisiana's economic development but also to the industrial growth of the nation. The communities in which such facilities were located, however, paid a significant price, as the disproportionate levels of cancer, asthma and other respiratory ailments increased. Louisiana has reached a pivotal point that requires the encouragement of growth in new sectors.

Because of its significant past contribution, many believe the coal, oil, gas and petrochemical sectors—now lagging state and national growth metrics—will bounce back. The industry and its

partner companies face a set of risks, however, that make the sectors unlikely to turn around. The new petrochemical buildout envisioned by state economic decision-makers faces strong countervailing market and political forces. The forces have caused the delay, cancellation and weak economic performance upon the opening of facilities in Louisiana and the nation. Several metrics constitute red flags that speak to the cumulative impact of the risks:

- Economic growth—the barometer historically used by petrochemical producers to project sales and new investment—is slowing down worldwide. The fast-growth days for Louisiana and the fossil fuel sector occurred when the global GDP growth rate was 3.2% (2000-10). In China, which drives the petrochemical sector internationally, the average annual GDP rose 10.9% during this period; the U.S. average was 2.0%.⁵ From 2022 to 2050, however, the U.S. Energy Information Administration projects much slower global growth at 2.6%, with China at 3.0% and the United States at 1.9%.⁶
- The previous rapidly growing economy motivated a period of petrochemical buildout to the point of oversupply. A slower economy means slower demand for petrochemicals.⁷
- Sustainability strategies that replace fossil fuels are reducing demand for traditionally sourced ethylene and methanol. Traditional production will face slower demand since it depends on fossil fuel feedstocks and uses fossil fuel-sourced energy power in the production process.⁸
- The industry’s main strategy to reduce carbon footprints—carbon capture and sequestration (CCS)—is unproven and expensive.⁹
- New geopolitical alignments have created disruptive pricing bottlenecks, spurring many countries to hasten reduction of fossil fuel use.¹⁰
- Those same geopolitical alignments and new technologies contribute to a realignment of trading patterns and partners, creating new winners and losers.¹¹
- Credit agencies have issued warnings that new technologies and sustainability patterns are reducing demand for fossil fuels and generating new product and production designs for plastics, particularly single-use plastics. Alternative products are proving cost-competitive. The warnings stem from a host of market-driven project cancellations and delays, as well as weak economic performance when operations do commence in the current market. Shell, for example, has acknowledged weak performance at its Pennsylvania petrochemical plant after being warned the project was misaligned with market forces.¹²

⁵ World Bank. [Growth Domestic Product, Real Growth](#). Last visited September 18, 2024. The measurement here is the Real annual average growth rate.

⁶ United States Energy Information Administration (EIA). [Annual Energy Outlook 2022-2050, International, Macroeconomic GDP](#). Last visited August 5, 2024.

⁷ See Below: Section II A and B.

⁸ See Below: Section II C and D.

⁹ See Below: Section II D.

¹⁰ See Below: See Section II F.

¹¹ See Below: See Section II G.

¹² See Below: See Section II H.

- Community concerns over environmental and climate change impacts are now part of most fossil fuel company risk profiles. Unprecedented opposition in the form of regulatory battles and litigation have altered the risk landscape. Many community-based efforts seek alternative economic development consistent with climate change goals.¹³

As petrochemical companies in Louisiana and around the world confront numerous technological, financial, regulatory and economic risks, most projects must also face the growth of community and other organizational opposition to these projects. As noted throughout this report, various rating agencies have taken note of community opposition and its growing impact as an investment risk.¹⁴ Much of the opposition stems from concern for environmental and carbon risks related to petrochemical development. This opposition is also taking on increasingly complex topics like CCS.¹⁵ The major concern with CCS in Louisiana has focused on an Air Products attempt to create a blue hydrogen hub using the area underneath Lake Maurepas as a depository for carbon captured by Air Products customers. These community concerns have become the backdrop for a set of larger policy questions related to CCS that are being raised globally.¹⁶

The 24 companies that invested \$82 billion in petrochemical projects since 2010, identified in this report, are in various stages of operation, expansion and planning. Of the total investment value, 61% is in ethylene and methanol markets.

Ethylene is considered the bellwether for the health of the broader petrochemical industry. As its fortunes go, so goes the industry. But ethylene is currently demonstrating significant evidence of oversupply, with utilization rates in the low-80% range in the United States, down from the low-90% range in the 2010-15 period. The utilization rates are likely to improve somewhat in the U.S. but will remain in the 70% range worldwide.¹⁷

Methanol, as this report explains, is overbuilt. The number and type of methanol plants already announced would make Louisiana the nation's leader in methanol production capacity. But the size of the proposed new buildout—particularly those employing outmoded technologies—plus the rapid development of renewable methanol make the new build plans for Louisiana extraordinarily risky.¹⁸

The remaining production plans for chemicals and derivatives identified in this study also present risks. We have identified ammonia, methyl methacrylate and industrial gases as next-stage research

¹³ See Below: See Section II I.

¹⁴ Moody's. *Shifting Environmental Agendas*, September 30, 2020 (Proprietary).

¹⁵ WWNO. [Public outcry against carbon capture and in Louisiana is growing](#). January 2, 2024.

¹⁶ In addition to the many questions raised by the United States Government Accountability Office concerning federal support for CCS (see for example GAO, *Carbon Capture and Storage*, GAO-22-105111) several individual projects have been called into question. See: IEEFA. [Shute Creek: World's largest carbon capture facility sells CO2 oil production vents unsold](#). July 2022. Also see: IEEFA. [Middle Arm Gas and Petrochemicals Hub combination of problems makes it unprofitable for business](#). June 14, 2023. Also see: IEEFA. [Carbon capture: A decarbonisation pipe dream](#). September 2022. Also see: IEEFA. [Norway's carbon capture and storage projects augur geological risks in global aspirants to bury carbon dioxide](#). June 14, 2023.

¹⁷ See Below: Section III B.

¹⁸ See Below: Section III C.

projects to examine. All share common risk patterns and are of deep concern to communities seeking viable economic development plans.

The \$82 billion in project investments all benefit from the state's Industrial Tax Exemption Program. IEEFA estimates the total tax exemption for the 10-year period is \$6.8 billion, based on state data.

Table 1: Selected Companies, Investments in and Tax Exemptions for Petrochemical Projects (2010-2024)¹⁹

Company	Investment	First Year Tax Exemption
Advance Refining Technologies, LLC	\$ 215,361,798	\$ 3,282,114
Air Liquide	\$ 424,837,968	\$ 10,151,154
Air Products	\$ 4,373,748,070	\$ 56,534,365
BASF	\$ 2,034,134,851	\$ 29,505,121
CF Industries	\$ 8,303,848,341	\$ 81,696,047
Cornerstone Chemical Company	\$ 128,439,388	\$ 165,227,043
Dow	\$ 1,878,168,467	\$ 26,659,970
ExxonMobil	\$ 3,053,503,242	\$ 18,650,792
Formosa	\$ 9,797,235,523	\$ 155,078,156
Hexlon	\$ 122,979,360	\$ 2,165,640
Huntsman International, LLC	\$ 4,013,026	\$ 63,747
Indorama	\$ 600,094,588	\$ 8,755,329
INEOS	\$ 4,578,015	\$ 70,842

¹⁹ Principal Source: Louisiana Economic Development. [Fast Track, Public Reports. Industrial Tax Exemption Program](#). Last visited June 22, 2024. Also see Louisiana Chemical Association. [Louisiana Chemical Association Shares Chemical Industry Investments and Announced Projects](#). November 2023. List has been adjusted by IEEFA based upon additional research.

Company	Investment	First Year Tax Exemption
Koch Methanols	\$ 1,032,592,544	\$ 16,524,409
Lake Charles	\$ 13,704,220,178	\$ 225,353,058
Linde	\$ 794,176,680	\$ 11,966,923
Lotte Chemical Louisiana LLC	\$ 1,092,949,658	\$ 18,143,540
Matheson	\$ 235,560,890	\$ 3,932,613
Methanix	\$ 2,499,252,227	\$ 8,001,869
Mitsubishi Chemical America, Inc	\$ 1,369,713,757	\$ 16,798,170
Nova Chemical Olefins, LLC	\$ 939,328,219	\$ 15,325,984
Sasol	\$ 20,329,695,951	\$ 352,821,093
Shintech	\$ 6,473,110,459	\$ 66,697,931
Westlake	\$ 2,260,032,257	\$ 34,239,235
	\$ 81,671,575,457.00	\$ 1,327,645,144.00
Total Ten-Year Exemptions		\$ 6,862,711,202

Source: IEEFA from LED and LCS

Table 2: Type and Value of Chemicals Investments in Louisiana since 2010²⁰

Commodity	Investment	Tax Exemption
Acrylonitrile	\$ 128,439,388	\$ 476,251
Ammonia	\$ 12,677,596,411	\$ 81,696,047
Carbon capture and sequestration	\$ 106,726,904	\$ 1,261,512
Chloro Alkali	\$ 7,694,454,018	\$ 84,569,213
Ethylene	\$ 36,797,239,901	\$ 610,612,148
Formaldehyde	\$ 122,979,360	\$ 2,165,640
Industrial gases	\$ 2,161,578,368	\$ 33,872,954
Lubricants	\$ 79,033,751	\$ 1,019,278
Methanol	\$ 14,736,812,722	\$ 241,877,467
Methyl methacrylate	\$ 3,868,965,984	\$ 57,362,530
Methylene diphenyl diisocyanate	\$ 2,354,237,374	\$ 33,669,294
Refining	\$ 1,966,603,603	\$ 30,705,239
Total	\$ 82,694,667,784	\$ 1,179,287,573
Ten-year estimate tax exemption		\$ 6,862,711,202

Source: IEEFA from ICIS database

At the federal level, several projects will benefit from new financial incentives announced under the Inflation Reduction Act (IRA). Closer scrutiny of this course of action in expenditure of taxpayer dollars is warranted.

²⁰ The one project included under the CCS heading reflects ExxonMobil's recent acquisition of Denbury's carbon capture and sequestration project. The main offtakers of the pipeline and CCS process and final disposition of has not been identified.

Louisiana Needs to Build a Stronger Economy

The number of people living in Louisiana is declining. The state's population has dropped by 1.5% since 2018, continuing a trend of decline observed over several decades.²¹ Louisiana's population was 4.57 million in 2023, down from 2020's 4.66 million. Only seven other states experienced a population decline during this period. Overall, the nation's population during the same period rose by 1.0%.²² Louisiana places 49th of the 50 U.S. states in population growth rate.

Louisiana has opportunities to improve its position, but it requires taking a hard look at existing conditions and a willingness to refocus efforts to build a stronger and more stable economy. That means confronting a fundamental shift in the significance of the oil, gas and petrochemical industry within Louisiana's economic base.

Household Income in Louisiana

Louisiana's median household income in 2023 was \$57,650,²³ an increase from the \$39,300 in 2010, rising 4% annually. Its rate of income growth has been comparable to U.S. median household income growth. Nevertheless, the state lagged the national average. The U.S. median household income was \$80,610. In 2023, Louisiana ranked 49th among the states.²⁴

Figure 2 covers changes in source of nominal personal income covering a 20-year period. In 1999, the oil, gas and petrochemical sector accounted for approximately 10% of personal income. By 2022, this share had declined to 8%. Manufacturing also dropped from 7% to 5%. The government sector experienced a decrease in its share by 2%, dropping to 17%. Conversely, the "high-skilled" super-sector—including education & health, professional, information, and financial industries—saw significant expansion, from 29% to 36% (Figure 2).²⁵

²¹ Louisiana Department of Labor. [Louisiana Workforce Information Review 2023](#). Last visited June 25, 2024, p. 10.

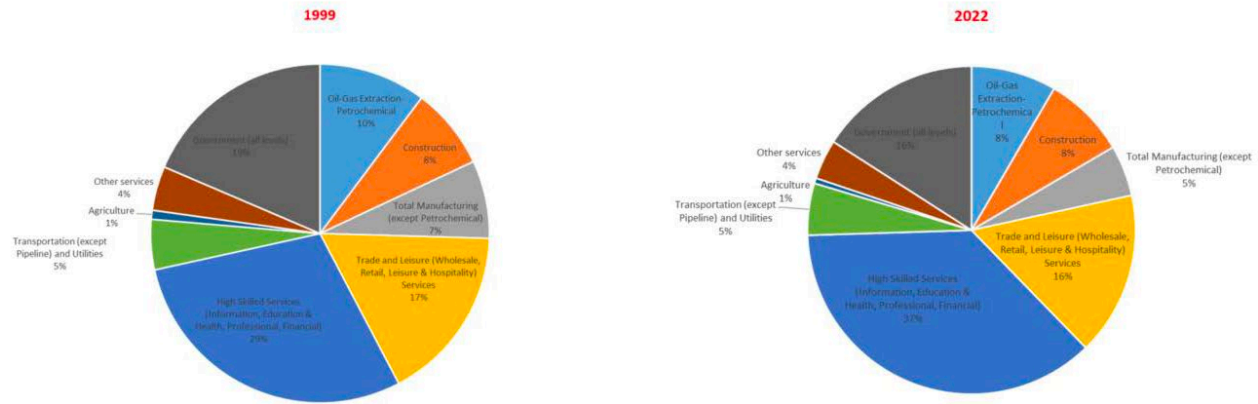
²² United States Census Bureau. [Quick Facts: Louisiana](#). Last visited June 25, 2024.

²³ Statista. [United States Median Household Income by State](#). Last visited October 2024.

²⁴ Statista. [United States Median Household Income by State](#). October 2024.

²⁵ Louisiana Division of Administration. [Executive Budget, FY2024-25](#), p. 5.

Figure 2: Personal Income Composition

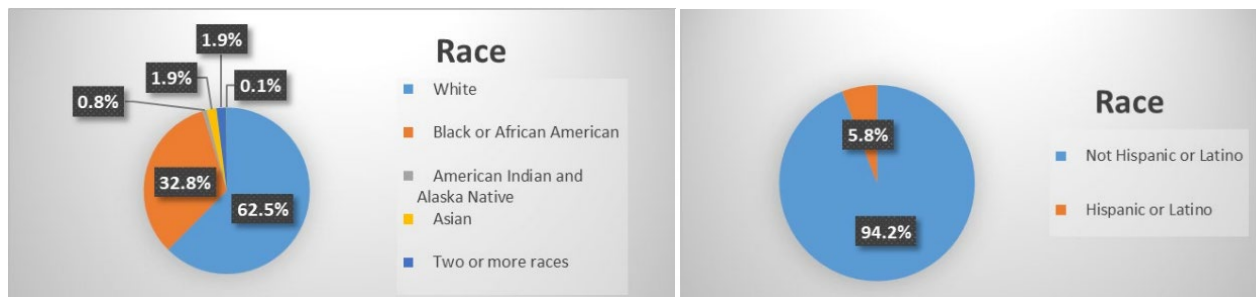


Source: State of Louisiana Executive Budget 2024–2025

Louisiana Demographics: Race and Health

Louisiana is racially diverse. Most Louisiana residents identify as either white (62.5%) or Black/African- American (32.8%), while 5.8% identify as Hispanic or Latino (of any race). (See Figure 3). The demographics of individual parishes and districts within parishes, however, vary significantly.

Figure 3: Louisiana Racial Demographics, 2023



Source: Louisiana Workforce Information Review 2023

Louisiana’s ethylene-producing cracker capacity, fed mostly by ethane from natural gas, is concentrated in six parishes across the southern portion of Louisiana. Eleven companies produce ethylene in Louisiana, with Dow, Westlake, ExxonMobil and Sasol having the largest ethylene presence in the state.

Table 3: Ethylene Crackers in Louisiana

Louisiana Ethylene Producers	Corporate Information	Corporate Headquarters	Location	Capacity (Tons)	Date
Dow Chemical		United States	Plaquemine	570,000	1978
Dow Chemical		United States	Plaquemine	1,055,000	1980
Dow Chemical		United States	St. Charles	590,000	1992
Dow Chemical		United States	St. Charles	390,000	2012
ExxonMobil		United States	East Baton Rouge	1,000,000	1974
Indorama Ventures		Thailand	Calcasieu	440,000	2019
LACC-Lotte-Westlake		Korea	Calcasieu	1,000,000	2019
Louisiana Integrated Polyethelene	Lyondell and Sasol	United States/South Africa	Calcasieu	1,500,000	2019
Louisiana Pigment		United States	Ascension	90,000	2005
Nova Chemicals		Canada	Ascension	885,000	1968
Sasol		South Africa	Calcasieu	455,000	1968
Shell		United Kingdom	St. Charles	635,000	1975
Shell		United Kingdom	St. Charles	840,000	1981
Shintech		United States	Plaquemine	500,000	2020
Westlake Chemical		United States	Calcasieu	660,000	1991
Westlake Chemical		United States	Calcasieu	740,000	1997
				11,350,000	

Source: IEEFA from ICIS database

Of the six parishes faced with the industry's leading projects, three have concentrations of African-Americans that exceed the statewide average of 32.8% (St. James, West Baton Rouge and Red River). The three remaining parishes have concentrations of African-Americans above 20% of the population.

Several research studies have demonstrated the relatively large concentration of African-Americans in communities that house large petrochemical facilities in Louisiana. Residents of these communities

face higher incidences of cancer and respiratory ailments.^{26,27,28} Public health analyses also point out the scarcity of medical services in the communities.²⁹ Such communities bear a disproportionate burden of the impacts from the petrochemical sector.

Moody's has undertaken a broad review of the underlying risks to the United States economy. On race, the credit agency concluded:

Recent events have highlighted the corrosive impact of inequality in the United States (U.S. Aaa, stable) with a particular focus on the long-standing, deeply institutionalized inequality faced by the Black community. In past research, we have noted how income and wealth inequality in the U.S. is both high relative to other highly rated countries and rising, and it could have a negative impact on the US' fiscal, economic and industrial strength. The unequal position of the Black community in the U.S. is a salient and persistent feature of the inequality dynamic that exemplifies and exacerbates credit-relevant social risks.³⁰

The siting of petrochemical facilities is often accompanied by assertions about the sector's economic importance to the state of Louisiana and its host communities, but such arguments are increasingly inconsistent with the facts about Louisiana's business base.

The Oil, Gas and Petrochemical Industry is Not the Top Economic-Growth Driver in Louisiana That It Once Was

Fossil fuel energy and manufacturing has long been a cornerstone of Louisiana's economy, enduring market cycles for more than a century. From 2008 to 2017, the industry contributed an average of 16% to Louisiana's economic output annually, according to the U.S. Bureau of Economic Analysis. Although this is a significant share, it is only half of what it was in the 1980s (see Figure 4). When adjusted for inflation, the combined output of Louisiana's energy sector peaked at more than \$80 billion annually in the early 1980s, dropped to around \$70 billion by 2005, and plunged to \$28 billion in 2017.³¹

²⁶ Denka, Inc. has been identified as the company producing one of the products with an exceptionally high carcinogenic impact. Louisiana has five parishes that constitute the areas with highest cancer concentrations in the country. The U.S. Environmental Protection Agency (EPA) has cited Denka as a leading emitter of carcinogens in the area. See: EPA. [LaPlace Louisiana Frequently Asked Questions](#). See final question: what are the highest NATA cancer risk areas in the USA?

Last visited October 12, 2024. Also see U.S. Department of Justice. [DOJ files complaint alleging public health endangerment caused by Denka](#). Last visited October 12, 2024. The company produces chloroprene.

²⁷ Very Well Health. [What is Cancer Alley](#). August 2023.

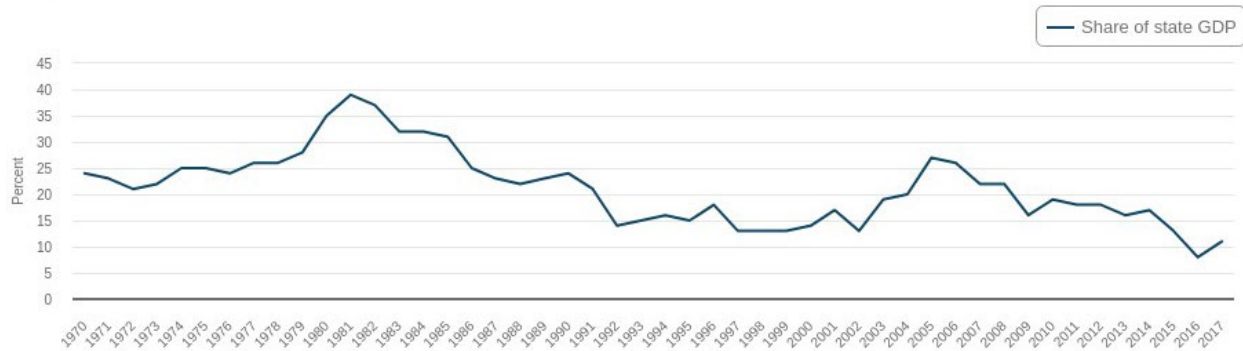
²⁸ Ann Martin-Anjaly. [The toxic toll of Cancer Alley](#). April 20, 2023.

²⁹ [Ibid.](#)

³⁰ Moody's Investor Services, General Principles for Assessing Environmental, Social and Governance Risks Methodology, Cross Sector Rating Methodology. December 14, 2020.

³¹ The steady downward trajectory of the oil and gas sector in Louisiana from 1980 to the present is reflected in the industry's broader stock market position. The energy sector (oil and gas) in 1980 equaled 28% of the Standard and Poor's 500 index. Today it constitutes 3.3%. See Standard and Poor's 500 Index. [USD Fact Sheet](#). September 30, 2024.

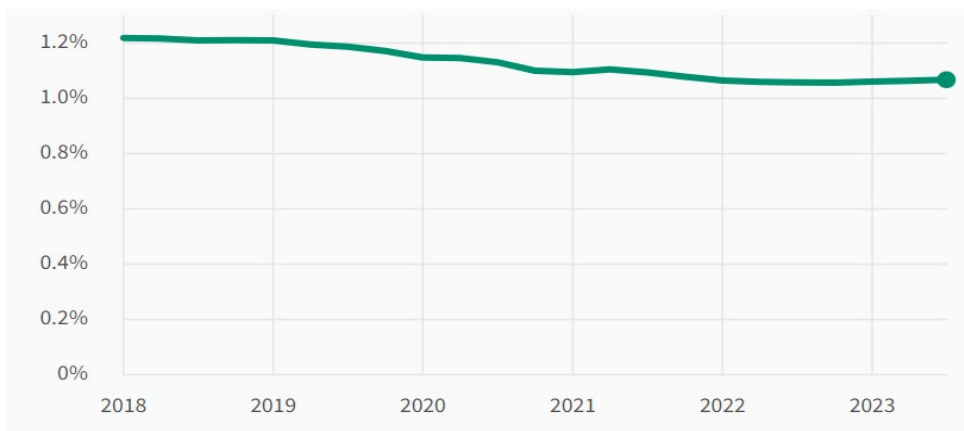
Figure 4: Share of Louisiana GDP from Oil and Gas Extraction and Fossil Fuel Manufacturing³²



Source: U.S. Bureau of Economic Analysis
 Source: U.S. Bureau of Economic Analysis

Louisiana remains a major player in oil and gas production, refining, and petrochemicals manufacturing. The state’s natural gas production is third in the nation behind Texas and Pennsylvania,³³ and second behind Texas for oil production.³⁴ Louisiana ranks 27th in the size of its economy and accounts for 1.1% of the U.S. economy.³⁵ Its relative contribution to the national GDP, however, has declined over the past five years.

Figure 5: Louisiana Economy as a Percentage of United States GDP³⁶



Source: Bureau of Economic Analysis

From 2000-05, Louisiana posted a 3.9% average annual increase in its GDP, significantly higher than the nation’s 2.6% increase during that period.³⁷ Its GDP growth rate was sixth-highest in the nation.

³² Federal Reserve Bank of Atlanta. [Over a century of ups and downs, Louisiana remains tied to energy](#). June 18, 2020 (hereafter, “Atlanta”).

³³ DNR, [Louisiana Energy Facts Annual, 2022 U.S. States Marketed Gas Production](#), p. 18, Figure 5.

³⁴ DNR, p. 9, Figure 2.

³⁵ USA Facts. [What is the current state of Louisiana economy](#). Last visited October 2024 (hereafter, “Current”).

³⁶ [Current](#). Last visited October 2024.

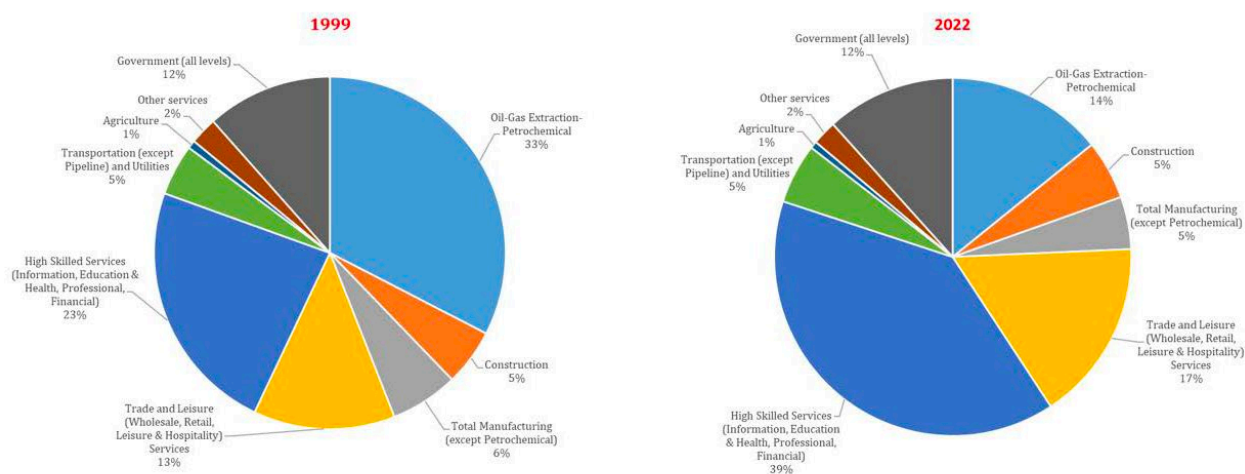
³⁷ U.S. Bureau of Economic Analysis. [SASummary annual summary statistics: Personal income, GDP, consumer spending, price indexes and employment. Interactive Data 2000-05](#). Last visited June 28, 2024.

During 2018-23, in contrast, Louisiana ranked 49th with an average increase of 0.3%.^{38,39} The national GDP over the same period rose an average of 2.3%.⁴⁰

These general declines are reflected in the data that measures the Louisiana economy. Most noticeably (see Figure 6), the state's petrochemical and manufacturing sectors have experienced declines while other sectors have grown.

From 1999 to 2022, the oil/gas extraction and petrochemical sectors declined from 33% of the GDP to 14%, the largest decrease of any industry in the state.⁴¹ The manufacturing sector without petrochemicals has also experienced some decline.⁴² The overall decline in the sectors is representative of the changing nature of the economy.⁴³ High-skilled services have increased substantially, from 23% to 39% of the GDP during the same period.

Figure 6: Louisiana Gross Domestic Product Composition⁴⁴



Source: *State of Louisiana Executive Budget 2024–2025*

The petrochemical and oil and gas industries are inextricably linked (See Figure 7). A more specific accounting of the oil and gas and extractive industries, however, reflects the downward pressure placed on the state economy by the fossil fuel sector. The oil and gas sector accounted for more than 12% of the state's GDP in the early 2000s; now, it accounts for 4%.

³⁸ *Ibid.*

³⁹ Statista. [Real Gross domestic product of Louisiana in the united States, 2000-2023](#), Louisiana (Compound annual growth rate between any two periods). June 15, 2024.

⁴⁰ Macrotrends. [U.S. GDP Trends 1960-2024](#). Last visited June 25, 2024.

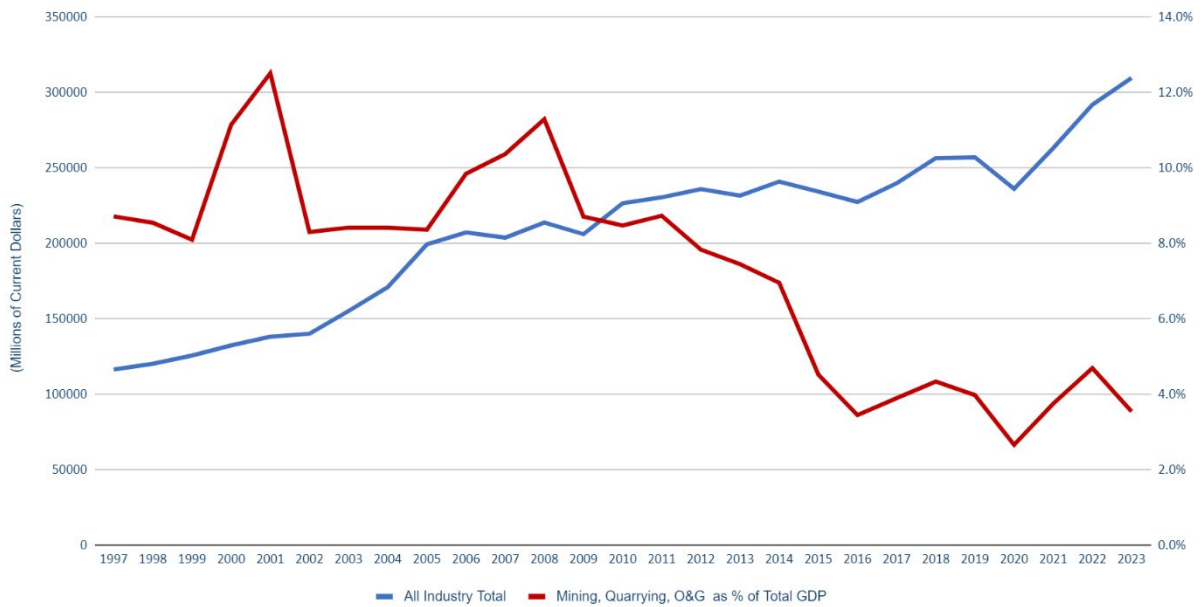
⁴¹ Louisiana Division of Administration. [2024-2025 Executive Budget](#), February 2024 (hereafter, "[Executive Budget](#)"), p. 4.

⁴² [Executive Budget](#), p. 4. According to the Manufacturing Partnership of Louisiana (MPL), chemical manufacturers and coal and petroleum products constitute the largest subsectors, followed by machinery and fabricated metals and food manufacturers. See: Louisiana Community and Technical College System Manufacturing Extension Partnership of Louisiana (LCTCS MEP of LA). [General Economics and Manufacturing Performance](#). Last visited June 19, 2024.

⁴³ *Ibid.*

⁴⁴ *Ibid.*

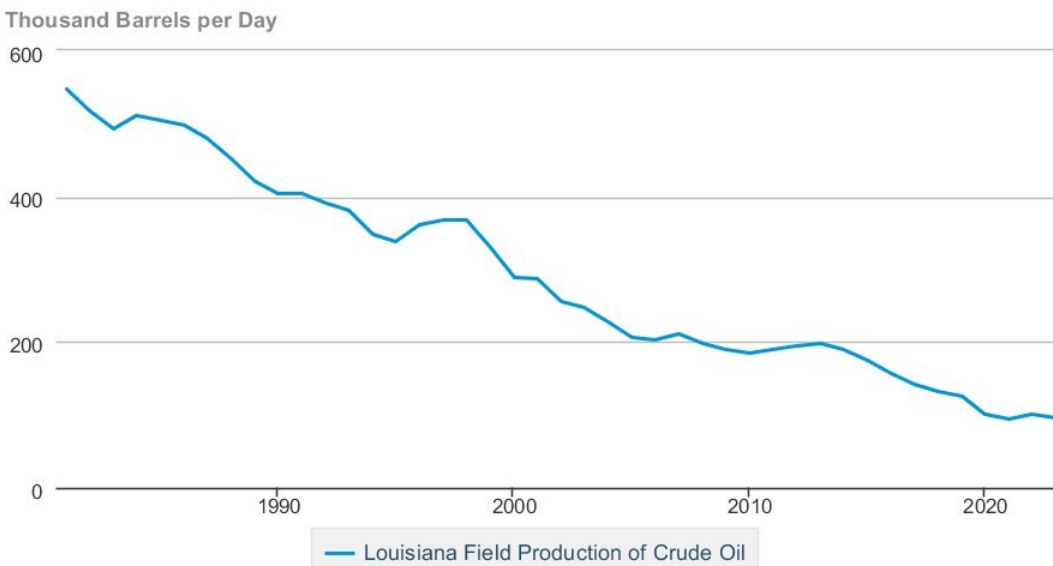
Figure 7: Mining, Quarrying and Oil and Gas as a Percentage of Total Louisiana State GDP⁴⁵



Source: BEA

Mineral revenues that support the state of Louisiana’s annual budget, once a significant portion of total state revenues, have experienced a downward trend, primarily due to the state’s longer-term decline in oil production (See Figure 8).

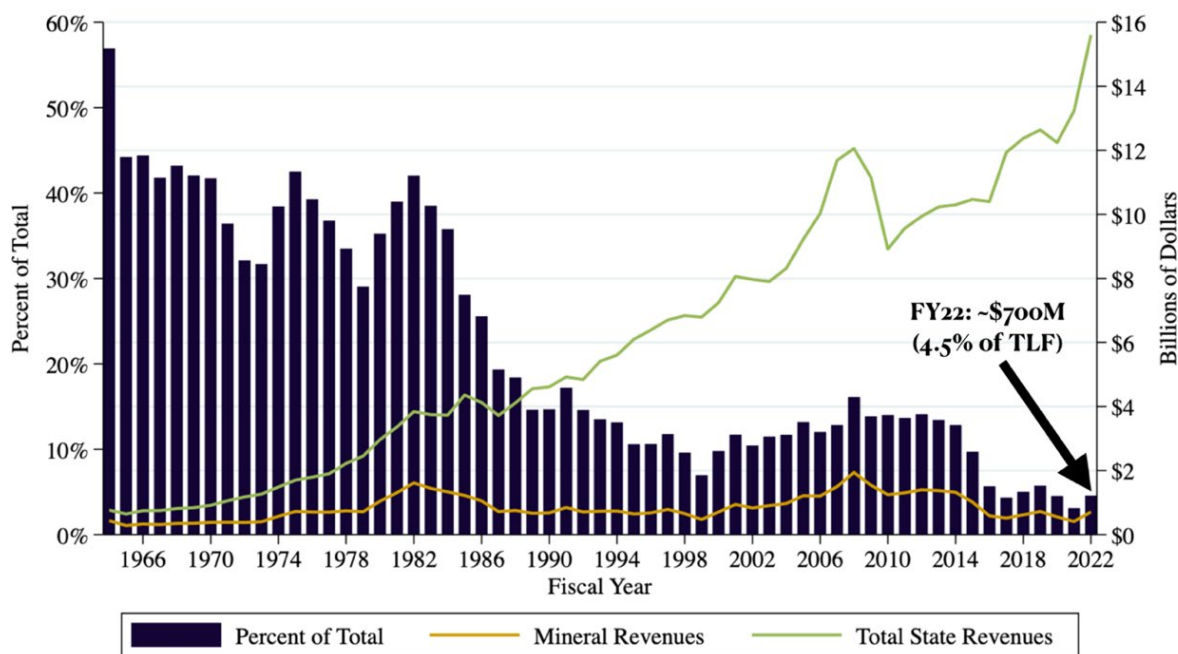
⁴⁵ BEA, [Regional Data](#). Last visited May 23, 2024.

Figure 8: Louisiana Oil Production⁴⁶

Source: U.S. Energy Information Administration

Despite general economic growth and inflation, the relative contribution of mineral revenues from severance taxes, royalty payments, and other fees from oil and natural gas production to Louisiana's total state revenues has been steadily declining. The story of mineral revenues has two parts: From the 1960s through the early 1980s, mineral revenues accounted for between 30% and 40% of the state revenues in the annual budget. (Prior to this period, mineral revenues hovered closer to 60% of revenues.) Since then, however, mineral revenues have accounted for less than 10% of state revenues. In recent years, mineral revenues accounted for as little as 4.5% of total state taxes, licenses, and fees—indicating a significant decline relative to historical standards. (See Figure 9.)

⁴⁶ U.S. Energy Information Administration (EIA). [Louisiana Oil Production](#). Last visited June 25, 2024.

Figure 9: Louisiana State Budget and Mineral Revenues⁴⁷

Source: *Mineral Revenues in Louisiana*. LSU Center for Energy Studies.

Louisiana's revenue deficit follows the much broader decline in oil and gas company investment performance over the same period. From 1980 to the present, the energy (oil and gas) sector of the stock market has declined from 28.6% to where it stands now on Sep. 30, 2024, at 3.3%.⁴⁸ The energy sector hit bottom at 2% in October 2021. The relative improvement since then is connected to the Russian invasion of Ukraine.⁴⁹

While the overall state GDP has decreased slightly, the internal composition of Louisiana's GDP has changed significantly. Skilled services, trade and leisure sectors of the economy have grown as the petrochemical sector has declined and manufacturing has remained flat. Between 2019 and 2024, arts and recreation (4.7%), professional, scientific and technical services (+2.5), administration (+1.7%), management of companies (5.4%), and healthcare (+4.2%) increased their contribution to GDP. In contrast, construction (-4.6%), manufacturing (-4.0%), mining (-2.6%), and agriculture (-3.7) decreased their share of GDP.⁵⁰ Employment in construction, manufacturing and mining all decreased during the period.⁵¹

⁴⁷ Center for Energy Studies. [Overview of Mineral Revenues](#). November 30, 2022, p. 4.

⁴⁸ Sibilis, Standard and Poor's 500 Sector Weightings. (Proprietary.) Also see: S&P Global. [SP 500 Index, Fact Sheet](#). S&P 500 (USD) Fact Sheet, September 30, 2024.

⁴⁹ The Executive Budget acknowledges the underlying cause of the increase in oil prices and its forward projections that now lower the price of oil to reflect a relative stabilization. The forward-looking prices per barrel are in the \$70s, down from \$87 per barrel in FY 2021-22.

⁵⁰ IBIS. [Louisiana Sector Statistics](#). Last visited June 14, 2024.

⁵¹ *ibid.*

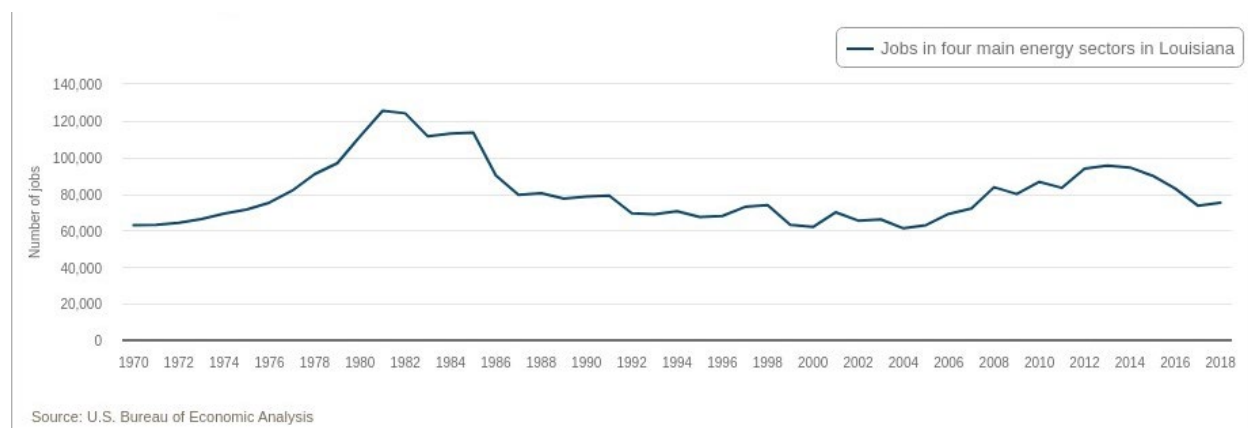
Despite the slower growth of the manufacturing subsector, chemical manufacturers have managed to grow at a rate of 2.5% annually since 2016. This growth rate for chemical manufacturing, which is a subsector of manufacturing, has been superior to other parts of Louisiana’s manufacturing subsectors—such as petroleum products, machinery and fabricated machinery and food production—which all have experienced double-digit declines during the period.

The oil and gas and petrochemical sectors are in a long period of decline (See Section III). The oil and gas sector has underperformed the market for most of the past decade, experiencing sharp growth only in response to Russia’s invasion of Ukraine. The underperformance stems from rising competition in each of the oil and gas and petrochemical sectors, an oversupply of oil and gas, and a realignment of political and trade blocks. As a result, Louisiana remains a leader in the petrochemical and oil and gas industry, but is still beset by a declining population, subpar income levels and weak economic growth.⁵²

The Louisiana Energy Sector, Once a Long-Standing Employment Engine, Now Faces Job Losses

Employment in Louisiana’s energy sector has experienced significant declines. It reached more than 120,000 jobs in the early 1980s, but has since dropped to approximately 75,000, with many of those positions serving clients outside the state (Figure 10).⁵³

Figure 10: Energy Employment in Louisiana, 1970-2018



Source: U.S. Bureau of Economic Analysis

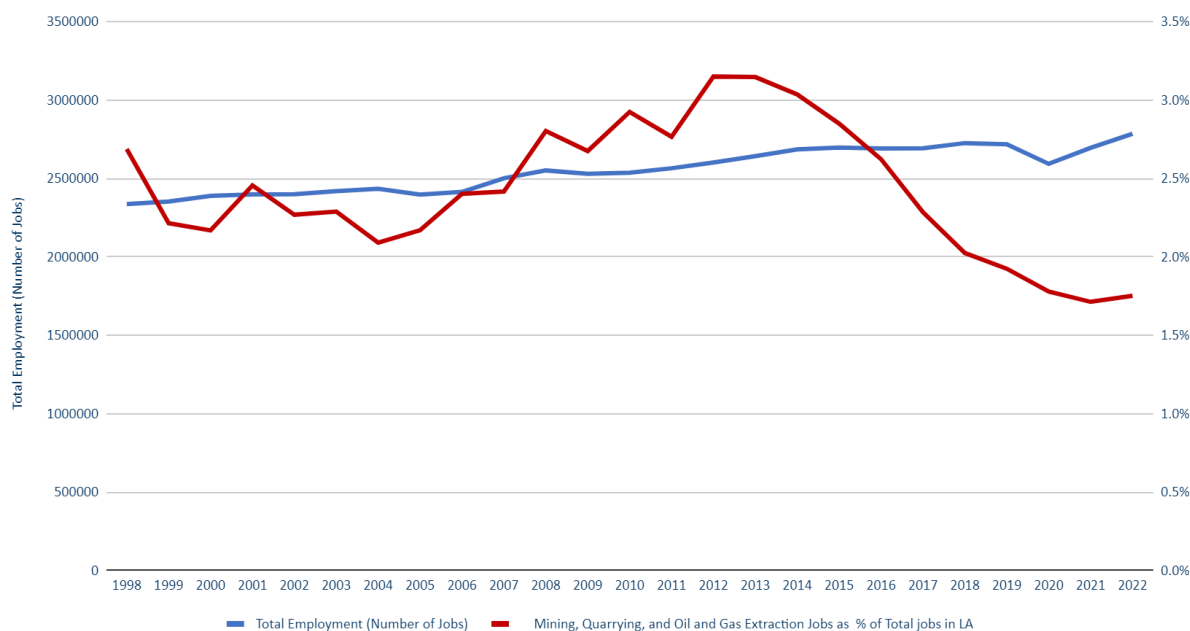
The declining trajectories of the oil and gas and petrochemical areas are reflected in the complex picture of job growth in the sectors. Mining, quarrying and extractive oil and gas jobs followed

⁵² IEEFA. [Two economies collide: Competition, conflict, cooperation and the financial case for fossil fuel divestment](#). October 2022.

⁵³ Atlanta.

manufacturing jobs with growth rates reduced from 3.0% to 1.5% from 1997 to 2021. The decline in the sector occurred even though the total rate of employment increased in the state.

Figure 11: Mining, Quarrying & Oil/Gas Extraction Jobs as Percentage of Employment in Louisiana (1997-21)⁵⁴



Source: BEA

In summary, while the oil, gas and petrochemical sector remains a significant part of Louisiana's industrial base, its role as a primary driver of the state economy is diminishing. The oil and gas industry is facing competitive challenges in each of its traditional markets—power generation, transportation and petrochemicals. The petrochemical producers in Louisiana have enjoyed the benefit of low-cost fracked gas but changing markets have eroded this advantage. The instability and volatility of fossil fuel prices have reduced the status of Louisiana's oil and gas industry as a major contributor to its revenue base and fiscal stability. The question is no longer whether low-cost petrochemical products can compete in the market. The question now is who will buy products with high carbon content.

Recent attempts to roll back successful reforms of Louisiana's industrial tax incentive program ignore today's realities.⁵⁵ The reforms granted local governments a stronger voice when industrial projects (generally petrochemical or oil-and-gas developments) sought to avoid paying local taxes.⁵⁶

⁵⁴ BEA, [Regional Data](#). Last visited May 23, 2024.

⁵⁵ Ryan.com, [Louisiana Industrial Tax Exemption Program](#), March 2024.

⁵⁶ IEEFA.org, [Louisiana Industrial Tax Exemption Program: 2016 reforms net parish governments \\$282 million](#), October 2022.

Questions about the benefits of oil and gas development, coupled with concerns about growing market risks require more public disclosure during this time of significant change.

The state must adapt to this evolving landscape by fostering growth in emerging sectors and investing in sustainable energy solutions.⁵⁷

Louisiana Cannot Rely on the Petrochemical and Oil-and-Gas Sector for Robust Growth: The Sector is Fraught with Increasing Risk

The global oil, gas, coal and petrochemical markets, despite their decline, are still important.⁵⁸ The oil and gas and petrochemical sector is still an important Louisiana industry as well, despite its diminished contribution to state GDP, tax revenues to the budget and job growth, and despite the emerging competitive impact of sustainable alternative markets in Louisiana.

The industry is, however, declining in significance. The oil and gas side of the equation is in decline due to the size and quality of future economic growth. The oil and gas industry's response, including its pivot toward petrochemicals, faces substantial challenges—and those challenges are Louisiana's challenge.

The state has historically supported the industry with lenient environmental regulation and generous financial incentives,⁵⁹ but the partnership between the state and the industry is unraveling.

Over the last decade, Louisiana's policy incentives have been enhanced by an abundant supply of cheap natural gas from fracking. Cheap natural gas serves as a feedstock for petrochemical production and a competitively priced energy source for power generation used in the production process. The existing legacy oil, gas and petrochemical investments in the state benefited from the surge in new gas extraction. Most companies allocated capital to expand upstream and downstream projects. The upstream production surge, however, was not met with increased profits for fossil fuel producers as natural gas oversupply drove prices and extraction margins down.⁶⁰

The relative shift in priorities from oil and gas extraction to petrochemicals is fraught. The risk profile is complicated, but the weak financial performance is clear. More importantly, the warning signs are increasingly hard to ignore.

⁵⁷ Dailycomet.com. [Industry report highlights oils value Louisiana economy](#). October 14, 2014.

⁵⁸ ICIS. [Global ethylene capacity would need to contract by 90% from ICIS base case](#). January 2024.

⁵⁹ Bloomberg.com. [A plastics giant that pollutes too much at home expands in America](#). December 12, 2019.

⁶⁰ Wall Street Journal. [Wall Street tells frackers to stop counting barrels and start counting Cash](#). December 13, 2017.

The steady decline of the oil and gas sector that Louisiana has already experienced over the last decade, one could argue, should be warning enough. A review of current market conditions, however, reveals an even deeper set of risks:

- A. Global GDP growth is expected to slow. The annual GDP during 2010-20 was 2.8% annually.⁶¹ During that time, China's GDP grew by 7.1% and the United States, 1.8% annually.⁶² As noted above, the EIA projects a global GDP growth from 2021-50 at 2.6% annually, with China expected to grow by 3% and the United States by 1.9%.⁶³ The direct connection between economic growth and petrochemicals stems in part from the fact that most petrochemical products are tied to new economic activity in the construction, automotive, medical and consumer/retail sectors. Companies plan petrochemical facilities in some relation to GDP growth. Many assume future growth will be tied to GDP growth or a multiple of it.⁶⁴ A slowdown in economic growth decreases demand, as well as revenues, margins and payouts to investors. China's economic decline is of note since it is the leading producer of petrochemicals in the world.⁶⁵
- B. With slower economic growth, any new capacity added to the market is likely to be absorbed more slowly, which reduces the return on equity metric used by most companies.

The best example relates to Chinese petrochemical growth. From 1992 through 2021, the Chinese economy averaged double-digit annual growth, extraordinary by most historical standards. The country's rate of ethylene cracker capacity growth was in the high single digits. Since the Chinese economy is expected to grow only by low single digits this year and beyond, its ethylene market growth is expected to slow down as well—and with it, the rate of new cracker buildout. Any capacity growth that may occur is likely to stem from domestic economic policy pressures or market rationalizations.⁶⁶

Since China is such a large part of the world's markets, when it shifts course, smaller trading partners change plans. The companies and countries that depend on petrochemical production, and the supporting commodity markets, must alter their plans for new capacity, products and revenue mixes in light of China's shift in petrochemical activity.

- C. The slowdown in economic growth is taking place at the same time new policies are changing the quality of economic growth.⁶⁷ Many nations are adopting planning tools—taxonomies that help to clarify the quality of economic change taking place. Climate change concerns are moving these taxonomy tools to emphasize sustainability in economic growth policy and strategies. The key is to identify the carbon exposure of the economy and the high-emitting companies, and adopt measures to decrease or eliminate that exposure, usually through policies that reward new investment that promotes less dependency on fossil

⁶¹ Statisticstimes.com. [United States versus China GDP](#). Last visited October 12, 2024. Also see: Macrotrends. [World GDP Growth Rate](#). Last visited October 12, 2024.

⁶² Statisticstimes.com. [United States versus China GDP](#). Last visited October 12, 2024.

⁶³ United States Energy Information Administration. [2023 Annual Energy Outlook, International/Macroeconomics](#). Last visited July 22, 2024.

⁶⁴ ExxonMobil. [Investor Day 2022](#), March 2, 2022, p. 38. ExxonMobil assumes that petrochemical growth will increase at twice the rate of global GDP.

⁶⁵ Bloomberg. [How China's faltering economic growth threatens to derail commodities markets](#). August 8, 2023.

⁶⁶ ICIS. [China Chemicals self-sufficiency may still increase despite the cap on refinery capacity](#). June 25, 2024.

⁶⁷ Illuminator.com. [Analysts expect Louisiana oil and gas sector to shrink or pivot to clean fuels](#). June 1, 2023.

fuels.

Every major petrochemical company in Louisiana must participate in global trade, and all have sustainability plans. The 24 petrochemical companies identified in this report face significant sustainability-related pressures. What they produce in the United States must meet U.S. standards, but also must be marketable in a host of other countries where the rules governing the size and content of products vary.

- D. The policy alterations supporting entirely new business lines have spurred new technologies that challenge the market position of existing assets. The new business lines are cutting into upstream market share and rendering obsolete large swaths of new petrochemical capacity organized along traditional fossil fuel industry production designs. For example, growing support for electric vehicle production is cutting into oil extraction plans. ExxonMobil CEO Darren Woods projected in 2022 that by 2040, no new internal combustion engines would be produced.⁶⁸ ExxonMobil and the rest of the industry will need to rethink the uses of oil. Since roughly 41% of a barrel of oil in the United States is used for motor gasoline in transportation,⁶⁹ the pending vehicle market change alone has vast implications for oil refineries and chemical production.
- E. Recognizing that oil and gas demand will likely decline, major oil and gas producers are responding with new financial strategies. Some are increasing their payouts to shareholders instead of investing in new fossil fuel projects.⁷⁰ This approach reverses a major investment thesis of the oil and gas industry that has been held for decades: For each barrel of oil and gas extracted and sold annually, companies would reinvest revenue to replace the reserve reduction on a one-to-one, barrel-for-barrel annual basis. The reinvestment strategy had been deemed prudent, based on the belief that GDP and oil and gas growth are inextricable.⁷¹ Higher cash payouts to investors in the current environment indicate the oil and gas industry acknowledges that most investors could and would do better investing in broader market opportunities. Louisiana's offshore rig count has plummeted from 181 in 2004 to just 40 today.⁷²
- F. The disruptive impact from market competition is occurring as new political alignments are increasing political conflict among producers. Since more than three-quarters of the world's oil-and-gas supply is owned and operated by governments, this aspect of market competition has significant geopolitical overtones. Fracking propelled the United States into a leadership position in the world, replacing Saudi Arabia and Russia. As the flood of oil and natural gas hit the market and drove prices down, these countries found their weakened revenues mushroomed into looming fiscal deficits, making state rulers more vulnerable to a challenge to their political legitimacy. Several political responses have occurred over the last decade that severely disrupted the market. The most notable occurred when Russia invaded Ukraine. While the overt rationale was tied to national historical grievances, Ukraine's critical role in

⁶⁸ The Daily Financial Trends. [Exxon Mobil CEO—By 2040, every new passenger car will be electric](#). June 26, 2022.

⁶⁹ EIA. [Oil and petroleum products explained: Use of oil](#). Last updated August 20, 2023. The EIA differentiates between motor gasoline used in transportation as opposed to industry or residential uses such as lawnmowers and other power equipment, clarifying that 43% of a barrel of oil is used to make motor gasoline, 96% of which is used in transportation.

⁷⁰ S&P Global. [Global oil and gas winners through the lens of dividends](#). January 2023.

⁷¹ Steven Coll. *Private Empire: ExxonMobil and American Power*. New York. 2013.

⁷² Louisiana Department of Natural Resources. [Weekly Rig Count](#). Last visited October 24, 2024.

Russia's fossil fuel value chain has been a thorn in Russia's side for decades.⁷³ Russia's move caused oil and gas prices to skyrocket, enriching oil and gas-producing nations and catapulting the entire energy sector from the bottom of the stock market to the top in 2021 and 2022. In 2024, the industry has by and large returned to its market lagging position near the bottom of the stock market.⁷⁴

This unsustainable market event has been used by oil and gas interests to assert the industry is back. Since the initial price shock, however, the industry has found itself struggling again to improve its position in financial markets. The oil and gas sector stock performances have been below the market average since 2022.⁷⁵

- G. The current global political environment has major implications for global power bloc formations and ongoing trade relations. China plays a dominant role in global petrochemical production, exports and imports. Due to domestic and international pressures, the Chinese government appears to be adopting a position that maximizes its productive capacity for domestic needs.⁷⁶ In part, this approach is repositioning its plans for imports and exports and disrupting established trade patterns. Limiting its imports of ethylene and other petrochemical products alters the export plans for many nations, causing a redirection of that productive capacity into a smaller world market. The oversupply upends the market, weakens several export countries and disrupts the plans for companies planning new capacity, as the global markets have been reshaped. Right now, there is rare political consensus in the United States that trade relations with China will remain contentious.⁷⁷ These trade bloc realignments create uncertainty for companies like Formosa, Air Products, Koch, Methanex and Mitsubishi.⁷⁸ Each of the companies plan to add capacity in Louisiana. The state, which remains an export powerhouse in the United States—with China as its lead market and petroleum and petroleum related products as its leading exports—is vulnerable to these uncertainties.⁷⁹
- H. Credit agencies have issued warnings to the petrochemical sector that reflect these risks. The global poster child can be found in the warnings issued about the proposed Formosa petrochemical plant in St. James Parish, La. In 2021 and again in 2023, Standard and Poor's issued a warning to Formosa that its planned project was problematic and was undermining the company's credit position.⁸⁰

The credit warning reissued in 2023 crystallizes the risks facing new petrochemical facilities. Formosa's proposed facility would produce ethylene and polyethylene for sale domestically and internationally in the single-use plastics market. The credit agency points out that markets for these products are likely to be less robust than anticipated, noting that more

⁷³ Agnia Grigas. *The Geopolitics of Natural Gas*. Harvard: 2017.

⁷⁴ Yardeni. [S&P 500 Sectors](#). Last visited October 11, 2024.

⁷⁵ Fidelity. [Sector Performance as of August 14, 2024](#). The Standard and Poor's 500-stock index has increased by 180.2% over the last 10 years. Energy stock performance decreased by 1.83%. Over the past 10 years, the energy sector is the poorest performing sector in the stock market.

⁷⁶ ICIS. [China Chemicals Self Sufficiency](#). June 25, 2024.

⁷⁷ The Guardian. [Capitol Hill finds rare bipartisan cause in China – but it could pose problems](#). February 26, 2023.

⁷⁸ Advocate.com. [Why a trade war with China could disrupt billions in commerce from Louisiana](#). April 6, 2018.

⁷⁹ International Trade Administration. [State Economy and Trade Factsheets, Louisiana](#). June 2024.

⁸⁰ Standard and Poor's. [Formosa Four Company Credit Opinion](#). October 2023. See also: Standard & Poor's, [Research Update](#), October 2024.

reliable petrochemical markets are likely to be found in producing plastics to serve emerging new sustainable product lines, such as electric vehicles.

In its rating analysis, Standard and Poor's also noted the political pressure on Formosa. The credit agency did not specify the pressures, but the St. James project has been the subject of strong opposition by community groups. The organizing efforts have made inroads in formal venues, obtaining a new environmental review by the Army Corps of Engineers,⁸¹ which is still pending. Less formal, but nevertheless impactful, President Biden took note of "Cancer Alley"—referring to the concentration of cancer incidence near petrochemical plants in Louisiana's southeast corridor—in remarks before signing a series of executive actions on climate and environmental initiatives in his first month in office.⁸²

The Standard and Poor's credit opinion extends beyond Formosa and Louisiana. The credit agency made clear that the risks facing Formosa in Louisiana were driven by global pressures that would impair the outlook for any future mega-petrochemical complex, stating:

We believe the four companies (referring to Formosa's related companies) will find it increasingly challenging to pursue mega expansion projects in the commodity chemical field because of surging global pressure to reduce carbon emissions as well as chemical and plastic pollution worldwide, just as Formosa Petrochemical has already experienced in the U.S. The four companies are likely to shift their focus to specialty products, particularly electronic materials for emerging applications such as electric vehicles.⁸³

The Standard and Poor's credit opinion highlights immediate risks related to current petrochemical markets in the United States. It also points out the significant capital allocation implications related to climate risk and chemical and plastics pollution worldwide. The issues are related, but the practical implications for corporate and public policy require separate and deliberative treatment.⁸⁴

Recently, Moody's and Fitch have released new review paradigms with statistical judgments regarding company and industry carbon exposure, and the actions companies are planning to take and have taken to address climate change.^{85,86} Of particular relevance to this report are the factors that the credit agencies consider regarding a) the credibility of company plans for sustainability; b) the capability of proposed technologies (whether or not they have a track record of success) and the ability to meet forward-looking goals with current technologies; and c) the commitment of companies to address community concerns—based on the concern that protracted regulatory or litigation ties up the cash flow of companies with announced new facilities.

⁸¹ IEEFA. [Army Corps of Engineers requires full environmental review for Formosa petrochemical project in Louisiana](#). August 18, 2021.

⁸² The White House. [Remarks by President Biden Before Signing Executive Actions on Tackling Climate Change, Creating Jobs, and Restoring Scientific Integrity](#). January 27, 2021.

⁸³ Standard and Poor's. [Four Company Credit Opinion](#). October 7, 2021.

⁸⁴ IEEFA. [Petrochemical producers remain on a business-as-usual path in the face of international criticism](#). January 23, 2024.

⁸⁵ Moody's. [Net Zero Assessment](#). Last visited June 30, 2024.

⁸⁶ Fitch. [Climate Vulnerability in Corporate Rate Ratings](#). February 23, 2023.

- I. The persistent presence of racism in the economic development process of the state is clear by the siting of the petrochemical projects discussed in this report. In 2020, U.S. District Judge Trudy White revoked the air permits required for the proposed Formosa petrochemical complex. The judge cited the history of the overconcentration of these facilities in African-American communities.⁸⁷ The judge also concluded that the Louisiana environmental agency failed to use proper data, to use the data in a manner proscribed by law and as such failed to assess the actual impact on the people of St. James Parish. The judge concluded the benefits to the development were outweighed by the costs.⁸⁸ A Louisiana appeals court reinstated the permits in January 2024, but the decision still recognized the need for the state agency to consider environmental justice issues in its actions.⁸⁹ Nevertheless, the community is continuing to fight the project through a federal environmental impact statement process conducted by the U.S. Army Corps of Engineers.

The discussion of racial inequality has credit implications for the companies and the governments identified in this paper. Moody's commented:

Even if the immediate credit implications of the protests were limited, rising social risks, if left unaddressed by policymakers, can carry negative longer-term implications. The strength of the US' institutions has diminished somewhat in recent years in the context of the increasingly polarized political environment. And there is a rising tension within the US' credit profile arising from the growing need for policy makers to act to contain the ongoing erosion of the sovereign's fiscal strength, and the inertia with respect to that erosion stemming from increased political polarization. Some research suggests that income plays an increasing role in driving congressional polarization on tax and redistribution issues. While there are indeed many social and economic issues that have contributed to the US' increased political polarization in recent years, looking ahead, the combination of income and racial inequality is set to be a potent force for further potential polarization and inertia.⁹⁰

All of the major elements of concern raised by Moody's are acutely present in most of the projects discussed in this report. Each project is viewed as a disturbing example of indifference to the impacts of environmental racism. The promised economic benefits from corporate and state and local officials ring hollow in the face of decades of industrial investment and decades of persistent poverty.

Section III examines two of the most important petrochemical commodities markets, which account for more than 60% of the investment value of the companies IEEFA has identified in this study. The underlying market dynamics shaping these markets play a pivotal role in Louisiana's future.

⁸⁷ Judgment (on a Rule to Show Cause re Intervenor's Motion for Judicial Notice and to Admit Proof of Procedural Irregularities), [Rise St. James, et al. v. Louisiana Dept. of Environmental Quality](#), No. 694,029, 19th Judicial Dist., Parish of East Baton Rouge (December 16, 2020, Trudy White, J.)(hereafter, "Rise St. James"), p. 2.

⁸⁸ [Rise St. James](#), p. 31.

⁸⁹ [Rise St. James, et al. v. Louisiana Dept. of Environmental Quality](#), No. 2023 CA 0578, La. Court of Appeal, 1st Circ. January 19, 2024, p. 4. The Louisiana Supreme Court denied a petition for review of the Court of Appeal decision on September 17, 2024, without issuing an opinion.

⁹⁰ Moody's Investor Service. Government of United States: Racial disparities exemplify the long-standing and growing income and wealth inequalities that raise social risk (PBM 1236663). July 14, 2020.

Risks in Louisiana’s Ethylene and Methanol Markets

Ethylene’s Central Role in the U.S. Petrochemical Industry Makes It a Useful Bellwether for the State of the Industry—and the Warnings for Louisiana Should Be Heeded

Ethylene markets play a central role in the petrochemical industry nationally and in Louisiana’s economy. As shown by IEEFA’s chart of \$82 billion in relatively new, expansion and planned petrochemical projects, 44% of the invested dollars require a robust ethylene market for success. Continued overreliance on this sector will not help Louisiana reverse the downward demographic, employment and economic trends discussed above. The trajectories explored in this paper suggest the petrochemical markets may contract and weaken growth plans.

The ethylene market is a bellwether for the rest of the petrochemical sector. As one ICIS analyst noted, “The story is similar in the other petrochemical building blocks and their derivatives. ICIS data point to levels of oversupply that tell us something much more than just an extended destocking cycle is taking place.”⁹¹

Ethylene is a building block for a large portfolio of petrochemicals.⁹² The largest use for ethylene is polyethylene, usually in the form of the polymers known as high-density polyethylene (HDPE), low-density polyethylene (LDPE) or linear low-density polyethylene (LLDPE). The polymers typically are used to manufacture single-use plastics for packaging, fast food utensils and medical equipment.⁹³

Ethylene can be derived from several sources, but the principal routes start with crude oil (from which naphtha is derived) or natural gas (refined into ethane). Each is subjected to an industrial process in a “cracker”—a plant that uses heat to separate ethylene and other derivatives from the base feedstock. The process creates the two most prevalent forms of ethylene—ethane-based or naphtha-based.

The close link between ethylene and its multi-sectoral use has important business implications. Ethylene typically is produced and transferred to production processes, often near the ethylene cracker. Integrated facilities usually link ethylene production with production of polyethylene (PE), polypropylene (PP), and methyl ethyl glycol (MEG). The integrated facility sells plastic resins or

⁹¹ ICIS. [Global Ethylene Capacity growth would need to be 90% lower the ICIS base case for healthy 2024-2030 operating rates](#). January 15, 2024. Also see ICIS. [Three scenarios for Chinas PE demand 2024-2030 and the effects on global operating rates](#). March 2024.

⁹² American Fuel and Petrochemical Manufacturers. [The World’s Most Important Chemical](#). Last visited June 26, 2024.

⁹³ Additional or secondary commodities include ethylene glycol, ethylene oxide, propylene, propylene oxide, acrylonitrile, and ethyl dichloride (poly and vinyl chloride). These compounds are used to create a wide range of intermediate products such as plastic resins and films used in creation of single-use plastics and durable plastics.

liquids in commodity markets that distribute them to manufacturers for next-stage processes and end-use production—plastic bags, straws, bottles, medicines.

The centrality of ethylene to the petrochemical process and petrochemicals to the economy makes ethylene—including its capacity, geographic concentration, distribution and price—a leading economic indicator. For example, the recent crash in ethylene margins in China is discussed in relation to China's plans to increase its manufacturing base, serve domestic purposes, increase electric vehicle use, decrease fossil fuel demand and use petrochemicals as an instrument of political power as nations realign the world order.⁹⁴

The rise of fracking in the United States placed the trajectory of ethylene production front and center in economic policy discussions.⁹⁵ Fracking, a technological development for oil and gas extraction, allowed greater volume production and productivity of natural gas and its derivative, ethane. The rapid growth catapulted the United States to the position of world leader in the oil and gas industry. The North American cost advantage spurred substantial new petrochemical sector investment, enhancing U.S. petrochemical producer competitiveness.⁹⁶

Fracking has produced a period of oversupply of oil and natural gas—particularly natural gas—in the United States. The surplus drove the price of natural gas down, providing substantial cost advantage to petrochemical producers in the United States. As the COVID-19 pandemic was still working its way through the market—first as disaster and then as a growth opportunity—Russia invaded Ukraine in 2022. The invasion created a series of bottlenecks that boosted oil and gas prices, and profits for fossil fuel producers. Although most of the economy suffered substantial losses during the pandemic, production of ethylene and many plastics derivatives rose due to higher demand for medical products and single-use plastics.

The cost advantage to North American petrochemical producers from the fracking revolution fuelled a host of new ethylene facilities in the United States and worldwide. But now, ethylene markets are oversupplied, lowering utilization rates and profit margins. The combined impact of slower growth, sustainable policy drivers and geopolitical realignments has eroded the low-gas-cost advantage for U.S. frackers, with important implications throughout the petrochemical sector. This has caused delays and cancellations of new crackers, financial underperformance and a weak outlook through 2030.

The instability and bottlenecks, moreover, are taking place alongside the development of new sustainable market opportunities that have created a period of unprecedented uncertainty.⁹⁷

⁹⁴ ICIS. [Risk Mounts for U.S. Ethylene Exports](#). March 31, 2024.

⁹⁵ U.S. Department of Energy. [U.S. Ethane Market issues and Opportunities](#). June 2023.

⁹⁶ Daniel Yergin. *The New Map*. New York: Penguin Press, 2021.

⁹⁷ ICIS. [Petrochemical market confusion set to continue as China deflation approaches](#). April 2021.

The U.S producer low-cost advantage is important to maintain a competitive edge on the global market. If customers for the product lose interest, however, or if interest is reduced substantially for any reason, the underlying financial calculus for a company and its petrochemical facilities will fail.

This is the dilemma facing the petrochemical industry and its expansion plans in Louisiana.

Globally and nationally, the capacity growth rate for ethylene is slowing, generating uncertainty for local proposed projects

Ethylene's current global production capacity is 226 million tons. China, with 51.6 million tons, holds 23% of global capacity. From 2010 through 2020, China's ethylene capacity grew at a rate of 9.6% annually and the U.S. capacity at an annual rate of 4.8%. In the following five years, China's capacity rate grew by more than 10% annually while the U.S. capacity rate fell by half.

The United States capacity currently is 45.3 million tons (20% of global capacity). By 2050, China is expected to have almost 30% of world capacity and the United States 16%. Louisiana's current capacity is 11.5 million tons, or 25% of U.S. capacity. Growth rates in all regions are expected to slow appreciably. From 2030, market estimates anticipate a growth rate in China of 1% annually and flat capacity in the United States. (Table 4).

Table 4: Ethylene Actual and Projected Capacity: United States, China and Rest of World (2010 to 2050)⁹⁸

	2010	2015	2020	2025	2026	2027	2028	2029	2030	2035	2040	2045	2050
United States	26481	28702	40454	45531	45531	47611	47611	47611	49361	49611	49611	51111	51111
China	15558	21479	31971	59283	64384	73493	76697	77306	78306	84306	87906	93006	96506
ROW	101912	109107	121494	132449	135089	139114	147534	148366	154234	158734	167384	175184	179634
Global	143951	159288	193919	237263	245004	260218	271842	273283	281901	292651	304901	319301	327251

Source: IEEFA from ICIS database

The United States was the second-largest exporter of ethylene in 2022. Its trading partners were principally China and Belgium.⁹⁹ China, the largest producer of ethylene, is also the largest importer, but its rate of importation is slated for reduction due to substantial changes in the country's economic and international policy. China has already cut its import levels by approximately 40% since 2018.¹⁰⁰ The shift has significant implications for countries that rely on ethylene trade with China.

⁹⁸ ICIS.

⁹⁹ Since ethylene poses logistical and cost issues to ship in its pure form, much of the ethylene trade takes place in the form of polyethylene and other intermediate compounds and is measured in ethylene equivalencies.

¹⁰⁰ ICIS. Commentary on Forecast Balances, Ethylene Trade in 2023. December 2023 (proprietary).

The policy and political changes taking place in the United States are also creating uncertainty for ethylene producers and project proposals across the country. Formosa Plastics, for example, has filed permit applications in Louisiana to build a petrochemical complex with 2.4 million tons of cracker capacity. The company has missed several target dates, purportedly due to rising construction costs, complicated trade relations, and global political pressures related to ocean pollution, toxic releases and carbon emissions. The company supports the project publicly but faces uncertainty at the federal regulatory level and credit warnings of a potential downgrade if the project goes forward.¹⁰¹

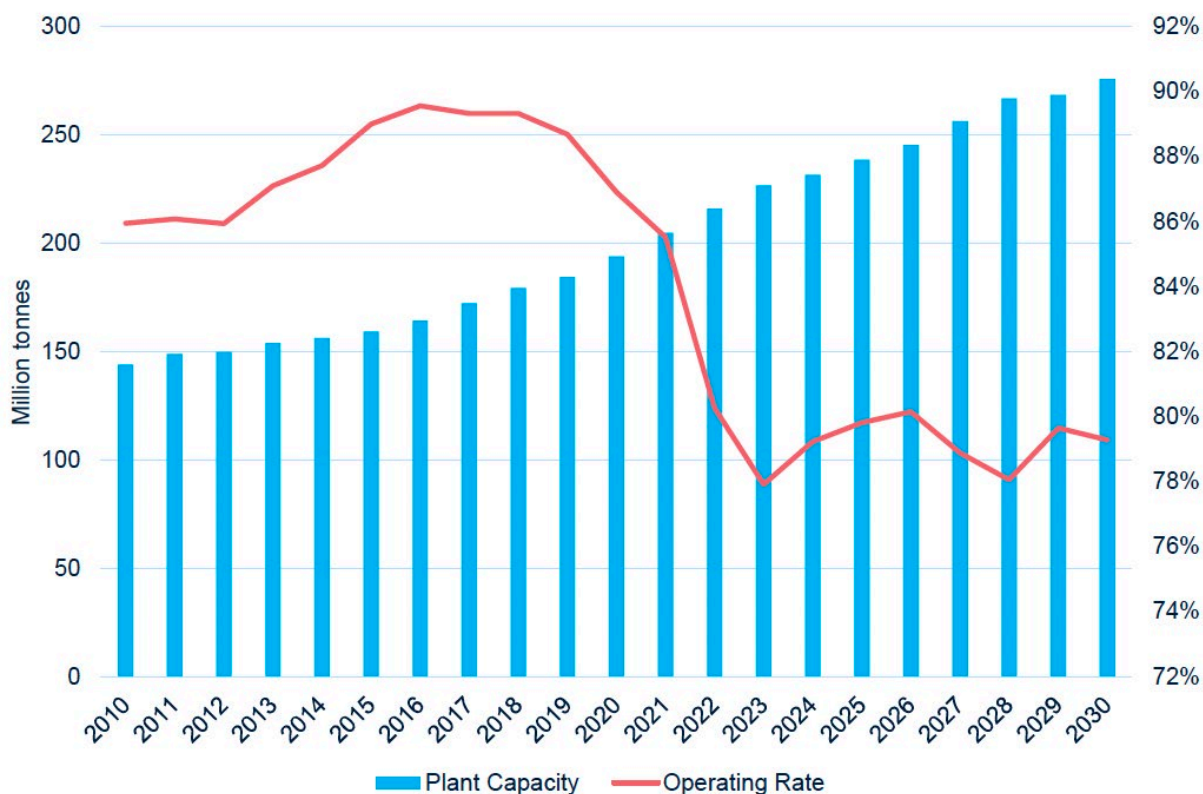
Louisiana Ethylene Capacity Faces Under-Utilization

Louisiana's ethylene-producing cracker capacity has risen significantly since the middle of the past decade. Four new projects have added 3.44 million tons of new annual capacity since 2015. Existing producers added 800,000 tons to their capacity as well, bringing the total to 4.258 million tons—a 59% increase. Global capacity of ethylene grew by 42% during the same period.¹⁰²

Driven by the flood of low-cost natural gas spurred by the growth of fracking technology, the increase in capacity in the United States has had an important impact on the utilization rate for U.S. producers. In 2015, U.S. producers experienced a 91.7% utilization rate. With the increase in supply from 2015, however, the utilization rate fell in the U.S. to 78.3%. The declining utilization rate in the United States follows a global pattern of response to oversupplied ethylene markets. Utilization rates are expected to vary, globally and in the United States, but remain depressed—well below the 90% levels—through at least 2030. The situation does not bode well for Louisiana petrochemical development.

¹⁰¹ Plastics News. [Louisiana court green lights Formosa Plastics Permits](#). January 2024.

¹⁰² ICIS.

Figure 12: Global Installed Capacity and Operating Utilization Rates¹⁰³

Source: ICIS

The principal changes taking place in the market in the coming decades are expected to include:

- 1) Policy changes in China that emphasize domestic internal security, including an increase in capacity and decrease in imports. Part of China's increase in ethylene capacity will be to offset closure of older, inefficient plants.
- 2) Slower economic growth overall.
- 3) Growing demand in the United States, Europe and other countries for recycled plastic.
- 4) Global pressure to reduce single-use plastics.
- 5) Increased pressure on sustainability issues such as carbon pricing.
- 6) Direct and indirect implications of technoeconomic changes related to sustainability, such as the uptake of electric vehicles, reduced use of fossil fuel in power generation and other changes in demand for oil and gas, as well as the projected effectiveness of CCS.

¹⁰³ ICIS. Ethylene: Commentary on Forecast Balances – Global. December 2023.

7) Realignment of trade relations, particularly the U.S.-Chinese trade balance.

None of the expected changes will likely improve ethylene capacity utilization rates, and a low utilization rate generally puts a project's profitability at risk.

The impact of the oversupply in the petrochemical market generally and in the ethylene market is already being felt in Louisiana.

- Sasol's controversial opening of its Lake Charles ethane integrated petrochemical plant faced cost overruns, weak markets and missed its initial financial targets. After shareholders and the company settled litigation over the plant, Sasol decided to take on LyondellBasell as a partner to share an unwieldy risk profile.¹⁰⁴
- Formosa's St. James facility, designed as an integrated ethylene/polyethylene complex, has been challenged in regulatory proceedings and faces construction cost increases. As noted above, Standard and Poor's has warned the company it could face a credit downgrade if plans for the facility proceed. The company has promised to make a final investment decision (FID) on two separate occasions but failed to meet the deadlines.
- Shintech Louisiana has withdrawn a permit for production of a polyvinyl chloride (PVC) plant in Iberville Parish. The expansion plan withdrawal of SPP-3 removes the 1.4 billion-ton-per-year project that had included production of chlorine, caustic soda and ethylene dichloride. The withdrawal does not affect the company's other permits for ethylene production.¹⁰⁵
- More broadly, Mitsubishi's proposed methyl methacrylate (MMA) project is behind schedule in announcing its FID due to changing economic circumstances.¹⁰⁶

Ethylene margins are stressed as the sector has hit its lowest utilization rates in a decade, with the current weak market likely to continue through 2030 and beyond.¹⁰⁷

In the past, the normal trajectory for ethylene and the petrochemical business has been that periods of oversupply are usually followed by periods of economic growth, absorbing the oversupply to a point where markets tighten, prices increase, and the market signals move into another period of buildout.

The current oversupplied market, however, faces numerous factors that likely will lead to a much slower absorption of the oversupply. Climate change, ocean pollution and sustainability issues are

¹⁰⁴ For an overview of the Sasol project profile, see Report Appendix: IEEFA. [Financial Risks loom for Shell's Pennsylvania petrochemical hub](#). June 4, 2020. Also see: LyondellBasell. [LyondellBasell and Sasol complete Louisiana joint venture](#). December 2, 2020.

¹⁰⁵ Providence Engineering. [Letter fr. Providence Engineering \(on behalf of Shintech Louisiana\) to Louisiana Department of Environmental Quality](#). 3164 V4 Modification. Withdrawn, May 29, 2023.

¹⁰⁶ Methyl methacrylate is a methanol compound. Methanol is a derivative of natural gas in the United States and coal.

¹⁰⁷ ICIS. [Risks Mount for US Ethylene Exports](#). March 2024.

transforming the political economy of the petrochemical market and disrupting typical market responses.¹⁰⁸

Broadly, the large uptake in the electric vehicles market is transforming the fundamentals of oil and gas extraction, refining and chemical production. When as much as 41% of a barrel of oil is no longer refined into gasoline for motor vehicle transportation, a core business for the oil and gas industry has been substantially eliminated. The full implications of this change have not been fully absorbed. The cumulative factors driving the business are fundamental, however, and require the re-examination of business practices and plans regarding oil and gas extraction and processing.

Bottom line: The low-cost natural gas advantage from fracking in the United States created a structural incentive for U.S. petrochemical producers to build new capacity. The incentive spurred new cracker construction to the point of oversupply. The oversupply is unlikely to be absorbed at a rate that supports ongoing profitability. Demand for ethylene is likely to grow more slowly than anticipated and to be increasingly replaced by sustainable alternatives. Ethylene producer margins are suffering now, and that is likely to continue. Plans for new construction of new cracker capacity in the United States, including in Louisiana, are ill-advised.¹⁰⁹

After just over a year of production activity, Shell’s CEO announced that its Pennsylvania petrochemical complex—opened in November 2022—would likely be the last of its kind. In reference to the Pennsylvania petrochemical facility, which is failing to meet its financial targets, he said the company “will be doing less of what we call the mega-projects.”¹¹⁰

Sustainable economics and geopolitics have shifted the discussion in the United States from a low-cost production advantage to a discussion of lower demand driven by slower growth and the broadening impact of sustainability.

This outlook places pressure on companies to shut down existing facilities and take a loss, or significantly slow the pace of new builds. These periods are also usually characterized by lower dividends and other problems, including extensive corporate reorganizations.

The shake-out period can take years, since company management is usually slow to act to shut down an existing facility. The damage from this period of uncertainty—particularly when global corporations are involved—usually falls on the workforce, resulting in layoffs or salary and benefit stresses. Host communities, faced with companies cutting corners on public health and safety issues, and declining household incomes as job opportunities disappear, are left with few options.¹¹¹

¹⁰⁸ ICIS. [Global Ethylene Capacity growth would need to be 90% lower the ICIS base case for healthy 2024-2030 operating rates](#). January 15, 2024.

¹⁰⁹ IEEFA. [Shell petrochemical plant likely to be the last hurrah for big petrochemical complexes](#). March 1, 2022.

¹¹⁰ Insider Monkey. [Shell plc \(NYSE:SHEL\) Q4 2023 Earnings Call Transcript](#). February 2, 2024.

¹¹¹ IEEFA. [An Instructive tale of two coal plants](#). May 15, 2015.

The failure to plan the long-term structural decline of the coal industry is an example of how a failure to plan and heed obvious market indicators can leave communities devastated.¹¹² As Section V of this report explains, Louisiana needs to plan a better path for the energy transition, including the changes continuing to alter the market landscape for ethylene.

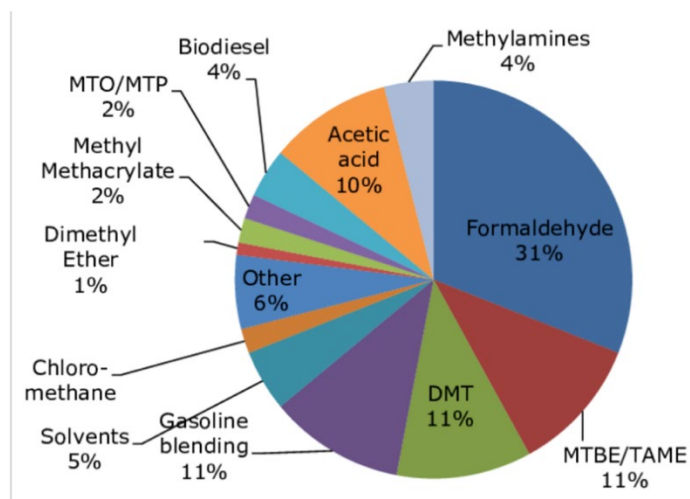
Producing Methanol From Fossil Fuels in Louisiana is Not a Good Bet

Methanol, a base chemical that combines with a vast array of other compounds into manufactured end products, historically has been rooted in the fossil fuel family. The chemical is used in processes to make formaldehyde, acetic acid, methyl tert-butyl ether (MTBE), gasoline and plastics—each of which has hundreds of intermediate uses and thousands of end products. The largest feedstock categories are gas (dominant in the United States) and coal (dominant globally).

With the advent of sustainable economics, however, the chemical is proving to be adaptable to molecular arrangements that can be replicated without fossil fuels, under the expanding umbrella known as “renewable methanol.” The pace of change toward sustainable adaptation is moving faster for methanol than for many other chemical compounds.

Louisiana producers have planned a significant buildout of new methanol capacity that is likely to oversupply the market with fossil-sourced methanol at a time when each of methanol’s primary compounds are being challenged by sustainable alternatives. The fossil-sourced projects have weak financial fundamentals and are poor business choices for Louisiana as tools of economic growth.

¹¹² Herald Leader. [Coal industry sheds jobs, leaving East Kentucky in tatters](#). July 18, 2013.

Figure 13: Methanol Uses, 2020¹¹³

The uses of methanol (<https://www.methanol.org>).

Source: *Research Gate*

Methanol's broad adaptability has provided it with a diverse market for the product. Seventy-six percent of methanol is used in the production of formaldehyde, MTBE, gasoline blending, acetic acid and dimethyl terephthalate/methanol-to-olefins (DMT/MTO). Formaldehyde is typically used as a bonding agent in wood products (particle board) and paint. MTBE is used as an anti-knocking additive that improves the octane rating of gasoline. DMT/MTO are chemical processes that produce feedstock for plastics and textiles and can replace ethylene. Acetic acid has a variety of uses in cleaning, textiles, solvents, herbicides and medicines. Its use in gasoline blending allows refinery processes to create a wide selection of quality specifications for gasoline.

Existing uses of methanol are facing challenges

Despite the strength of methanol's diverse market, each of the current uses for methanol is being challenged with market-based alternatives responding to sustainability demands to reduce carbon footprint and environmental toxicity. The precise impact of these market challenges is uncertain but the loss of market by off-takers seeking alternatives to traditionally sourced methanol is inevitable.

Replacements for formaldehyde are beyond the experimental stage as companies like BASF are producing and selling an eco-friendly substitute for it.^{114,115} Methanol as a feedstock for plastics faces the same challenges from recycling, replacement and fossil-free feedstocks as ethylene and other

¹¹³ Research Gate. [Synthetic Liquid Fuels: Prospects for innovative technologies based on underground coal gasification](#). January 2020.

¹¹⁴ National Library of Medicine. [Alternatives to Phenol and Formaldehyde for the Production of Resins](#). September 2020.

¹¹⁵ BASF. [The eco-friendly alternative to formaldehyde-based resins](#). April 24, 2023.

fossil-based plastic feedstock.¹¹⁶ Similarly, new product designs for acetic acid are emerging.¹¹⁷ Demand growth for methanol-based gasoline additives is predicated on continued use of gasoline to power automobiles,¹¹⁸ but electric vehicles (EVs) do not require gasoline. EV use is expected to increase, with ExxonMobil, the nation's largest oil company, anticipating a replacement of the internal combustion engine in new automobiles by 2040.¹¹⁹

Table 5: Principal Current Uses of Methanol, Percentage of Market Share and Emerging Alternatives

Compound	Market Share	Current Use	Alternatives
Formaldehyde	31%	Bonding agent	Biomaterials
MTBE	11%	Additive to gasoline	Electric vehicles
DMT/MTO	13%	Plastics feedstock	Recycle, replace
Acetic acid	10%	Cleaning solvent, textiles	Biomaterials
Gasoline blending	11%	Fuel quality	Electric vehicles

Source: IEEFA

The role of renewable methanol is uncertain

Between 2023 and 2030, it is anticipated that renewable methanol capacity growth using new fossil-free feedstock and green energy sources will begin to affect market share appreciably. Renewable methanol capacity is expected to grow to 24.2 million tons by 2029, almost 11% of global capacity. Renewable methanol is currently produced through two routes: (1) E-methanol, which uses captured CO₂ from renewable sources, and renewable electricity for power generation, and (2) Bio-methanol,

¹¹⁶ IRENA. [Innovation Outlook: Renewable Methanol](#). 2021.

¹¹⁷ Sciencedirect.com. [Sustainable routes for acetic acid production: Traditional processes vs. a low carbon biogas-based strategy](#). September 2022.

¹¹⁸ MarketsandMarkets Blog. [Rising demand for MTBE research and analysis trends](#). April 30, 2023.

¹¹⁹ IEA.org. [Trends in the Electric Vehicle Industry](#). April 2024.

which is derived from forestry and agricultural waste, biogas, landfills and municipal solid waste streams, through production processes expected to be powered using renewable electricity.¹²⁰

Currently, 152 renewable methanol projects exist globally, with heavy concentrations in Europe and Asia. A smaller concentration of projects in renewable methanol can be found in the United States. In all, the Methanol Institute estimates substantial reductions in CO₂, nitrogen, sulphur and particulates resulting from the successful development of a host of renewable methanol investments.

Two projects on the drawing board in Louisiana can be characterized as renewable methanol—the Lake Charles Methanol Project and Syngas Holdings. The Lake Charles project is designed to produce “blue methanol,” a product sourced with natural gas but achieving a low-carbon tag because the company envisions contracting with a third-party source to capture carbon.¹²¹ Louisiana Economic Development explains:

*The proposed facility would reform natural gas and renewable gas feedstocks into hydrogen, while capturing carbon dioxide, which would then be used to produce about 3.6 million tons per year of methanol. Lake Charles Methanol plans to work with a third party to capture and sequester about 1 million metric tons of carbon dioxide per year, which would reduce the carbon intensity of the hydrogen for synthesis into low carbon intensity methanol.*¹²²

The concept of blue hydrogen, however, is an unproven and costly technology. IEEFA found that studies in favor of blue hydrogen supported by the U.S. Department of Energy and used as the basis of funding to a host of alternative projects relied on overly optimistic assumptions about the ability of technologies to capture carbon at promised levels. Risk models used to judge technological viability do not consider methane leakages. So far, no projects have been financially viable.¹²³

Renewable methanol represents a genuine wildcard for the future. Methanex and the International Renewable Energy Agency (IRENA) offer a bullish outlook, driven in large measure by the demand for renewable methanol as a shipping fuel. IRENA estimates that demand could reach 500 million tonnes per annum (mtpa) by 2050 with 80% of the fuel from renewable sources.¹²⁴ Overall, there is a significant level of debate and controversy regarding its technological and economic viability.

¹²⁰ See Methanol Institute. [Renewable Methanol](#). Last visited June 6, 2024. Also see: International Renewable Energy Agency (IRENA). [Innovation Outlook: Renewable Methanol](#). January 2021.

¹²¹ Louisiana Economic Development. [Lake Charles Methanol announces plan for new \\$3.2 billion manufacturing plant in southwest Louisiana](#). February 14, 2024.

¹²² [Ibid.](#)

¹²³ IEEFA. [Blue Hydrogen: Not clean, not low carbon, not a solution](#). September 12, 2023.

¹²⁴ IRENA. [Innovation Outlook: Renewable Methanol](#). January 2021.

Methanol by the Numbers: Global, United States and Louisiana

The 2023 global methanol market consists of 177 million metric tons of capacity. China is the largest producer with 60% of existing capacity; the United States has 6%. Louisiana has 2% of the world's capacity and 39% of the United States capacity, second only to Texas.

In 2014, the United States had capacity of 2.5 million tons. Since then, the figure has climbed to 10.3 million tons. The extraordinary increase has been driven in part by the growth of fracking. The surplus production of natural gas created by the advent of fracking has lowered prices to such a level that U.S. petrochemical producers now have a cost advantage on a wide variety of compounds and products.

Between 2014 and 2023, methanol capacity grew globally by 6% annually. China's capacity grew 76%, and the United States added 1,250%. Actual production grew globally during the same period by 60%, from 73.5 million tons to 116.8 million tons. China's production doubled from 40.4 mtpa, and United States production grew by 337% from 1.9 mtpa to 8.3 mtpa.

Global utilization rates remained in the mid-60% range. Chinese utilization rates increased from 67% to 75% and United States rates remained well above the global average, close to 80%. Projections by some analysts expect utilization rates to tighten in the United States, approaching 90%.¹²⁵ Global and Chinese utilization rates are expected to remain in the mid-70% range.

Table 6: Methanol Capacity Trends 2014-2029 with Growth Rates for 2014-2023 and 2023-2029¹²⁶

Capacity History	2014	2023	Aggregate Growth ('14-23)	Annual Growth ('14-23)	2029	Aggregate Growth ('23-'29)	Annual Growth Rate ('23-'29)
Global	107,764.00	176,914.00	64%	6%	219,394.00	24%	3%
China	60,695.00	106,910.00	76%	8%	131,027.00	23%	3%
United States	2,485.00	10,300.00	314%	31%	14,800.00	44%	6%
Louisiana	32	4,032.00	12500%	1250%	5,832.00	45%	6%

Source: ICIS with IEEFA adjustments

Through 2029, global capacity growth is expected to slow to 3% annually, down from 6% over the prior decade. Capacity is expected to slow to 6% annually in the United States and Louisiana and 3%

¹²⁵ ICIS.

¹²⁶ ICIS.

in China. In the 2030-50 period, growth is expected to slow dramatically with one projection (assuming a net-zero scenario) anticipating negative growth in China.¹²⁷

Table 7: Speculative Industry Capacity Additions to Louisiana Methanol Market through 2030¹²⁸

Company	Location	Capacity (tons)	Date
Big Lake Fuels	Lake Charles	1,400,000	2028
IGP Methanol	Plaquemine Parish	1,800,000	2028
Koch Methanol (expansion)	St. James	1,300,000	2028
Lake Charles Methanol	Lake Charles	1,300,000	2026
Syngas Holdings	St. James	500,000	2026
Sungas	Rapides	400,000	
Total		6,700,000	

Source: ICIS

In January 2024, Louisiana had six proposals for either new methanol capacity or expansions of existing methanol facilities (Table 7). If each of these projects were built by 2030, Louisiana's methanol capacity would grow from 4 million to approximately 12.5 million tons per year (exceeding industry estimates), making Louisiana the leading producer of methanol in the United States. Texas and other states could grow from approximately 6 million tons to 9 million tons.

¹²⁷ Also see: Statista. [Methanol demand forecast for China through 2050 using net-zero scenario](#). Last visited June 26, 2024.

¹²⁸ [ICIS](#).

If all projects were built, the net effect would alter the United States methanol market substantially. In 2020, the utilization rate for methanol in the United States was 72%. An additional 6.7 million tons per year of capacity would reduce the U.S. utilization rate to between 50% and 57%.¹²⁹ The recent announcement by Big Lake Fuels that it is withdrawing its plan for a methanol project in Lake Charles may be an indicator that the market for new methanol projects cannot carry the size of the proposed increase.¹³⁰

The United States is the world's second-largest exporter of methanol, trailing only Trinidad and Tobago. Its primary trading partners are South Korea, the Netherlands, Spain, Belgium and Switzerland. Domestic producers have their sights on China, the world's largest importer, but trade restrictions have prevented that from happening thus far.¹³¹

Overall, the net change by the U.S. from importer to exporter has set in motion trade shifts that move more methanol into the world market. The hope for greater importation from China, however, is not materializing. Large surpluses would develop if U.S. companies increased the production of methanol as planned in Louisiana.

Louisiana Methanol Analysis

Five clear warning signals indicate methanol markets are unlikely to perform in the robust manner needed to advance the ambitious plans of the six methanol producers seeking to grow their operations in Louisiana.

First, a slower growth economy will mean slower GDP growth rates.¹³² Slower GDP growth means fewer consumers for the product. Even with an extraordinary 10% methanol consumption growth rate (requiring an unlikely 5% annual GDP increase) in production through 2030, the proposed buildout will dramatically reduce utilization rates (See Appendix I).

An across-the-board decline in GDP touches the construction, retail, transport and consumer markets. In addition to the demand-side impact of a slower economy, U.S. producer margins will be pressured by another factor. Slower growth is likely to lower the methanol prices in China, whose methanol spot price is the market maker as shown in Figure 14. With slower demand, U.S. prices and margins are likely to decrease. During a period when China and U.S. prices decline, margins tighten.

¹²⁹ This assumes a 10% annual increase in production in the United States.

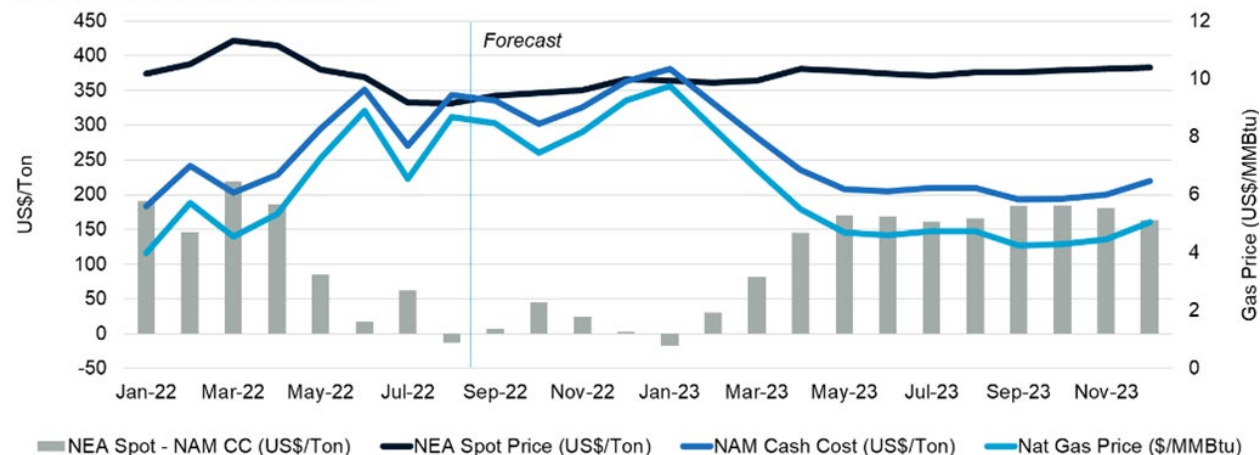
¹³⁰ IEEFA. [Company turns halt of gas methanol project to cancellation](#), April 9, 2024.

¹³¹ Argus Media. [U.S. methanol trade flow shifts to exports](#), January 3, 2023.

¹³² The Methanol Institute shows annual growth rate at 2.6% for methanol between 2019 and 2023. Global GDP during the same period saw an annual growth rate of 1.2%. ExxonMobil uses a petrochemical-to-GDP growth ratio of 2X as part of its business model. Even assuming a 10% growth rate, something reminiscent of the 1992-2010 period, utilization rates would continue to decline. To maintain a historical production growth of 2.6% pursuant to the Methanol Institute's database, there would need to be a global GDP increase of more than 1.3%. According to the EIA, it is likely that GDP (2023-30) will grow at a rate of approximately 1.6%. Through 2050, the EIA anticipates GDP growth of 1.9%. See: EIA. [Annual Energy Outlook 2023, Macroeconomics](#). Last visited June 21, 2024.

Figure 14: NAM Cash Costs vs. NEA Spot Prices¹³³

NAM Cash Costs vs. NEA Spot Price



Source: Chemical Market Analytics by OPIS

Also, during periods of high natural gas prices, U.S. petrochemical producers experience tighter margins. When U.S. producer costs increase and rise above the Northeast Asian spot price, then U.S. export potential declines.¹³⁴ The sweet spot for U.S. producers operates in a narrow corridor relative to China. Significant volatility in any market factor creates imbalances to the detriment of U.S. producers.

Second, adding more supply by these companies will triple Louisiana's current methanol capacity. The increase will be so large that it is likely to compound existing oversupply conditions and drive down utilization rates. With it will come even lower capacity rates and lower margins for the methanol market in the United States. Rates would range between 50% and 57%, even using annual demand growth rates through 2030 exceeding 10% annually. (See Appendix I.)

Third, the U.S. producer cost advantage from low priced fracked natural gas is eroding in the face of a cumulative set of risks. Low-priced fracked natural gas unleashed a series of new investments that increased the supply of methanol facilities. The abundance and low price from fracking made U.S. producers competitive on the international market. Global pressures to reduce emissions, however, have led to the emergence of new, lower-cost renewable methanol as an alternative. The new methods of producing methanol, some of which substantially eliminate carbon emissions using biomass feedstocks, now may command as much as 11% of the methanol market.

Of the six planned projects in Louisiana, only two—Lake Charles Methanol and Sungas—claim they will produce renewable methanol. The new technologies are being tested and debated. If the slate of new Louisiana projects proceeds as planned, the new facilities will likely be built to standards that are

¹³³ Chemical Markets Analytics. [Economics Highly Challenging the North America Methanol Market](#). Last visited July 16, 2024.

¹³⁴ A. Greenwood, ICIS. [Insight: Natgas price surge raises ethane costs, squeezes US chem margins](#). July 29, 2021.

on the higher end of the cost curve. If methanol markets achieve the aggressive growth scenarios that some are predicting, the growth will be driven by renewable methanol, not traditional fossil fuel-driven production methods. Most of the supply of fossil fuel-derived methane proposed in Louisiana will likely be obsolete before it is even constructed.

Fourth, sustainable economics research, development and investment is maturing and transforming the nature of products that use methanol in the production process. Mainstream demand projections for traditionally sourced methanol end products are being disrupted. Formaldehyde, acetic acid, MTBE and other gasoline blending, and plastics products are all facing sustainability challenges. In the automotive industry, the impact on methanol is likely to be quite large. Regarding MTBE and gasoline blending, 25% of methanol's current market is comprised of gasoline additives that will have diminishing use as the electric vehicle market share increases.

Fifth, traditional trade routes are being disrupted by new product lines and geopolitical realignments. U.S. producers have traditionally exported products to South Korea and European customers. Risks to these traditional markets will rise as competition from China with South Korea is likely to increase in intensity, challenging U.S. exports to South Korea.¹³⁵ And as the U.S. role as a methanol importer fades and it becomes a player in the export market, methanol that used to come to the United States from Trinidad and Tobago is now likely to go to Europe and Asia, competing with U.S. export interests. China's stated policy of greater national security is likely to decrease Chinese imports. The aspiration of U.S. producers placing surplus with China over a long period is unlikely to materialize.¹³⁶

Louisiana's acceptance of six different companies' plans for more fossil fuel-derived methanol facilities (see Table 7) links the state's economic future with this highly volatile industry at a time of market oversupply, technological change, political uncertainty and a realignment of trade patterns that disadvantage U.S. producers. A broader, more diversified approach to economic development would more likely serve Louisiana's economic interests.

Petrochemical Policy Priorities in a Time of Shrinking Markets: Federal/State Incentives Are Not Well-Designed to Promote Clean Industry or Local Fiscal Health¹³⁷

Companies that invest in the petrochemical industry in Louisiana may qualify for federal and state tax breaks.

As noted above, IEEFA has compiled a list of petrochemical projects representing \$82 billion in investments and covering 11 petrochemical submarkets. All these investments are covered by the

¹³⁵ ICIS. [South Korea Petrochemical challenges and opportunities](#). June 4, 2024.

¹³⁶ Argus Media. [U.S. methanol supply in surplus by 2018](#). June 14, 2018.

¹³⁷ Louisiana Chemical Association. [Louisiana Chemical Association Shares Chemical Industry Investments and Announced Projects](#). November 2, 2023.

state's industrial property tax program. While IEEFA researchers were not able to find basic investment information for each plant on the list, we were able to find investment information for a representative sampling of 30 projects, taken largely from the Louisiana Department of Economic Development Fastlane, Industrial Tax Exemption Program (ITEP) database.¹³⁸

State and Local Tax Breaks

The total tax exemptions added up to more than \$6.8 billion—the amount of the total 10-year tax exemption. The state's Industrial Tax Exemption Program was established to reduce the property tax on industrial properties. In return for the tax exemption, property owners agree to make a specific investment in either an existing or new facility in the state.

In response to public dialogue, the state instituted a series of reforms in the program in 2016. The reforms gave the local government authority to approve a project after a hearing, reduced the value of the tax incentive (retaining more local tax revenue), and strengthened the job creation requirement. The improvements were widely hailed and generated new revenues for local governments.¹³⁹

In February 2024, Gov. Jeff Landry eliminated the job creation requirement and weakened the approval process, giving the governor's office final authority to approve or reject tax exemption applications. The most recent changes continued the existing programs tax relief benefits, but the program is weaker and less beneficial for local Louisiana communities.

Federal Tax Breaks

In 2022, President Biden signed the Inflation Reduction Act—a combination infrastructure, economic and climate package. A section of the act provides tax credits and loan guarantees for carbon sequestration, clean hydrogen and other clean industry financing. Concerns have been raised, however, about the reliance of carbon capture and management.

The provisions of the law that support private sector investment focus on three tax credits for eligible companies:¹⁴⁰

- The carbon oxide sequestration (45Q) credit was created by the Internal Revenue Service (IRS) in October 2008.¹⁴¹ It provides a credit for carbon oxides that are geologically stored permanently, stored and used through enhanced oil recovery, or via other utilization. The tax credit is applicable to carbon dioxide (CO₂), carbon monoxide, and carbon suboxide emissions.¹⁴² Subsequent amendments to the tax credit have raised its value from \$50 per

¹³⁸ Louisiana Economic Development. [Fast Track, Public Reports. Industrial Tax Exemption Program](#). Last visited June 22, 2024.

¹³⁹ IEEFA. [Louisiana Industrial Tax Exemption Program \(ITEP\)](#), *op. cit.*

¹⁴⁰ U.S. Department of the Treasury. [Fact Sheet: How the Inflation Reduction Act's tax incentives are ensuring all Americans benefit from the growth of the clean energy economy](#), October 20, 2023.

¹⁴¹ 45Q refers to the provision in the tax code that details the terms and conditions of the credit. [26 USC §45Q](#).

¹⁴² Carbon Herald. [What is the 45Q tax credit](#), November 8, 2023.

ton to \$85 per ton for carbon capture and storage (CCS) and from \$35 to \$60 for enhanced oil recovery (EOR) or other utilization. The reason for the value increase is that the “early-stage” development amounts were insufficient to cover the cost of development. The amendments now also recognize CCS, carbon capture with utilization and storage (CCUS) and direct air capture (\$180 per ton), as well as covering power generation and various industrial applications.

- The clean hydrogen production (45V) credit regulates the tax credits available to producers of hydrogen. The provisions anticipate the use of hydrogen in several new industrial end uses, displacing current feedstocks.¹⁴³ The U.S. Department of Energy has developed a model that supports wider application of hydrogen and expenditure of federal funds. IEEFA has found this course of action is based on a record of DOE failure to address four major risk areas: 1) failure to properly measure short- and long-term climate effects; 2) failure to accurately account for methane leakage; 3) unjustified assumption that maximum CO₂ capture rates will be achieved and 4) failure to account for hydrogen leakage.¹⁴⁴
- The advanced manufacturing production (45X) credit supports investments in critical minerals and infrastructure used in the creation of renewable energy assets.¹⁴⁵

The provisions provide tax credits and loan guarantees for carbon oxide storage,¹⁴⁶ clean hydrogen and other investments.¹⁴⁷

Several projects in Louisiana plan to take advantage of the new investment tax breaks. For example, Air Products is proposing a facility that would produce 750 million cubic feet of blue hydrogen per day, as well as blue ammonia. The company claims the project would capture and permanently store 95% of emissions. The project would include a 700-mile pipeline to distribute hydrogen to multiple industrial consumers.¹⁴⁸ The project is slated to receive a \$44 million first-year tax exemption from Louisiana, and Air Products expects to receive federal support under the Inflation Reduction Act.¹⁴⁹ The company also expects to use 45Q credits for CCS, signalling it is unlikely to meet the more stringent qualifications for clean hydrogen under the 45V program.¹⁵⁰

Lake Charles Methanol II has not indicated whether it will qualify for Section 45V credits or will access 45Q benefits. In either case, the successful acquisition of credit will rely on the CCS system.

¹⁴³ Michael Leibreich’s [Hydrogen Ladder 5.0](#) and related publications cover the potential for end uses employing a variety of hydrogen production scenarios. Leibreich’s work, constantly updated, seeks to capture the improvements and challenges of hydrogen production and its uses for a wide variety of industrial applications.

¹⁴⁴ IEEFA. [Blue Hydrogen: Not clean, not low carbon, not a solution](#). September 12, 2023.

¹⁴⁵ IRS. [Proposed Rulemaking: Section 45A Advanced Manufacturing Production Credit](#). 88 Federal Register 86844. December 15, 2023.

¹⁴⁶ IRS. [About Form 8933](#). Last visited June 18, 2024.

¹⁴⁷ IRS. [Proposed Rulemaking: Section 45V credit for production of clean hydrogen](#). 88 Federal Register 89220. December 26, 2023.

¹⁴⁸ Air Products. [Louisiana Clean Energy](#). Last visited June 23, 2023. Also see: Louisiana Economic Development. [Air Products announces \\$4.5 billion blue hydrogen clean energy complex](#). October 21, 2021.

¹⁴⁹ Illuminator. [Carbon capture and sequestration](#). August 13, 2023.

¹⁵⁰ Hydrogen Insight. [“We will not claim the US hydrogen production tax credit on our \\$4.5 billion blue H2 plant in Louisiana,” Air Products](#). June 17, 2024.

CCS has repeatedly failed to meet its performance and financial benchmarks. A 2021 federal audit found only two of the three industrial plants that were built with federal funding were operational, and none of the eight coal plants with CCS are operational today. The projects were mostly cancelled due to high costs.¹⁵¹

In a 2022 analysis that assessed policy options to improve the outlook for CCS, the Government Accountability Office (GAO) evaluated the status of CCS projects using a technology preparedness model that assessed how each of the projects under study met technical standards. The study found potential for expanded use of CSS in some operations, but determined the technology would “require further demonstration in some of the highest-emitting sectors (e.g., power generation).”¹⁵² The GAO also observed, “Lengthy time to deployment and high costs hinder widespread deployment.”¹⁵³

There is no clear evidence that CCS projects are commercially viable. It does not appear the technology can pass a test of financial viability without subsidization. ExxonMobil has made it clear that even the current \$85 per ton is insufficient and must be increased to at least \$100 per ton to make its project viable.¹⁵⁴ ExxonMobil also wants eligibility for tax credits to cover 30 years instead of 12 years,¹⁵⁵ which would effectively shift the tax credit from a short-term incentive to long-term maintenance.

The history of CCS development has had several starts and stops. The endings have all been the same. The technology has had only limited success, and many projects have been cancelled due to spiraling costs.¹⁵⁶ Louisiana would benefit if federal incentives were deployed on more effective and sustainable initiatives.

Planning for a Just Energy Alternative

Louisiana can take a proactive approach to build a strong, more sustainable economy by redirecting its economic development programs. Large energy transition projects play a role, but the state needs a comprehensive economic planning process that can properly manage the remains of the fossil fuel sector and build out several new business opportunities.

Louisiana’s past growth and the nation’s economy benefited from fossil fuel industrial development while communities and workers disproportionately bore the adverse health and safety impacts. This burden of petrochemical development increases with each new production facility and crowds out

¹⁵¹ U.S. Government Accountability Office (GAO). [Carbon Capture and Sequestration](#). GAO 22-105111. December 2021. Also see: GAO. [Advanced Fossil Energy: Information on DOE Provided Funding for Research and Development projects started from Fiscal Years 2010 through 2017](#). GAO -18-619. September 21, 2018.

¹⁵² GAO. [Decarbonization: Status, Challenges, and Policy Options for Carbon Capture, Utilization and Storage](#). GAO-22-105274. September 29, 2022 (“Decarbonization”), p. 1.

¹⁵³ [Ibid.](#)

¹⁵⁴ Oilprice.com. [Exxon Calls for Higher Calls for Higher Carbon Pricing](#). June 2022.

¹⁵⁵ CNBC. [ExxonMobil CEO Darren Woods wants higher price on carbon emissions](#). June 2022.

¹⁵⁶ IEA. [Is Carbon capture too expensive?](#) February 2021.

the promise of jobs and taxes. The underlying fact of a history of racial injustice exacerbates this trend. Those communities and workers who were most affected are entitled to priority in plans for recovery, revitalization and redirection of the economy.

For Louisiana to achieve a stronger and more resilient and sustainable economy, it must diversify its business sector base. Several examples of successful economic transition advances can provide guidance.

Experts point to other Southern states like Georgia and Texas,¹⁵⁷ which have bolstered their economies with professional services, healthcare, and technology sectors. For Louisiana to mitigate the impacts of future economic disruptions, it must follow suit and expand into other sectors.¹⁵⁸

The U.S. Department of Defense has developed a methodology to assist communities hurt by base closings. It has been deployed in a wide range of local economic scenarios.¹⁵⁹ As an example of the type of economic development projects that would be considered First Solar, the largest solar energy manufacturer in the United States has selected Acadiana Regional Airport in New Iberia for its fifth American manufacturing facility. With an investment of as much as \$1.1 billion, the facility is projected to generate 700 new direct jobs.¹⁶⁰

An effective just transition program would require a four-point plan, focusing on:

- 1) Community economics
- 2) Workforce planning
- 3) Fiscal needs of localities and the state as a whole
- 4) The macro-economy (in collaboration with relevant federal agencies).

Louisiana should develop a planning mechanism with a robust public participation component to set priorities, identify funding strategies (involving both the public and private sector), and establish follow-through mechanisms to ensure the action steps are carried out and changes are made where needed to establish success.

¹⁵⁷ Heart of Texas Council on Economic Development, [Strategic Direction and Action Plan](#), 2024. See also: Dallas Federal Reserve Bank, [Texas Research](#), 2024.

¹⁵⁸ Louisiana Illuminator. [Louisiana economy struggles with reliance on oil and tourism, analysis shows](#). July 28, 2021.

¹⁵⁹ Office of Technology Assessment. *After the Cold War*. 1992.

¹⁶⁰ Louisiana Economic Development. [Economic success: South Louisiana's year of record-breaking growth](#). January 25, 2024.

Conclusion

The partnership between the coal, oil and gas and petrochemical industries and the state of Louisiana is unravelling. Once the principal driver of growth, jobs and tax dollars that led the nation, these industries now lag the markets, and Louisiana is now an economic laggard.

Louisiana is not currently on a track to improvement. The \$82 billion investment and 24 petrochemical projects in Louisiana face significant challenges. The oil and gas industry is in a state of decline and the petrochemical industry, once thought of as a financial alternative to extractive industries, faces a set of challenges that it is unprepared to address. Alternative replacements for fossil fuel-sourced chemicals now confront petrochemical companies at almost every part of the innovation curve.

This analysis focused on the impact of the ethylene and methanol markets on Louisiana, two powerful bellwethers of the petrochemical sector in Louisiana and globally. The market calculation used to justify these investments rests upon low-cost feedstock and energy. These are no longer viable metrics. The question is no longer whether Louisiana's petrochemical producers have a competitive cost structure due largely to fracking. The question is now whether the world will buy Louisiana's fossil fuel-sourced petrochemicals.

The declining significance of these investments is taking place as Louisiana and the world economy is producing a different kind of growth. There will be fossil fuel demand well into the future, but the industry is in a secular decline. The pathways of the fossil fuel and green economies are in competition. The state needs to play a critically important coordinating role, to guide the transition of the declining fossil fuel industries and redirect its primary support activities to growth areas of the economy, lest this competition turn into collision, conflict and further community disruption.

Appendix I: 2020 Existing Capacity, Plus 2030 Louisiana Expansion and 2030 Industry Projection without Louisiana Expansion

Methanol Capacity (LA)	Status	2020	2030 With Louisiana Expansion	2030 Projected
Methanex	Active	1,025	1,100	1,100
Methanex	Active	1,000	1,100	1,100
Praxair	Active	32	32	32
Total		2,057	2,232	2,232
Big Lakes Fuel	Speculative		1,400	
IGP Methanol	Speculative		1,800	
Koch Methanol	Existing		1,800	1,800
Koch Methanol (Expansion)	Speculative		1,300	
Lake Charles Methanol	Speculative		1,300	
Methanex	In Construction		1,800	1,800
Rapides/Sungas	Speculative		400	
Syngas	Speculative		500	
Sub total			10,300	3,600
Total		2,057	12,532	5,832
Texas and Other		6,037	10,368	10,368
Total U.S. Capacity		8,094	22,900	16,200
Production		5,800	13,000	13,000
Utilization Rate		72%	57%	80%

Source: IEEFA from ICIS database

Appendix II: Background on the Petrochemical Industry

Petrochemical products are found everywhere in the world, providing necessities and more to individual households, as well as some of the most sophisticated products used in the construction, health, food, communications, recreation, housing, transportation and textiles sectors. Distribution markets command pipelines, trains, trucks and barges to move physical product to next-stage production facilities for intermediate and finished processing. The end use or finished products are typically distributed through retail and internet sales.

On an annual basis, petrochemical producers worldwide have the capacity to make 2.4 billion tons of product, generating an estimated \$580 billion.¹⁶¹ The largest producer country is China. Other principal producer countries are the United States, India, South Korea and Saudi Arabia. The largest petrochemical companies are Saudi Arabian Oil Co.; China National Petroleum Corporation; China Petroleum and Chemical Corporation; ExxonMobil; Shell plc; Total Energies SE; BP; Chevron; Marathon Petroleum; and Valero Energy.¹⁶²

Petrochemical facilities use coal, oil and gas in two ways: as an energy source to drive industrial production processes and as feedstock. Coal and natural gas are used to power a wide range of machines and instruments. The production processes of petrochemicals broadly require heating, cooling, mixing, finishing, and transporting. All require electricity.¹⁶³

Coal, natural gas and crude oil derivatives are also used as feedstock, to be reconfigured at the molecular level by chemical processes into compounds for use in the manufacturing of finished packaging and products. Although most oil is refined and used for transportation purposes, 14% is used globally for petrochemical purposes. Similarly, most natural gas is used for home heating or in electrical power production, but 8% is used for petrochemicals.¹⁶⁴

When coal, oil and gas are used as feedstocks, regional positions heavily influence the choice. Broadly speaking, coal and crude oil or naphtha is the feedstock of choice in China and the Northeast Asian region. Ethane, the natural gas-based feedstock for ethylene, is used most heavily in the United States. The favoured feedstock in the United States is ethane, a natural gas derivative that became increasingly abundant during the 2000s due to hydraulic fracking.

Natural gas feedstock is processed in a cracker, which then throws off ethane and a host of other co-products. Beyond oil and natural gas-based feedstocks, a significant percentage of ethylene production is driven by butane, gasoil, propane, methanol-to-oil and crude-to-oil. All processes at their core are fossil-fuel based.

¹⁶¹ Statista. [Petrochemical industry worldwide](#). Last visited June 25, 2024.

¹⁶² Globaldata.com. [Global petrochemical companies by revenue](#). Last visited June 25, 2024.

¹⁶³ EIA. [Energy Use Explained](#). Last visited June 25, 2024.

¹⁶⁴ IEA. [The Future Use of Petrochemicals](#). October 2018.

Large integrated petrochemical facilities require significant acreage, as each phase of production requires facilities to house the heating, cooling, mixing and finishing phases of the process. From the outside, the physical design of these complexes are massive tangles of buildings, pipelines, towers, and smokestacks that dominate the landscape and light up the night sky of hundreds of communities around the world.

The balance sheet for a petrochemical facility charts its financial life, which is driven by revenue accounting. Revenues usually include the accumulated cash garnered from the market price and sale of the 11 petrochemical products that IEEFA has identified and more. The prices of the ethane and ethylene, which comprise the principal cost of resin production, are considered expenses. Each individual operating unit on a petrochemical complex plays a role in the ultimate financial viability of the complex. The complex is part of a company-wide portfolio, usually stretched over a worldwide expanse. The financial life of each asset is part of reporting units that are consolidated on the company's income and expense statement and balance sheet. The financial presentations are usually published on a quarterly and annual basis. This enterprise-wide financial presentation represents the core of the company's disclosures to its investors and the public.

Appendix III: Ten-Year Tax Relief Calculation

IEEFA conducted a multiple tier scenario analysis of the Louisiana Industrial Tax Exemption Program (ITEP).¹⁶⁵ The purpose of the review was to create a methodology to account for the value of the 10-year tax relief stream that accrues to program participants. An independent calculation is necessary, as the Louisiana Economic Development disclosure database currently available provides the first year of the tax exemption,¹⁶⁶ but does not present the full 10-year benefits that accrue to a company from the program.

To derive the full 10-year value requires a complicated set of calculations using the ITEP database, data available from third party sources and reasonable independent assumptions. Prior to 2016, the Board of Commerce prepared an annual review that included the full 10-year value for an individual applicant. IEEFA has reviewed those reports and created certain independent modelling tools to assist with the preparation of IEEFA's final calculation.¹⁶⁷

IEEFA compiled a list of 24 petrochemical companies that are active participants in the Louisiana petrochemical industry today. It was created in part from a list prepared by the Louisiana Chemical Association (LCA).¹⁶⁸ Additional projects and companies were included based on news reports and Securities and Exchange Commission filings.

A search to identify the major projects undertaken by these companies using the program uncovered over 700 applications since 2010.

To determine the 10-year tax relief provided by ITEP, IEEFA totaled the approved investment values of the projects (\$82 billion). Pursuant to program rules, this value was reduced by 20%, leaving 80% of investment value eligible for the tax relief. IEEFA calculated the 10-year value by applying to the adjusted investment value, the assessment rate (15%).¹⁶⁹ Once the assessed value is established, the millage rate determines how much of the value should be taxed for the year under consideration.¹⁷⁰

An annual depreciation schedule was used to determine the reduction in the investment value that could be subject to tax relief in the next year. The calculation assumed a 10-year depreciation rate, so the exercise was repeated for each year until 2033. (The projects had a 2024 start date.) IEEFA's calculation results in a \$6.8 billion, 10-year tax relief for the companies—and corresponding tax loss for the state, parishes and school boards.

¹⁶⁵ IEEFA. [Louisiana Tax Exemption Program](#). October 11, 2022.

¹⁶⁶ Louisiana Economic Development. [Industrial Tax Exemption Program/Projects Report](#). Last visited September 20, 2024.

¹⁶⁷ Louisiana Economic Development. [Louisiana Board of Commerce and Industry Incentive Approvals](#). September 2017.

¹⁶⁸ Louisiana Chemical Association. [LCA Shares List of Industry Investments and Announced Projects](#). November 2023.

¹⁶⁹ The assessed value is the taxable value of a property.

¹⁷⁰ The millage rate is set by local governments. Those with a property tax establish the millage rate in relation to the total market value of the property. Technically, it is the rate that is applied per \$1,000 of market value for a property.

IEEFA applied this methodology to the \$82 billion investment value of the eligible projects from the 700 applications. The 10-year total tax relief provided by ITEP, according to IEEFA's estimate, is \$6.8 billion.

IEEFA employed several other methodological approaches, using sensitivity analyses, for comparison.

- Simple straight-line projection of the first-year number multiplied by 10 years. This resulted in an estimate of \$13.6 billion.
- Aggregation of the investment value for the approximately 200 incentive approvals by the Board of Commerce provided in the 2016 annual report and the 10-year projection provided in that report.¹⁷¹ This analysis resulted in a ratio of approved investment value divided into the 10-year tax exemption stream.¹⁷² The ratio of 15% was derived. This would result in an approximate \$9.8 billion tax relief estimate.

During its analysis, IEEFA contacted several state and parish officials to obtain additional descriptions of the data.

¹⁷¹ Louisiana Economic Development. [Louisiana Board of Commerce and Industry Incentive Approvals](#). Program Performance Reports, September 2017.

¹⁷² It is noteworthy that the LED reports prior to 2016 contained a reporting metric for the full 10-year tax exemption value. In 2017, the database was established and now in use. That second database offers the first-year tax relief figure but not the full 10 years of tax relief.

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

About the Authors

Tom Sanzillo

Tom Sanzillo, director of financial analysis for IEEFA, is the author of numerous studies on the oil, gas, petrochemical and coal sectors in the U.S. and internationally, including company and credit analyses, facility development, oil and gas reserves, stock and commodity market analysis and public and private financial structures. Sanzillo has experience in public policy and has testified as an expert witness, taught energy industry finance and is quoted frequently in the media. He has 17 years of experience with the City and the State of New York in senior financial and policy management positions. As the first deputy comptroller for the State of New York Sanzillo oversaw the finances of 1,300 units of local government, the annual management of 44,000 government contracts, and over \$200 billion in state and local municipal bond programs as well as a \$156 billion global pension fund.

Suzanne Mattei

Suzanne Mattei, an attorney (Yale Law School) and consultant with Lookout Hill Public Policy Associates, has over 30 years' experience in environmental policy. As Regional Director for the NYS Department of Environmental Conservation for four years, she led permitting and enforcement in New York City. Her widely cited recent report on a proposed fracked gas pipeline in New York found flaws in proponents' arguments. As NYC Executive for the Sierra Club, her research exposed federal mismanagement of the 9/11 response; her testimony to Congress helped lead to passage of the James Zadroga Act, providing healthcare to Ground Zero workers.

Abhishek Sinha

Abhishek Sinha is an energy finance analyst at IEEFA. He analyzes petrochemical industry trends, regulations and company data. Abhishek covered the energy and chemicals sectors at Thrivent Asset Management for five years. He has a mechanical engineering degree from Bangalore University, a master's in management information systems from Texas Tech University and an MBA from Columbia University.

This report is for information and educational purposes only. The Institute for Energy Economics and Financial Analysis (“IEEFA”) does not provide tax, legal, investment, financial product or accounting advice. This report is not intended to provide, and should not be relied on for, tax, legal, investment, financial product or accounting advice. Nothing in this report is intended as investment or financial product advice, as an offer or solicitation of an offer to buy or sell, or as a recommendation, opinion, endorsement, or sponsorship of any financial product, class of financial products, security, company, or fund. IEEFA is not responsible for any investment or other decision made by you. You are responsible for your own investment research and investment decisions. This report is not meant as a general guide to investing, nor as a source of any specific or general recommendation or opinion in relation to any financial products. Unless attributed to others, any opinions expressed are our current opinions only. Certain information presented may have been provided by third parties. IEEFA believes that such third-party information is reliable, and has checked public records to verify it where possible, but does not guarantee its accuracy, timeliness or completeness; and it is subject to change without notice.

