

Formosa's Louisiana Project Update:

Supply and Demand Dynamics, Legal Challenges

Bode III

Executive Summary

Financial, market, regulatory and political risks have combined to make Formosa Plastics' petrochemical Sunshine Project proposed for Louisiana unviable. IEEFA first identified these conditions in a March 2021 report. Although some improvement has occurred in the commodity price environment since then, four key conditions have changed: Construction prices have risen; regulatory scrutiny has intensified; credit agency support has withered; and community opposition has heightened questions among stakeholders.

Formosa Plastics is a financially strong corporation with a solid dividend history. The project proposed for the St. James parish of Louisiana would manufacture several types of plastic resins, using ethane as its primary feedstock. It faces staunch opposition by community groups and environmental advocates because it would add significant toxic emissions to an already heavily polluted community.

The company has not yet made a final investment decision (FID) to proceed with the Louisiana project. This update of IEEFA's March 2021 report shows that on-and off-balance sheet issues have converged to make the project less likely to move forward.

- **Rising construction costs:** Rising construction costs will diminish the project's profitability. The problem has raised red flags for the company's credit rating. S&P Global estimated last year that the construction cost for the project rose 28 percent—from \$9.4 billion to \$12 billion— between 2018 and 2020. Driven by higher commodity prices and overall inflation, the cost is likely to be much higher than \$12 billion. Costs have only risen further since then, driven by higher commodity prices and overall inflation
- **If built, Formosa's Sunshine Project would add more capacity to an already oversupplied market.** U.S. producers have added new capacity to the U.S. market over the last five years. The pandemic and current disruptions in the market have created confusing business signals, and the rate at which the market can absorb capacity additions is uncertain. Market fundamentals suggest that the oversupply will push prices down, which makes going forward with the project unlikely.
- **Polyethylene (PE) prices are volatile and point long term to diminished demand for additional capacity.** PE prices, the driver of the Louisiana project's profitability, have been on a roller coaster since IEEFA's March 2021 report. Prices and margins for PE in the United States reached record levels in 2021 but appear to have peaked in September 2021. Price spikes in

early 2022 have been driven by rising oil and gas prices, inflation and market turmoil. Market fundamentals suggest a moderation will occur in PE prices, against a backdrop of high construction and feedstock costs. Longer term policy initiatives that disrupt supply and demand dynamics for virgin plastics also have altered the market outlook for Project Sunshine.

- **Price pressures on ethane and ethylene tighten the margin picture, causing Formosa's project economics to deteriorate further.** PE margins are highly sensitive to feedstock costs, and rising construction costs will put additional downward pressure on margins. Based on IEEFA's analysis, a 10 percent increase in ethane prices (feedstock) and 10 percent decrease in ethylene prices could reduce Formosa's margins by 50 percent. With the increase in feedstock costs and moderating PE prices, margins in the United States could be headed for a correction, a condition that doesn't bode well for Formosa's economics.
- **Regulatory and community hurdles loom:** The Formosa project is engulfed in a myriad of regulatory and environmental hurdles. The project's state and federal permits face legal challenges. Since IEEFA's last report, the U.S. Army Corps of Engineers has required an environmental impact statement (EIS) as part of a re-evaluation of its water permit approval process. The company faces a challenge to its air pollution permit, issued by the Louisiana environmental agency, that raises concerns about cumulative toxic air emissions impacts and environmental justice.
- **Standard and Poor's Global strongly suggests the project is not viable.** In a credit update issued in October 2021, the agency determined that the delays in the project have been positive for the company's credit rating. Significant cash outlays for a project with the risk profile of Project Sunshine would be unwise. Looking forward, S&P Global identified rising construction costs, difficult local labor conditions and a tough regulatory climate due to heightened concerns about pollution and climate change. S&P Global noted that the difficult regulatory climate in the United States is part of a global trend that makes mega petrochemical projects like Project Sunshine increasingly risky.

The military incursion by Russia into the Ukraine has significant implications for commodity prices, regional and global trade patterns, and petrochemical logistics. The crisis will very likely affect long-term supply and demand dynamics. The next few weeks and months have the potential to cause long-term permanent changes in world commerce, including the petrochemical industry. What were already difficult market dynamics stemming from the pandemic and an uneven economic recovery from it now makes analysis that much more difficult and the project even more uncertain.

I. Cost and Market Factors Will Diminish the Formosa Project’s Profitability

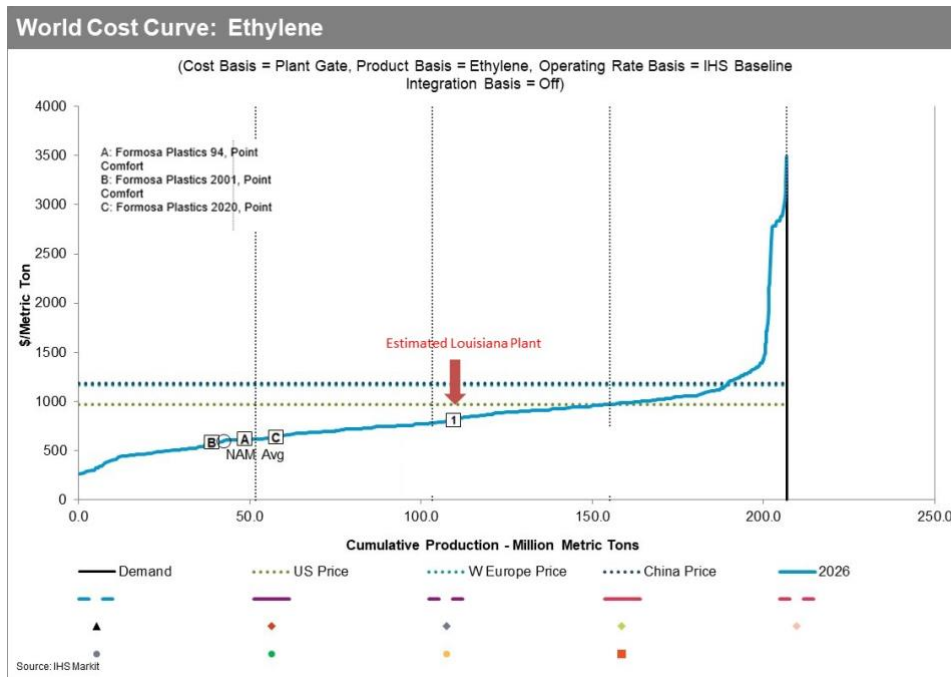
A. Construction Costs Are Rising

The Taiwan Ratings Corporation, an S&P Global company, estimated the cost of the project in October 2020 to be \$12 billion, a 28 percent increase from Formosa’s original 2018 estimate of \$9.4 billion. Local press reports confirmed the estimate, although Formosa did not confirm or refute the precise amount of the rising costs.¹

IEEFA’s review of the company’s portfolio shows that even at a \$9.4 billion construction cost, moderate feedstock prices and other cost assumptions,² the Louisiana project placed higher on the cost curve than any of Formosa’s previous three cracker plants in the United States, which are all located in Point Comfort, Texas.

The 28 percent increase from the \$9.4 billion in the construction cost significantly moves the plant further up the cost curve.

Figure 1: World Cost Curve for Ethylene



Source: IEEFA analysis using IHS Markit model.

Note: Analysis assumes 28% increase in construction cost.

¹ The Advocate. [Major Formosa plastics plant in St. James may cost \\$12 billion, rating agency estimates](#). December 15, 2020.

² Other cost assumptions include: Ethane \$1.25/ton, Fuel \$3.5/MMBtu, Electricity \$0.05/kWh, Cooling Water \$0.02/ton, Operating Labor \$34/hr, Steam \$9.4/ton, Process Water \$0.03/ton. Based on data provided in HIS Markit. CCMA-Ethylene. October 24, 2021 (Proprietary).

Based on the current inflation rate and global logistic challenges, the cost is likely to be much higher than \$12 billion.³ In 2021 heavy construction prices increased across the board.⁴ Construction costs are highly susceptible to general inflation and so long as inflation continues, along with an uneven recovery, more project delays can be expected. S&P Global's October 2021 review of the company stated that the costs for the project will be sharply higher.⁵

B. Rising Supply Due to Boom in Capacity Additions Will Place Downward Pressure on Prices and Contribute to an Uncertain Outlook

IEEFA's initial report on the Formosa petrochemical project proposed for Louisiana observed that the plant would face stiff competition, as it is at the tail end of a global surge in new ethylene capacity additions.⁶ Asia and North America are the prime drivers for the capacity increase. Data from IHS Markit indicates that years 2021-26 will see a 33 percent increase in global ethylene plant capacity compared to 2016-2020 (see Figure 2).⁷ The ICIS estimates U.S. capacity will rise by 18 percent in 2022 alone.⁸

³ Levelset. [Construction Costs Experienced the Largest Spike Since 1970: Can Contractors Fight the Effects](#). February 8, 2022. Also see: Commercial Property Executive. [Construction Costs Will Keep Rising. Here's How Much](#). October 7, 2021.

⁴ Associated General Contractors of America. [2022 Construction Inflation Alert](#). February 2022.

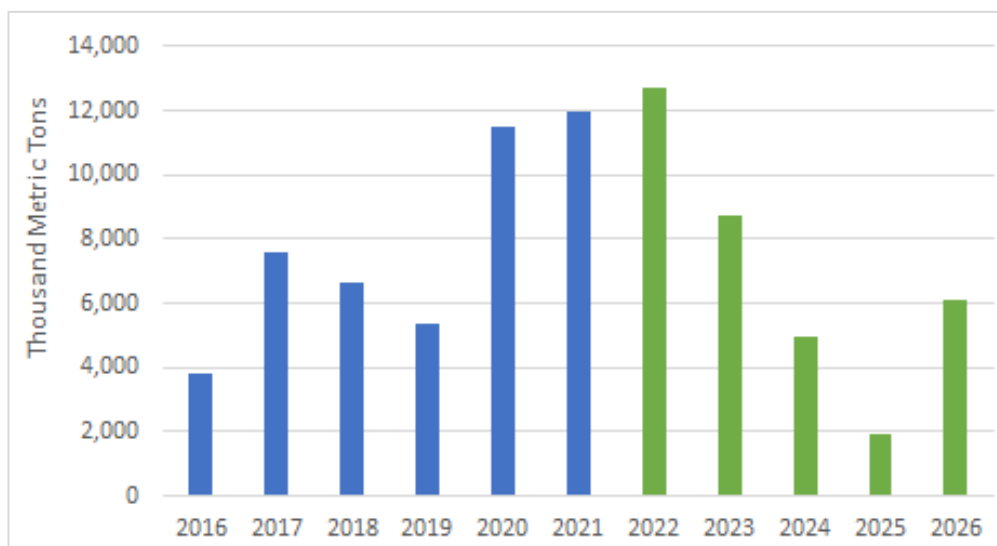
⁵ S&P Global. [Ratings On Formosa Plastics Corp. And Three Associated Companies Affirmed At 'BBB+' On Low Debt Leverage; Outlook Stable](#). October 2021.

⁶ IEEFA. [Formosa's Louisiana Project: Wrong Products, Wrong Time, Wrong Place, Wrong Finances](#). March 2021.

⁷ IHS Markit. [World Analysis - Supply and Demand, Worldwide \(Ethylene, December 2021. Edition 2022\) \(Proprietary\)](#). The IHS data only includes the plants that have cleared a firm FID; plants like Formosa, which doesn't even have an FID established yet, are not even included in this dataset.

⁸ ICIS. [European and US LLDPE margins may in 2022 sink towards northeast Asian levels](#). January 14, 2022.

Figure 2: New Global Ethylene Capacity (2016-2026)



Source: IEEFA and IHS Markit data.

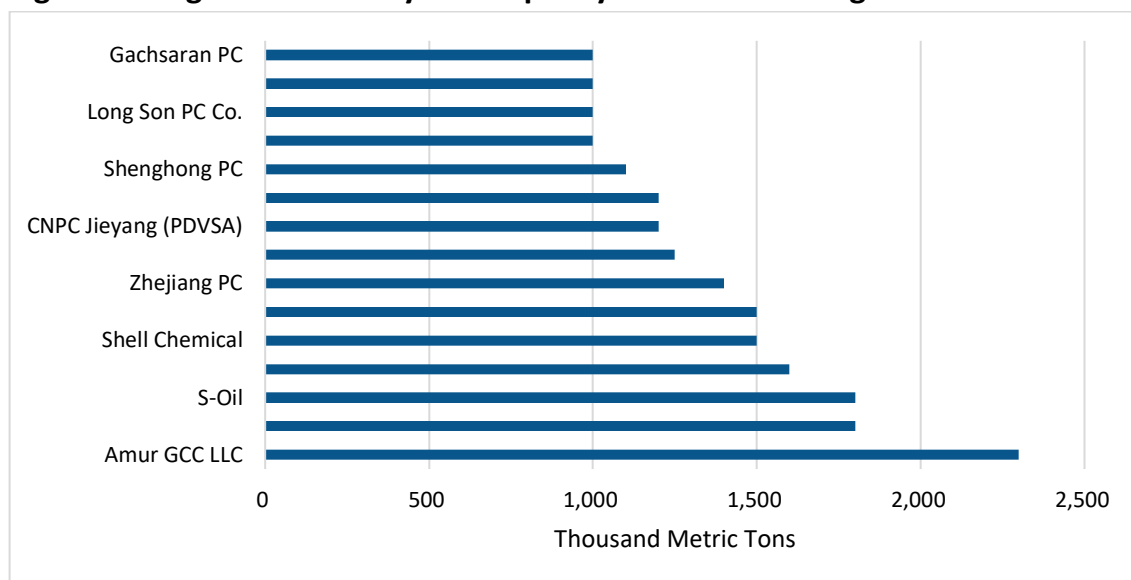
The initial announcement of interest in the Formosa project in 2015 came against a backdrop of worldwide announcements of cracker build-outs. The total impact of these proposals, including the Formosa project, was predicted to increase global ethylene production capacity by 50 percent.

Global ethylene capacity reached a total volume of more than 206 million metric tons in 2021, which is about 12 million metric tons (or more than 6 percent) higher than in 2020. The current outlook assumes that about 77 million metric tons of ethylene producing capacity will be added by the end of the IHS Markit forecast period to 2031. The largest increases are expected to occur in China, the Middle East, Russia, North America, and the Indian subcontinent).⁹

The year 2022 will see a new wave of U.S. ethylene capacity hit the industry, with three large projects—Bayport Polymers, Gulf Coast Growth Ventures and Shell—contributing to year-over-year growth. These projects will establish over 5 percent growth in U.S. domestic capacity.

⁹ IHS Markit’s data system includes the following countries within the Indian Subcontinent region: India, Pakistan, Bangladesh, Bhutan, Nepal, Sri Lanka and Maldives.

Figure 3: Largest Global Ethylene Capacity Additions Through 2026



Source: IEEFA and IHS Markit data.

Typically, rising capacity levels place downward pressure on ethylene and polyethylene prices and margins. The pandemic and additional market factors, in contrast, resulted in significant upward price pressures during 2021. Although prices came down somewhat in late 2021 and the planned addition of Shell's Pennsylvania cracker facility in 2022 will have an impact on the market, a new round of inflationary pressures in early 2022 is putting upward pressure on feedstock costs. The near-term volatility in feedstock costs, inflation and market turmoil creates a confusing basis for a long-term price assessment.

The rate at which the U.S. economy and export markets absorb U.S. capacity additions is uncertain. Market fundamentals point to price moderation due to relatively oversupplied markets, pushing prices to the downside.¹⁰

C. Short-term Elevated PE Prices Face Countervailing Pressures Likely to Moderate Longer-term PE Prices

Both PE prices and margins in the United States reached all-time record highs in 2021. The year 2021 witnessed an unprecedented rally in PE and polypropylene (PP) prices, led by a confluence of events: Strong domestic demand, interrupted supply issues, weather impact, a general inflationary environment, higher oil prices and a significant disruption of global trade/freight.¹¹ In particular, the need for

¹⁰ ICIS. *Insight: Can demand absorb the last big wave of global PE capacity?* February 2, 2022.

¹¹ IEEFA. *Why external review of price-setting mechanism for plastic resins is warranted.* October 2021.

personal protective equipment and other measures to reduce spread of COVID-19 increased the demand for single-use plastics.¹²

The upward price spiral that started in the third quarter of 2020 became a strong rally, pushing margins to historical highs. Rising prices were accompanied by rising end markets that allowed price increases to be passed along.¹³

PE prices peaked in September, but corrected sharply in the months of October and November. The tight market conditions eased in late 2021, when the COVID-19-related demand surge waned. Momentum remained downward through January 2022.

The current price environment is highly volatile. With the onset of inflationary pressures, followed by the conflict in the Ukraine, prices have spiked since January 2022. The current round of increases stemming from rising oil and gas prices erodes the potential for reliable margins. Political instability creates a level of uncertainty that contributes to further delay or cancellation scenarios.

PE prices are on a roller coaster. The impact of the current instability makes any price assessment necessarily tentative. The current inflationary environment is likely to move U.S. prices higher but in the longer term, as oil and gas prices recede, so should PE prices. The concern over rising costs from high oil and gas prices however is likely to push prices higher but margins down. Longer term, the oversupplied conditions going into the pandemic are likely to push prices down. PE prices should tend toward moderation, though still high when compared to pre-pandemic conditions.

Although rising prices for single-use plastics were successfully passed along to consumers during the pandemic, it remains to be seen if this will remain true for that segment of the market or for plastics generally.

Another long-term pressure on prices relates to the potential for policy initiatives to reshape plastics demand. Many national, state and local governments have passed various types of legislation to curtail demand of plastics. Recently, the United Nations Environmental Assembly forged an agreement to develop a long-term plan to address plastics production and pollution.¹⁴ The plan requires the participation of national governments. In addition, a number of major comprehensive processes are already far along in Europe and China.¹⁵ These initiatives have the potential, along with existing mandates, to change traditional supply and demand dynamics with a high likelihood that new mega petrochemical complexes will be hard to justify.¹⁶ In

¹² Chemical & Engineering News. [Single-use plastics have boomed during COVID-19](#). July 26, 2021.

¹³ Dive Brief. [P&G to hike prices as chemicals, raw material costs soar](#). January 27, 2022.

¹⁴ UN Environment Programme. [Historic day in the campaign to beat plastic pollution: Nations commit to develop a legally binding agreement](#). March 2, 2022.

¹⁵ European Commission. [EU Taxonomy for sustainable activities](#). March 13, 2021. Also see: IPE Magazine. [EC releases EU, China green taxonomies comparison](#). November 5, 2021.

¹⁶ IEEFA. [Accepting gas is unsustainable will bolster China's position on green energy finance](#). January 5, 2022.

the current environment, the initiatives create further uncertainty as companies consider long term capex commitments.

D. Formosa Petrochemical Plant Economics Deteriorate Further as Price Pressures on Ethane and Ethylene Tighten the Margin Picture

The principal attractiveness of the United States as a location for a petrochemical mega complex in recent years has been the low cost of natural gas.¹⁷ Currently, however, natural gas prices are high—and whether high or low, the price picture is volatile. Also, the relatively low cost of natural gas needs to be balanced against the constellation of risks related to construction costs, feedstock, regulatory and political issues, tariff issues and public opposition. PE margins are particularly sensitive to the feedstock costs.¹⁸

As Figure 9 shows, a 10 percent increase in ethane prices and 10 percent decrease in ethylene prices would reduce margins by 50 percent.¹⁹ IEEFA calculates the project has the potential for a margin of roughly \$258/metric tons, which is in line with that of IHS Markit’s margin analysis for ethylene plants in North America (See Figure 10).²⁰ Given the uncertainties due to inflation and environmental objections, the risk of a 50 percent reduction in margin based on current cost and market factors alone should give the company pause.

Figure 9: Illustration of Impact of Rising Ethane Prices and Declining Ethylene Prices on Cracker Margins (All Prices per Metric Ton)

	\$/Metric Ton	\$/Metric Ton	
Ethane	\$331	\$364	← +10%
By product Credits	(\$108)	(\$108)	
Utility	\$68	\$68	
Other Variable Costs	\$75	\$75	
Total Direct Fixed Costs	\$60	\$60	
Indirect Fixed Costs	\$50	\$50	
Depreciation	\$240	\$240	
All in Costs	\$716	\$749	
Ethylene Basis	\$974	\$877	← -10%
Margin	\$258	\$128	

Source: IEEFA analysis.

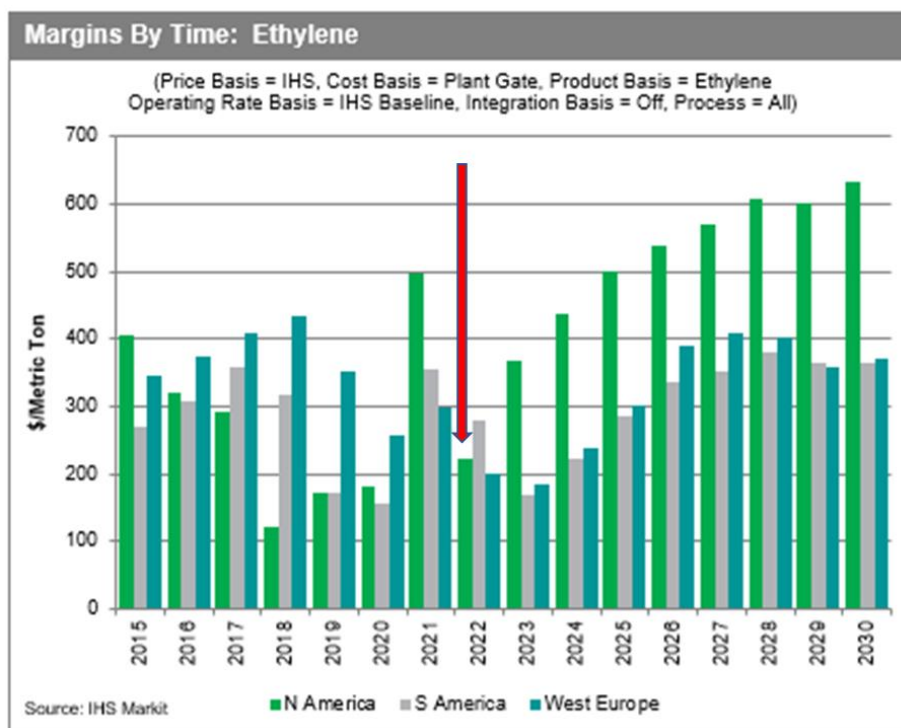
¹⁷ For a more detailed discussion of relative price advantage see IEEFA, [Shell’s Pennsylvania Petrochemical Complex: Financial Risks and a Weak Outlook](#). June 2020.

¹⁸ IHS Markit. Formosa Group Competitive Analysis. September 2021 (Proprietary).

¹⁹ For example, the Dallas Federal Reserve points during 2018-19 increased shale production drove down ethane prices while a series of factors aligned to tighten ethylene markets and drive prices upward. Federal Reserve Bank of Dallas. [Energy Indicators](#). February 2020.

²⁰ IHS Markit. Formosa Group Competitive Analysis. September 2021 (Proprietary).

Figure 10: Ethylene Margins as Estimated by IHS Markit



Source: IHS Markit data. Graphic adaptation by IEEFA.

Volatility in oil and gas prices have a significant impact on the ability of Formosa to develop a realistic financial scenario with robust margins that can withstand significant price changes. In the context of rising construction costs, a balance sheet analysis does not provide significant support to move to a final investment decision.

II. Regulatory and Community Hurdles Loom

A. Regulatory Issues Cloud Project Progress

The Formosa project faces regulatory risks. Formosa management has acknowledged that it cannot build a new petrochemical plant in Taiwan due to government concerns over environmental impacts. The company has stated that Texas and Louisiana government officials are more cooperative. Yet in Louisiana, Formosa's local, state and federal permits face legal challenges from the community and public interest organizations. The U.S. Army Corps of Engineers is re-evaluating the project's water permit based on new information on alternatives. The agency has required an environmental impact statement. Simultaneously, the company faces a challenge to its air pollution permit, issued by the state environmental agency, that raises concerns about cumulative toxic air emissions impacts and environmental justice. The potential for any of these proceedings to derail the project or add to its costs remains significant.

1. A Federal Agency Revoked the Project's Clean Water Act Permit Based on New Information and Now Requires Production of an Environmental Impact Statement

A Clean Water Act permit for the project was embroiled in litigation when the Corps identified new information on potential alternative sites for the complex, and decided to reconsider its decision. The Corps suspended the permit on Nov. 10, 2020, to consider the siting matter and other aspects of the permit decision.²¹ In the process, the Corps determined that an EIS was needed; the failure to conduct an EIS had been an important ground of the legal challenge to the initial permit in 2019.²²

The risk that the plant may cause water pollution through the discharge of tiny plastic pellets is likely to be discussed in the EIS. A Formosa plastics plant in Point Comfort, Texas, was sued in 2017 for allegedly discharging pellets and powders into nearby waterways. Although the company settled the case in 2019 with an agreement to conduct a cleanup, in 2021 it halted part of an interim cleanup of surface waters. In March 2022, a federal judge ordered Formosa to resume the cleanup work.²³

The EIS process is just beginning, and is likely to take at least a year to produce a final document and set of findings on which the Corps will rest its permit ruling. The ruling will be a new decision, and it may spark another appeal.

2. The State Air Permits for the Mega Complex Are in Litigation Before the Local District Court of Louisiana

Community and environmental organizations have challenged the decision of the Louisiana Department of Environmental Quality (LDEQ) to grant air permits for the various pollution sources that are part of the Formosa petrochemical complex. The organizations assert the LDEQ failed to analyze the cumulative impacts of the project on toxic air pollution levels in local residential areas and ignored environmental justice concerns. The complaint notes that the Formosa project site is located in a community with a high concentration of African-American residents, is already saturated with dozens of active industrial sites, and is one of the most heavily polluted residential areas in the United States.²⁴ When an intervenor requested consideration of certain additional evidence of the impact of the project from an environmental justice perspective, Louisiana District Judge Trudy White issued an interim order remanding the permit back to the LDEQ for more analysis. The judge stated, "I agree that the environmental justice analysis was inadequate in

²¹ U.S. Army Corps of Engineers. Notice of Suspension of Department of the Army Permit MVN-2018-00159-CM. November 10, 2020. Also see U.S. Army Corps of Engineers. Findings for Suspension (submitted in the permit appeal proceeding on November 13, 2020).

²² See 42 U.S.C. § 4332(2)(C).

²³ *San Antonio Bay Estuarine Waterkeeper, et al. v. Formosa Plastics Corp., et al.*, No. 6:17-cv-00047, slip op. (S.D. Tx. March 18, 2022).

²⁴ Petitioners Brief in Support of Their Petition for Judicial Review, *Rise St. James, et al. v. Louisiana Dept. of Env'tl. Quality*, No. 694,029, 19th Judicial District, parish of East Baton Rouge, February 14, 2020.

this particular case." She observed that "inherent ... in a robust environmental justice analysis is the recognition that environmental racism exists," and that it "operates through the state's institutions."²⁵ The First Circuit Court of Appeals overturned the interim order as going beyond what was requested in the intervenor's motion and what the judge had the authority to order the LDEQ to do in an interim ruling.²⁶ The district judge subsequently granted a second motion specifically requesting the court to order the LDEQ, on limited remand, to accept the evidence of disproportionate impact on the community. The LDEQ added the evidence to its record, as instructed, but reaffirmed its decision to issue the air permits. Legal briefs on the case in total have been submitted and oral argument before the District Court is expected to be held on March 14, 2022.

3. Environmental Justice Issues Will Remain a Prominent Driver of Public Concern About the Mega Complex Regardless of Litigation and Permit Process Outcomes

IEEFA's initial report discussed at length the issue of environmental racism, explaining that the matter found its way into the court based on decades of mistreatment of the African- American community.²⁷ President Biden, in remarks on signing an executive order on environmental policy, cited Louisiana's Cancer Alley as one of the hard-hit areas of concern with regard to "the disproportionate health and environmental and economic impacts on communities of color."²⁸ Those issues are not going to go away. They will remain center stage in the public dialogue.

Community residents have raised the issue that the proposed site for the petrochemical plant is a former African slave burial ground. The company has disputed the community's findings.²⁹ The matter remains a protracted controversy rooted in the historical patterns of discrimination that are on display as the disputes over the project continue.

²⁵ Order granting writ, *Rise St. James, et al., v. Louisiana Dept. of Env'tl. Quality*, No. 2021 CW 0032 (L. App. 1st Cir., March 15, 2021).

²⁶ *Rise St. James v. Louisiana. Dept. Env'tl. Equality*, 2021-0032, 2021 La. App. LEXIS 336 (La. App. 1st Cir., March 5, 2021).

²⁷ IEEFA. *Formosa's Louisiana Project: Wrong Products, Wrong Time, Wrong Place, Wrong Finances*. March 2021.

²⁸ The White House. [Remarks by President Biden before signing executive actions on tackling climate change, creating jobs, and restoring scientific integrity](#). January 27, 2021.

²⁹ Louisiana Illuminator. [How many burial sites are on the land where Formosa Plastics plans to build?](#) July 20, 2020.

III. The Taiwan Ratings Corporation (Standard & Poor's) Downgrade of the Company Is Based in Part on Doubts About the Proposed Louisiana Petrochemical Project

The balance sheet risks and the regulatory risks that ultimately find their way into project bottom lines are growing in size and complexity. For the Formosa project, the convergence of these risks at this time are daunting.

A. The S&P Rating of 2021 Expands on Concerns Raised in the 2020 Rating

The Taiwan Ratings Corporation, an S&P Global company, downgraded Formosa in October 2020, based in part on the anticipated risks associated with Project Sunrise. Since then, Formosa has put the project on hold in light of the pandemic,³⁰ and the Army Corps ordered a halt to activities related to the suspended federal water permit.³¹ In the short term, the absence of significant cash outlays to build the project has improved the company's credit standing.

In its October 2021 analysis, the credit rating agency takes a longer view of the project. In addition to the impact on profitability of the current construction price environment and other market factors, the credit analysis states that the decision by federal regulators in August 2021 to require an environmental impact statement casts doubt on the future of the project.

B. The Proposed Project Suffers From Diminishing Prospects

Standard and Poor's sees diminishing probability that the planned project in Louisiana will go ahead, given the state and local permit challenges that the project faces. The project has been on hold since November 2020, as noted above. The company has now put off any final investment decision pending the outcome of the permit process. Sharply higher construction costs due to high inflation in material prices and wages, hefty tariffs on imported equipment from China, and lower availability of local labor due to the pandemic add further uncertainty.

S&P's recent review of the company and the project supports the concern that the project faces potentially insurmountable challenges.

"We believe the four 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

³⁰ S&P Global. [Formosa Taiwan unit indefinitely delays \\$94 billion Louisiana petrochemical complex](#). November 23, 2020.

³¹ U.S. Army Corps of Engineers. Notice of Suspension of Department of the Army Permit, *op. cit.*

specialty products, particularly electronic materials for emerging applications such as electric vehicles. This could help smooth their capex cycles without sharp swings in their free operating cash flow and debt levels.”³²

The hiatus driven by the pandemic and the EIS requirement takes place against a backdrop of increasing challenges to the company and the industry from the public and from market forces. S&P notes that Formosa and other companies seeking to develop large petrochemical complexes are likely to encounter continued opposition. Formosa's internal assessment of the market and political considerations may also contribute to a strategic pivot by the company into specialty projects and electronics with more profitable outlooks, especially areas that contribute to the energy transition.

Conclusion

This 2022 update from IEEFA's 2021 report demonstrates that the key financial conditions affecting the proposed Formosa petrochemical mega complex in Louisiana have further deteriorated. The project remains unviable. Recent regulatory developments, in addition, challenge the future legal status of the project. The recent credit opinion of the company, issued by a Standard & Poor's global company, reflects the growing view among members of the financial community that Formosa's Louisiana project is a poor investment.

³² S&P Global. Ratings on Formosa Plastics Corp. and Three Associated Companies Affirmed at 'BBB+' On Low Debt Leverage; Outlook Stable. October 2021.

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

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