



ADI Analytics

OIL & GAS • ENERGY • CHEMICALS

2022 ADI Industry Outlooks



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2022 Upstream Industry Outlook: Balancing growth and discipline



Utkarsh Gupta

Upstream: Balancing growth and discipline

January 2022

After the COVID-19 pandemic-related lockdown in 2020 that shook the global economy and shattered oil prices to record bottoms, the upstream oil and gas industry rebounded strongly throughout 2021 with oil prices reaching record levels not seen in past six years. Upstream oil and gas performed better than expected in 2021 and future trends will rely on how the upstream producers and investors go along in 2022. We expect 10 key trends that will shape the upstream oil and gas industry in the coming years:

North American shale producers will show greater capital discipline

North American shale industry is no longer following the traditional price and investment cycle

Despite high oil prices, O&G companies will show greater production and capital discipline and we expect global upstream capital spending to grow marginally in 2022. Even as WTI oil prices returned to pre-pandemic levels of just above \$70 per barrel, shale producers are choosing to conserve cash rather than spend it on new production. Historically, shale companies have reinvested all their discretionary cash flow back into new capital spending and then borrowed extra to reinvest on top of that. But now this reinvestment rate, once as high as 110-130% of cash flows, has fallen sharply. A fall in drilling but uncompleted (DUC) wells inventory, flat crude oil production levels, and slow rise in rig count suggests that the industry is no longer following the traditional price and investment cycle.

Share of oil companies' capital spending on renewables will increase as part of their commitments to energy transition

More and more companies have announced their net-zero goals and robust oil prices will allow them to fund their net-zero commitments going forward. High oil prices will allow producers to comfortably invest in riskier and costlier green energy

solutions such as carbon capture, storage, and utilization (CCUS). Oil majors will lead the transition with a greater share of capital spending in renewables which will be followed by O&G independents, Canadian oil sand producers, and national oil companies.

U.S. oil production to remain ~12 MMbpd with producers maintaining production discipline even as oil prices are rising

Oil companies will continue to draw down their inventory of unfinished wells as they are limiting new drilling to satisfy investors who want to see financial discipline after the pandemic-driven oil bust. Drilling but uncompleted wells (DUCs) help operators produce oil and natural gas at a lower cost and with high decline rates per well, operators are drilling new wells by first exhausting their DUC inventory to maintain production levels before putting their money on a new well. The DUC inventory declined by ~27% in 2021 from the previous year and is expected to decline further through 2022 before the producers start to drill new wells.

Oil majors will lead energy transition

Conventional oil production will reach pre-pandemic levels

OPEC maintained its forecast that world oil demand will grow by 5.65 million bpd in 2021, after last year's historic decline at the start of the pandemic. In 2022, OPEC expects further growth in demand of 4.15 million bpd which will push world consumption above 2019 levels. OPEC and its allies, known as OPEC+, are gradually unwinding record output cuts put in place last year. Recently, they agreed to boost monthly output by 400,000 bpd in January 2022, despite the concerns about the new variant. A new drilling program will get Russian supply growth back in line with its OPEC+ quota hikes, allowing crude production to increase by nearly 500,000 b/d by June 2022.

ESG, sustainability, and net-zero commitments will lead to big portfolio shifts

Investors are increasingly seeking out positions that reduce their exposure to climate change as well as the risk of stranded assets. Several oil and gas companies have already set net-zero-emissions targets. Occidental Petroleum partnered with the Canadian start-up Carbon Engineering to build a plant that will capture and bury 500,000 metric tons of CO₂ each year. Oil majors' low-carbon investment guidance shows that BP and Equinor will invest ~35% of the total capex followed by Shell and ENI will invest ~20-25% going forward. Apart from the doubled investments in clean energy, a major difference from 2020 is that U.S. supermajors, ExxonMobil, and Chevron, have also pledged investments in low-carbon energy.

DUC inventory will continue to decline in 2022

Business model restructuring will significantly impact oilfield service companies

Revenues and earnings of most of the oilfield service (OFS) companies have fallen sharply as most upstream companies have reacted to investor skepticism and negative market sentiments cutting their cost structure with the goal of decoupling their costs from the movement of hydrocarbon prices. With margins at the mercy of another price cycle and reduced spending, many OFS companies are crafting a new strategy for the future of energy. They have restructured their business by making big bets on cloud and edge computing, partnered with startups and institutions through development centers, and investing in low-carbon technologies as a secondary solution provider to upstream players committed to energy transition.

OPEC+ output may increase by ~500,000 b/d by June 2022

Operators will continue investments in their offshore oil & gas assets albeit at a slower pace of growth

Oilfield service companies are investing in low-carbon technologies

High oil prices will allow oil majors to continue offshore oil and gas discoveries and invest in and highly productive deepwater assets. Prospects in Brazil, Guyana, Suriname, Namibia, and South Africa will see high capital investments. By the end of 2022, 13 new projects could account for about 12% of total Gulf of Mexico crude oil production, or about 200,000 barrels per day. Another relevant discovery was made offshore Malaysia when Nangka-1 became the second successive exploration well drilled within Block SK 417. Furthermore, Norway continues to unearth small-to-medium finds, providing an opportunity to materialize these discoveries with available infrastructure.

Non-public shale companies will capitalize on high oil prices but may disrupt the balance going forward

By the end of 2022, 13 new projects could account for ~12% of total Gulf of Mexico crude oil output

After years of unwieldy supply growth, large E&Ps and oil majors have shown restraint in capital spending and production volumes but private operators' ambitious growth plans present the industry with a wild card as prices rebound and it attempts to lift its own production and financial situation. At one point, DoublePoint Energy was running more rigs in the Permian Basin than Chevron, and meanwhile, family-owned Mewbourne Oil had about the same number of rigs as ExxonMobil. Private equity-backed companies are being driven to pump harder than ever before because of a more complicated exit strategy. We expect a lot of private operators will return in an aggressive manner to add wells and rigs because they are able to realize returns faster as oil prices are improving.

Gas players will make it big going forward

Global natural gas production dropped by almost 2.5% or 10 billion cubic feet per day in 2020 impacted by reduced demand due to the COVID-19 pandemic and resulting economic recession. Demand recovery in 2021 and growth in emerging markets from continued displacement of coal with natural gas

Private equity-backed companies are being driven to pump harder

drove the gas supply growth although most of it mainly came from projects already under development. Going forward, Europe, mainly led by Russia, followed by Middle East, Africa, North America, and Asia Pacific are collectively expected to grow at 7-9% through 2025. North American gas supply growth will mainly be driven by U.S. LNG exports of natural gas produced primarily from plays such as Appalachian and Permian. European gas production growth will be driven by Russia, which will benefit from projects such as the Power of Siberia and Nord Stream 2 pipelines, and the Yamal and Arctic LNG 2 plants.

ESG issues are at an inflection point in the global chemical industry with growing focus on material and substantive efforts

Powerful alliances will play a key role in oil price trends

More and more companies are being impacted by ESG issues from regulators, consumer choices, and other stakeholders. Going forward, we expect a greater focus on material and substantive efforts. For instance, BASF acquired a 49.5% share in the offshore windfarm Hollandse Kust Zuid and signed multiple power purchase agreements (PPA) with renewable energy providers as part of their net-zero CO2 emissions goal. Additionally, in partnership with SABIC and Linde, they are developing an electric steam cracker furnace. In another example, Poland-based PKN Orlen and Orlen Poludnie are planning to build 25,000 tpy bioethanol plant. Finally, India-based Gas Authority India Limited (GAIL) and Gujarat Alkalies and Chemicals Limited (GACL) are also planning to set up a 1,428 tpy bioethanol plant. These trends are expected to continue over 2022.

We expect a greater focus on material and substantive efforts in 2022

Geopolitics are likely to play a longer role in oil markets than ever before

The steep rise in oil and gas prices was probably the most dramatic development in commodities markets in 2021. The surge in energy prices fueled high inflation worries as soaring costs badly affected businesses and consumers globally.

Western countries accused Russia of limiting gas deliveries to put pressure on Europe amid tensions over the Ukraine conflict and to push through the controversial Nord Stream 2 pipeline set to ship Russian gas to Germany. Increased shale gas and shale oil production in the USA will affect global geopolitics and national security considerations. An influx of Qatari LNG into Europe and Asia, which is diverted from the USA, will erode the tremendous market share held by Gazprom and significantly reduces its pricing power. Crude oil prices also rocketed in 2021, gaining more than 50% as demand recovered and oil-producing nations led by the Organization of the Petroleum Exporting Countries (OPEC) and allies including Russia modestly boosted supplies. Powerful alliances will play a key role in determining the future trends of oil prices.

Utkarsh Gupta

ADI Analytics will continue to monitor, track, and research the upstream oil and gas market. Please review and [contact us](#) to learn more about our [research](#).

2022 Midstream Industry Outlook: Challenging times ahead



Thomas Dennis

2022 Midstream Outlook: Challenging times ahead

January 2022

Midstream companies will cut back on capital spending in 2022 significantly by over 50% from 2021

Capex of Enbridge and Kinder Morgan will be cut by \$4.3 B and \$1 B, respectively

The projections for capital spending in 2022 by large midstream players show a consistent trend of cutting back from 2021 spending. For example, Kinder Morgan expects to cut \$1 billion in capital spending while Enbridge has announced a capex target that is \$4.3 billion less than in 2021. This is in large part due to companies choosing to be fiscally responsible and focus on investor returns after a large year of expansion projects in 2021. This is also reflective of lower rig counts due to the higher levels of spending discipline amongst upstream operators meaning midstream companies were able to use 2021 as a “catch up” year and can lower their expansion projects now until production picks back up. However, the rig count in the U.S. has slowly been creeping back but has yet to reach pre-pandemic numbers. Finally, the allocation of capital spending in 2022 may shift a bit towards energy transition with spending on areas such as renewable natural gas and cutting Scope 1 emissions.

Crude oil, NGL, and gas pipelines will grow by 930,000 bpd, 45,000 bpd, and 14.7 bscfd, respectively

Midstream capacity in the U.S. will increase but at a slower pace in 2022

In the US, there are currently only two planned expansion projects expected to come online in 2022 which will add 930,000 barrels per day of crude oil evacuation capacity. This number could go up, but it is expected to remain below the 3.4 million barrels per day of capacity that was scheduled to be completed in 2021. This is consistent with midstream companies' cuts to capital spending. Both NGL and natural gas capacity are also expected to be on the low side this year with 45,000 barrels per day expected in NGL capacity expansion and 14.7 billion standard cubic feet per day for gas.

Oil's production capacity is waiting on production to catch back up

As it stands right now, crude oil takeaway capacity is still building but midstream operators have put many projects on hold to wait for production to catch back up. The Permian basin's crude takeaway capacity is going to remain higher than production until mid-2025 according to ADI's projections and Bakken and Eagle Ford could see capacity remaining above production through 2025 as well.

NGL production will ramp up from 5.38 to 5.84 million bpd in 2022

Natural gas' takeaway capacity constraints are expected to continue in 2022

As projects are slowing down, midstream companies remain behind gas production. In the Permian basin, they could be behind by as much as 3 billion cubic feet per day if no new projects come online. In the Bakken, we expect capacity to meet production at 3.3 billion cubic feet per day, but to quickly be passed again by the start of 2023. The Appalachian region outlook is not much better, as capacity constraints may cause seasonal shut ins in the coming years.

Guyana expects to be producing around 750,000 bpd by 2025

The natural gas liquids takeaway capacity will be more reflective of crude oil than gas

NGL production is expected to ramp up in 2022 from 5.38 to 5.84 million barrels per day. Despite this, takeaway capacity should be able to account for it all as it is currently 7 million barrels per day ahead of production.

Midstream growth in a few international markets is expected to be higher than in the U.S.

Midstream projects are expected to be announced in South America to meet the growing production they are experiencing in some of their offshore oil plays. Projects are popular in the region due to quick payback times and low breakeven prices in

countries like Guyana where offshore activity has been hectic. The country expects to be producing around 750,000 barrels per day by 2025 leaving open the door for midstream infrastructure to be put in place to accommodate the new production.

Midstream companies are investigating their role in carbon capture and sequestration projects

In Europe, although new midstream capacity additions will be limited, a lot of attention will converge on the controversial Nord Stream 2 gas pipeline that seeks to deliver another 150 million scfd of natural gas from Russia to Germany. Although the pipeline's construction is more or less complete, Germany has not approved operations yet and the decision is subject to a number of geopolitical factors.

Midstream looks to make its mark in energy transition with projects in carbon capture and storage

Along with the oil & gas industry, midstream is trying to shift its focus onto energy transition projects. Many operators are motivated by the push from investors as well as new tax credits from the government. A few midstream companies are investigating their role in carbon capture and sequestration projects. For example, Energy Transfer LP has already begun working on a project at the Marcus Hook liquids terminal in Pennsylvania. By partnering with oil downstream company, Sunoco Logistics, to transform the Marcus Hook liquids terminal from a storied refinery to an NGL hub.

Understand global small-scale LNG markets with ADI's new research study

Hydrogen is also of interest to midstream operators exploring energy transition opportunities

Another area in the energy transition that we expect to see midstream grow in is hydrogen transportation. New policies such as the potential for federal hydrogen tax credits in the coming year could further intensify interest in hydrogen. It has been suggested that due to the large pre-existing natural gas

pipeline infrastructure, it makes sense to [convert the pipes to move a natural gas hydrogen blend](#) rather than build entirely new hydrogen pipeline infrastructure. This has come with its own set of issues, though, as the differences between the gases would still cost what many consider to be an unworthy amount of capital to calibrate the pipelines to take the hydrogen.

Despite this, companies like Kinder Morgan are currently investigating ways to see if it can work. Some players are also beginning to look at hydrogen as a fuel option to clean up their operations. This is primarily being looked at to power compression and facility power generators. Outside of hydrogen, a few companies are beginning to investigate renewable investment opportunities such as Kinder Morgan's investments in renewable natural gas.

European Union is indirectly tackling the flaring problem by enforcing regulations aimed at reducing methane emissions from the oil and gas industry

New 2022 policies could slow midstream capacity growth in the coming years in the U.S. and Europe

New regulations and policies could slow the U.S. midstream oil and gas industry. The EPA is rewriting a rule made under the Trump administration that changed how the Clean Water Act is viewed. This will allow states the ability to put regulations on where pipelines can be built and hold up projects more easily.

Regarding emissions, the discussion of more stringent flaring and methane emissions regulations in the United States was had at state and federal levels last year, with New Mexico, Colorado, and North Dakota showing the greatest interest in cutting down flaring and methane emissions. In January 2021, President Biden signed an executive order that encouraged the Environmental Protection Agency to propose new regulations to reduce methane emissions in the oil and gas sector before the end of September 2021. Without fail, the EPA devised a plan and proposed new regulations that are currently being evaluated. These proposed regulations mention the importance of cutting down flaring and list some action items that could be

enforced in the final rule sometime this year. The agency also intends to issue a supplemental proposal this year that will support the regulations that were proposed last year.

There are over 50 new processing facility projects under way in the Permian

Internationally, the European Union is also indirectly tackling the flaring problem by enforcing regulations aimed at reducing methane emissions from the oil and gas industry. International groups that have prominent members from both the public and private sector also exist to help reduce methane emissions and flaring in troubled countries, such as Nigeria. It is expected that efforts to reduce methane emissions will continue to be led in 2022, which will consequently cast a spotlight on flaring activity and regulations. Europe is also in the middle of handling the future of its natural gas infrastructure which is currently centered around Nord Stream 2. The U.S. government has dropped sanctions against Gazprom, but the European Union policies prevent both the pipeline and gas supply to be owned by the same company, holding up Russia's efforts. If completed it will give Russia a stronger role in European gas prices and supply, and limit opportunities for further demand growth for U.S. LNG.

Europe's winter gas shortages may provide a perfect launch point for the natural gas storage markets

Midstream companies continue to add capacity for much needed gas processing and little needed NGL fractionators

As natural gas capacity will continue to be tight in 2022, midstream companies are rolling out projects to add new and move current gas processing facilities to high production areas in the Permian, Bakken, and Appalachian regions. In the Permian region, there are over 50 new processing facility projects under way on top of companies building pipeline infrastructure to run near pre-existing processing facilities. For example, Summit Midstream and Exxon's XTO Energy are working on a pipeline that will run past 30 processing facilities with a total processing capacity of around 10 billion cubic feet per day. NGL fractionators, however, do not share this need for expansion. There is already an overbuild of capacity for the NGL production and more projects are still scheduled to come.

We therefore anticipate strong opportunities for further exports of NGL components in 2022.

With Europe's lack of natural gas this winter, we could see natural gas storage capacity increase

It is unlikely that natural gas storage in the U.S. will ramp back up anytime soon. Despite the increase in renewable energy plants needing backup power and winter storm Uri causing concern for utility companies, the supply of natural gas in the U.S. still has companies comfortable as they do not expect another Uri like event for quite some time and renewable energy is still growing. However, Europe's winter gas shortages may provide a perfect launch point for the natural gas storage markets as capacity will likely increase in 2022. Due to the lack of supply in Europe except from Russia, as well as leading the world in renewable energy efforts, Europe is the perfect region for new natural gas storage in projects.

Thomas Dennis

ADI will continue to monitor, track, and research midstream oil and gas markets and players. Please review our [expertise](#) in this segment and [contact us](#) to learn more about our [research](#).

2022 Refining Industry Outlook: Cautious optimism in the wake of a challenging transition



Uday Turaga

2022 Refining Outlook: Cautious optimism in the wake of a challenging transition

January 2022

Looking back, 2021 was likely more frustrating for petroleum refiners globally than 2020. Refiners had reconciled to the black swan year of 2020 represented by the pandemic, the resulting lockdowns, and fuel demand destruction. However, 2021 was supposed to mark a return to normalcy, and, to a large extent, the world made a lot of progress towards normalcy. But the COVID variants put paid to the complete recovery oil & gas markets were hoping to achieve.

First, the Delta variant roiled major fuel consumers such as India in the summer of 2021, and, then, Omicron engulfed the world and slowed down the momentum towards recovery. Collectively, only ~40% of the ~7.5 million barrels per day that refiners cut throughput by in 2020 was recovered in 2021. Refiners thus enter 2022 with tempered expectations and cautious optimism, which is appropriate given the 10 themes we are forecasting at ADI Analytics.

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**Fuel demand and refining capacity utilization
will continue to inch upwards globally to
historical averages of 92% to 94%.**

Demand recovery across fuels and regions will, however, be uneven. For example, jet fuel demand recovery will continue to struggle through 2023. [Historically, jet fuel demand destruction has been slow to recover as we have pointed out in a recent blog for our new multi-client study on the future of jet fuel markets.](#)

**Crack spreads will generally follow fuel
demand and utilization recovery but we
anticipate diesel cracks to be better**

positioned in 2022.

Crack spreads will generally follow fuel demand and utilization recovery but we anticipate diesel cracks to be better positioned in 2022.

At a high level, there was little news in how gasoline, diesel, and jet fuel cracks performed across the major markets in 2021. Going forward, however, we anticipate limited upside in either gasoline or jet fuel cracks. Diesel margins, however, may benefit from the high natural gas prices in European and Asian markets driving up demand for gasoil. Another factor that will likely drive up diesel margins will stem from growing competition for bio-based feedstock to feed renewable diesel hydrotreaters.

High oil prices and a return to traditional pricing differentials will help refiners but high inflation rates globally may start impacting fuel demand and cut into margins.

In 2022, continued discipline among OPEC and shale oil producers is expected to push oil prices, at least, into the \$80s and potentially higher. Further, as crude oil supply is closer to demand, traditional pricing differentials, e.g., between light and heavy crude, will be restored. Collectively, large and complex, high-conversion refiners will enjoy better margins. But the crude oil discounts that mid-continent refiners in the U.S. enjoyed due to lack of pipeline capacity or high production rates are now a thing of the past. Collectively, these trends will support refining crack spreads in 2022.

Major refining capacity hubs, e.g., U.S. Gulf Coast and Middle East, will have to continue improving their cost competitiveness as exporters to emerging markets.

Global refining capacity is oversupplied by 5% to 6% today after adjusting for utilization, with much higher levels of excess capacity in some regions.

ADI has benchmarked the global asset base of refineries for their economic and sustainability competitiveness and our analysis shows that, while refinery closures have picked up pace, another 2-3 million barrels per day of refining capacity will have to be closed over the next year or two. In the

absence of such closures, refining margins will face severe downward pressure in a few markets.

Refiners will continue to add more granularity to their long-term corporate strategies especially around preparing for the Energy Transition.

Major refining capacity hubs, e.g., U.S. Gulf Coast and Middle East, will have to continue improving their cost competitiveness as exporters to emerging markets.

Latin America and some parts of Asia continue to struggle with supplying refined products to their rapidly growing domestic markets. [This has over the past decade created opportunities for refiners on the U.S. Gulf Coast and the Middle East to export although both regions are oversupplied in refining capacity.](#) Refined product importers are, however, changing by implementing fuel policy reforms, improving capacity utilization rates, and promoting adoption of electric vehicles, fuel efficiency standards, and biofuels. In the wake of these developments, refiners relying on exports will have to continue to find ways to improve their competitiveness in 2022.

Renewable diesel capacity will continue to rise but the party may begin winding down in 2022 due to falling credit prices, feedstock supply challenges, and more competition.

Renewable diesel (and gas) is helping operators simultaneously address multiple challenges: growing demand for energy transition investments, California's greenhouse gas emission regulations, and the need to cut surplus, high-cost refining capacity. Aided by incentives from California's Low-Carbon Fuels Standard (LCFS), renewable diesel capacity could grow with new projects to 7-8 billion gallons through 2025. However, soybean oil and other bio-based feedstocks are likely to fall short of renewable diesel capacity. That coupled with lower LCFS credit prices could impact renewable diesel margins.

Retail assets and competencies are fashionable again and will be pursued aggressively in 2022.

Sustainable aviation fuel (SAF) is in the spotlight, and while more progress will occur in 2022, the year may also highlight the significant challenges that await its widespread commercialization.

Sustainable aviation fuel (SAF) is in the spotlight, and while more progress will occur in 2022, the year may also highlight the significant challenges that await its widespread commercialization.

As various airlines run commercial flights with SAF-blended jet fuel, the renewable fuel is enjoying its place in the sun. Even so, these are baby steps relative to the challenges of decarbonizing aviation, which is a hard-to-abate sector that is also the focus of intensive consumer scrutiny. While a number of SAF technologies are making progress, costs are still too high and widespread commercialization will face the same challenges in sourcing bio-based feedstocks that we are seeing with renewable diesel.

Net-zero commitments in response to sustainability and energy transition pressures rely heavily on biofuels beyond which cutting emissions becomes increasingly expensive.

Refiners can cut their greenhouse gas footprint significantly through the production of ethanol, biodiesel, and renewable diesel, and most are pursuing those opportunities to the fullest extent possible within their assets' capabilities. Beyond that, operators will have to rely on carbon capture and storage for any material reductions. However, CCS is very expensive to deploy in refineries and likely uncompetitive for smaller plants. Even so, a few refiners will have to explore options to deploy CCS to prepare for their companies' broader net-zero commitments.

Refiners will continue to add more granularity to their long-term corporate

strategies especially around preparing for the Energy Transition.

Refining has changed significantly in the past few years and a number of those changes were motivated by pressures that are, to a large extent, related to the Energy Transition. For example, several U.S. refiners shifted their West Coast capacity towards renewable fuels and/or terminals as California's climate change and low-carbon fuel policies made for challenging operations. Similarly, a number of integrated European oil majors divested their refining assets. Finally, refining independents have begun identifying carefully developing opportunities that fit their competencies in an Energy Transition world. For example, Phillips 66 leveraged its specialty coke capabilities to acquire stake in a battery materials company. Valero continue to strengthen and expand its biofuels business and Reliance is exploring crude oil-to-chemicals although its tie-up with Aramco is being re-evaluated. Such careful portfolio optimization will intensify in 2022 preparing the largest refiners for the Energy Transition.

*Understand
global small-
scale LNG
markets with
ADI's new
research study*

Retail assets and competencies are fashionable again and will be pursued aggressively in 2022.

Petroleum refiners spent the 2000s getting rid of retail fueling stations in a bid to pursue opportunities that offered higher returns on capital employed. In a low-/zero-carbon world, oil & gas majors will need deeper relationships with their customers that can be facilitated through strong fuel retailing brands. Refiners will likely strengthen their existing presence or explore opportunities to build retail presence in 2022.

Uday Turaga

ADI brings deep expertise in fuels, refining, and downstream markets including chemicals and petrochemicals through its ADI Chemical Market Resources business. We will continue to track these markets through consulting and research projects. Please [contact us](#) to learn more about our [research](#).

2022 LNG Industry Outlook: Streaming into the roaring twenties



Panuswee Dwivedi and Uday Turaga

LNG: Streaming into the roaring twenties

January 2022

The global LNG market showed strong even if tumultuous growth during 2021. Demand rebounded post-COVID driven by easing restrictions, a long and cold winter, and intensifying decarbonization efforts. Record-low inventories and damp supply growth resulted in a tight LNG market that will continue well in 2022. China surpassed Japan as the largest buyer of LNG and emerging markets in Latin America and Asia are expected to drive further demand growth. **The United States surpassed Australia as the largest exporter of LNG in December 2021** while export from some LNG exporting countries is likely to fall. Collectively, the LNG team at ADI Analytics sees 9 major themes for 2022:

The U.S surpassed Australia as the biggest exporter of LNG and ...

Global LNG supply and growth will be led by the U.S. that surpassed Australia as the largest exporter this year

Global supply and shipping constraints and cost-advantaged shale gas resulted in the U.S. claiming the number one LNG exporter spot in 2021. U.S export capacity peaked at 88 million tons of LNG in 2021 followed by Australia and Qatar that have export capacities of 87 and 79 million tons, respectively. Qatar will not be able to export more until the North Field expansion comes online. The U.S. is expected to lead the market for a while mainly with multiple projects coming online.

... Nearly 20 million tons per year capacity is expected to come online in 2022

Cheniere, Tellurian, Venture Global, and Golden Pass are expected to drive U.S. LNG exports in 2022

Expected expansions in 2022 will add approximately 20 million tons of export capacity

Global LNG demand is expected to grow by ~3% in 2022

- Sabine Pass LNG Train 6 with 5 million tons per year capacity
- Sabine Pass LNG may expand capacity by 10% across all six of its trains amounting to around 3 million tons per year expansion
- Corpus Christi LNG also may expand capacity by 14% across all three of its trains amounting to around 2 million tons per year expansion
- Calcasieu Pass LNG start-up with 10 million tons per year capacity
- Golden Pass LNG Trains 1 to 3 with combined capacity of 18.10 million tons per year is under construction to start-up by 2024 or 2025
- In addition, FID is targeted for Driftwood LNG, Louisiana with 27.6 million tons per year capacity, Freeport LNG train 4 in Texas with 5.1 million tons per year capacity, and Corpus Christi LNG Stage III with a capacity of 11.5 million tons per year in Texas, totaling 44.2 million tons per year
- Other approved projects that have completed FEED are Plaquemines LNG Phase 1 and 2 with combined capacity of 24 million tons per year, Texas LNG with capacity of 4 million tons per year, and Rio Grande LNG with 27 million tons per year. A successful 2022 for U.S. LNG will surely impact the decision on whether these projects will go forward.

Access ADI's multi-client study on [the Jet Fuel outlook](#)

Global LNG demand is expected to grow by ~3% in 2022 following a ~7% growth in 2021

Global LNG demand grew from 360 million tons in 2020 to 384.5 million tons in 2021, a 6.8% year-on-year growth. It is expected to increase to 396 million tons in 2022, a growth of 2.9% year-on-year. China surpassed Japan as the largest buyers of LNG in 2021 and will remain so in 2022. A disparity in slowing or stagnant LNG demand growth in developed economies such as Japan and Western Europe and rising demand growth in emerging economies such as China, India, and other countries in Asia as well as Africa will result in falling LNG demand growth.

Gas demand in Japan fell during 2021 while demand growth in South Korea slowed down

Growing dependence on nuclear power in Japan and nuclear as well as coal-based power in South Korea impacted their LNG imports that amounted to nearly 76 million tons and 40 million tons, respectively, in 2021, compared to 75 million tons and 36 million tons, respectively, in 2020. Gas demand in Japan is expected to remain flat during 2022 whereas South Korean gas demand is expected to grow as the government pushes away from coal-fired power generation. A similar push away from coal in other emerging economies will offset Japan's stagnant LNG demand.

Global LNG demand will be driven by China mainly replacing coal for power but rising domestic coal production may hinder LNG imports

China imported nearly 83 million tons of LNG in 2021, 21% higher than 2020, mainly driven by advancement in the residential and commercial sectors that resulted in natural gas grid expansion. China will continue to retain the number one importer spot in 2022, however, the gas supply crisis and high prices may force China to reevaluate their dependence on imported LNG.

Emerging economies in Asia will support global gas demand growth offsetting demand drop in developed economies

Even so, we anticipate this to be a short-term bump with continued dependence on LNG in the medium- to long-term. Pakistan, Bangladesh, and Thailand along with China will be key growth areas driven by rising regulatory pressure for decarbonization. Imports to Indonesia are expected to rise from roughly 4 million tons in 2021 to 4.8 million tons in 2022.

Global LNG demand will be driven by China and emerging economies in Asia, Latin America, and Africa

Asian LNG prices will range \$8-\$10 per MMBtu and ...

... LNG prices will range \$11-\$15 per MMBtu in Europe

Imports to Malaysia will increase by 1.6 million tons to reach 4 million tons in 2022. Imports to Thailand will increase from 6.6 million tons in 2021 to about 7.4 million tons in 2022.

Small-scale LNG will see more growth in 2022

Many new LNG importers in Asia, Latin America, and Africa are expected to emerge over the near term

Vietnam, Philippines, Australia, and Sri Lanka in Asia as well as few countries in Latin America – El Salvador, Nicaragua, and Ecuador, and Ghana, Senegal, and Benin in Africa are likely to start importing LNG in the near term.

Continued dependence on LNG in Asia will keep prices at \$8-\$10 per million Btu while LNG woes will keep prices high at \$11-\$15 per million Btu in Europe

LNG prices were more volatile in 2021 than in the past and touched \$10/MMBtu in Asia and \$16/MMBtu in Europe. We expect similar high prices and volatility in 2022 because of limited LNG supply growth before 2023/2021, geopolitical challenges with Russian gas supply into Europe, and rapid economic growth coupled by intensifying decarbonization in Asia.

Understand global small-scale LNG markets with ADI's new research study

Growth in small-scale LNG is likely to continue in 2022

Small-scale LNG will continue to be used in applications such as energy storage, peak shaving, city gas distribution, transportation, and remote power. U.S. based Chart Energy recently announced their involvement in small-scale projects across U.S. for energy storage and peak shaving applications. Additionally, they will also provide liquefaction technology for European biofuel provider, Verbio, for biomethane liquefaction. LNG as fuel in marine transport in the Baltics is another driver

for small-scale LNG in Europe. Singapore-based small-scale LNG provider, Pavilion Energy, entered an agreement to supply 0.5 million tons per annum (mtpa) to Chinese gas distributor Zhejiang Hangjiixin Clean Energy. Eagle LNG will supply LNG to a power plant in Aruba from its small-scale LNG plant in Florida. In Nigeria, the planned small-scale LNG import terminal will replace diesel other fuels used for remote power. Gas-to-power developer, New Fortress Energy, will deploy its Fast LNG technology to produce 1.4 million tons per year LNG in the Atlantic coastal basin offshore Mauritania aimed to serve local gas and power markets as well as for international exports. Fast LNG pairs gas liquefaction technology with jack up rigs or a similar floating structure saving time and cost of a similar floating liquefaction infrastructure. New Fortress Energy expects to be able to produce LNG at \$3-4/MMBtu and will become operational in about 20 months.

Panuswee Dwivedi and Uday Turaga

ADI will continue to monitor, track, and consult in the LNG market. You can access our insights by subscribing to the [ADI Newsletter](#) or [contact us](#) to learn more about our research.

2022 Hydrogen Industry Outlook: Continued momentum towards a grand vision



Utkarsh Gupta

2022 Hydrogen Outlook: Continued momentum towards a grand vision

January 2022

Powered by rising support for decarbonization, hydrogen is being positioned as a key pillar to the energy transition. Through 2021, more than 200 hydrogen projects were announced, 30 countries had released their hydrogen roadmaps, and governments worldwide announced billions of dollars in capital spending towards hydrogen infrastructure. This momentum is expected to continue in 2022 with demand generation and cost reductions being the focus across the hydrogen value chain.

Hydrogen demand will grow at 4.5% through 2025 with Europe growing

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Global hydrogen demand is expected to grow at 4.5% annually depending on decarbonization policies from ~74 million tons per year (MMTPA) to ~77 MMTPA in 2022. Demand will be dominated by Asia Pacific, Europe, and North America with Europe growing the fastest followed by Asia-Pacific and North America. Transportation use of hydrogen, driven by decarbonization goals and government incentives, will be the fastest growing sector followed by industrials including methanol and ammonia manufacturing.

Europe, North America, and some Asian countries will be early adopters of hydrogen

Government and policy support stems from a global shift in sentiment for decarbonization with ~75 countries announcing their net-zero ambitions and ~30 countries that have created hydrogen strategies on a national level. Europe leads globally in the number of announced hydrogen projects, with Australia, Japan, Korea, China, and the U.S. following as additional hubs. In expected major demand centers like Korea, Japan and Europe, the focus will be on industrial usage and transport application projects. While Japan and Korea are strong in road transport applications, green ammonia, liquid hydrogen (LH2), and liquified organic hydrogen carriers (LOHC) projects, Europe will champion multiple integrated hydrogen economy projects.

Falling production and distribution costs will commercialize mobility applications in the next few years

Falling production and distribution costs will commercialize mobility applications in the next few years

Commercial mobility applications become viable at hydrogen costs of \$3.0 per kg whereas passenger vehicles become viable at ~\$2.0 per kg. Current green hydrogen production costs are still two to three times higher than the target costs with the cost of renewable hydrogen production falling drastically by up to 60% in the past few years. This can be attributed to the falling costs of renewable electricity generation, scaling up of electrolyzer manufacturing, and development of lower-cost carbon storage facilities. All these parameters will drive the costs further down to \$1.0 to \$1.50 per kg by 2030 which will be on par to current large-scale gray hydrogen production methods. Lower production and distribution costs will both contribute to lowered delivered hydrogen costs.

More than \$300 billion announced in hydrogen investments through 2030

More than \$300 billion announced in hydrogen investments through 2030

Investments in hydrogen are gathering momentum with more than 300 projects being announced globally totaling ~\$300 billion out of which ~\$80 billion are mature investments already in planning or development phases. Of these, there are 17 giga-scale production projects with the biggest in Europe, Middle East, and Chile. There are 53 transportation-related and 23 infrastructure related projects covering hydrogen distribution, storage, and conversion. A key focus in 2022 will be assessing how these projects are advanced and commercialized.

Demand for small-volume applications will grow as part of decarbonization strategies

Hydrogen applications are increasingly growing for small-volume applications such as the steel industry, transportation, glass manufacturing, semiconductors, chemicals, and space heating for buildings. Demand for hydrogen in steel and mobility will grow rapidly according to ADI Analytics research through 2030 whereas hydrogen demand in glass, food, and

Capital costs of electrolyzers will fall sharply by ~50% through 2030

space industry will grow quickly as well. Hydrogen will increasingly be used to create renewable synthetic fuels to decarbonize commercial aviation and freight shipping, which are harder to decarbonize using pure hydrogen and fuel cells. Developing these small-volume applications quickly will be a focus in 2022 to drive demand in the near term.

Capital costs of electrolyzers will fall sharply by ~50% through 2030

Interest in hydrogen is driving investments in electrolyzers, and ~28 GW of additional capacity is expected to come online with ~200 projects being announced or planned over the next ten years. Alkaline and PEM electrolysis will dominate the market, and solid oxide technology development is advancing rapidly. Improving performance and reducing the costs of electrolysis technologies are the focus of intense R&D efforts globally. Current capex for alkaline electrolyzers range from \$600 to \$1,400 per kilowatt for complete electrolyzer systems which is expected to fall ~50% by 2030. Most of these cuts will be led by diaphragm and electrode packages and power supply. For PEM electrolyzers, current capex is ~\$1,000 to \$1,300 per kilowatt for the entire electrolyzer system but costs are expected to fall significantly by 50% by 2030. Bipolar plated and power supply contributes to the high costs but will fall the most going forward. The progress towards these cost reductions at leading electrolyzer manufacturers will be closely watched in 2022.

Hydrogen will find widespread adoption for commercial vehicles

Hydrogen will find widespread adoption for commercial vehicles

Hydrogen can play a critical role in a low-carbon technology portfolio with much of its application in the transportation sector. In transportation, hydrogen-powered vehicles are commercially available now or will become available in the next five years. With production costs likely to drop with scale, allowing hydrogen to compete in segments such as smaller cars and minibuses will be more viable. We expect mass-market acceptability in the near-term for trucks, minibuses, trams, forklifts, and passenger ships. Medium or small-sized passenger vehicles will see a little penetration as most of this segment will see a stiff competition from electric vehicles with batteries. The energy efficiency of

FCEVs is much lower than BEVs whereas batteries have the lowest energy density per weight, making them well suited for lighter vehicles and shorter ranges.

Shipping hydrogen can be a viable option soon

Producers will face a daunting task to utilize existing gas infrastructure to support the hydrogen economy

Hydrogen transportation via pipelines will be critical to developing the hydrogen economy. However, significant progress around technical standards and demonstrating the viability of using existing pipelines with hydrogen has to occur in 2022.

Shipping hydrogen can be a viable option soon

Countries such as South Korea and Japan will need shipping routes to import hydrogen for domestic needs, but the costs and technology limitations associated with shipping hydrogen need to be addressed. Transporting hydrogen as ammonia seems to be the most cost-effective solution over long distances whereas liquefaction or compressed hydrogen pathways are more preferred for shorter distances (~2,000 nautical miles). On a levelized cost of hydrogen basis, the cost associated with transporting hydrogen in the compressed form for 2,000 nautical miles is ~\$1.60 per kg whereas transporting hydrogen with ammonia as liquid can cost as much as ~\$2.50 per kg. Significant technological progress will, however, have to occur in 2022 towards these goals.

Big uncertainties around demand and adoption of choice between green hydrogen and blue vs. green hydrogen

Big uncertainties around demand and adoption of choice between green hydrogen and blue vs. green hydrogen

Uncertainties in the hydrogen value chain around technical learning rates, consumer behavior, and the strategic interactions of governments, automakers and fuel providers are particularly acute. U.S regulators and industry leaders are skeptical about how to consider introducing blue or green hydrogen into the nation's energy supply mix. Today, green hydrogen is two to three times more expensive than blue

hydrogen, however, falling electrolyzer costs will reduce the gap going forward. Blue hydrogen is cheaper, and its production can more easily be ramped up to a commercial scale and can provide a bridge to an economy in which the zero-carbon green hydrogen is predominant. There needs to be a demand or market for green hydrogen that can drive the investments for green hydrogen production pathways. Developing policy frameworks in 2022 will help reduce these uncertainties.

Diaphragm compressors, fueling equipment, and alkaline and PEM electrolyzers will dominate the mobility infrastructure

There will be a greater need of critical equipment to build the hydrogen infrastructure such as diaphragm and piston-type compressors for the fueling stations and high-efficiency, low-cost electrolyzers for hydrogen generations. Diaphragm and piston-type compressors serve most of the compression needs in the hydrogen value chain. Fueling station operators prefer to use diaphragm compressors and other applications are predominantly dominated by reciprocating compressors. Alternatives for fueling compression needs such as metal hydride and electrochemical compressors are currently in early stages. For electrolyzers, alkaline and PEM electrolysis dominate the market, and solid oxide technology development is advancing rapidly. Improving performance and reducing the costs of electrolysis technologies are the focus of intense R&D efforts globally. Leading electrolyzer players are projecting cost reductions to enable hydrogen production at ~\$1.50 per kg by 2025. However, modeling levelized costs of hydrogen production with realistic assumptions projects the costs to range from \$2.10-\$2.90 per kg at \$40/MWh electricity prices. Advances in the scale and performance of these key equipment categories in 2022 will help develop hydrogen infrastructure in the future.

Utkarsh Gupta

ADI brings deep expertise in hydrogen market. We will continue to track these markets through consulting and [research](#) projects. Please [contact us](#) to learn more.

2022 Energy Transition Industry Outlook: Messiness as a Measure of Progress?



Uday Turaga

2022 Energy Transition Outlook: Messiness as a Measure of Progress?

January 2022

Energy transition advanced rapidly through the collective public consciousness in the past two years although starting this past summer, it has run into significant challenges. To a large extent though, both energy transition's progress in 2020 and the challenges of 2021 were more conceptual than rooted in concrete form.

Investor-led demand for a greater focus on environmental, social, and governance (ESG) issues in public companies' strategies and plans accelerated through COVID-19 culminating in growing momentum for energy transition. While capital investments in low- and zero-carbon energy projects have grown quickly, they are still lower than the collective investments in the fossil fuel-based infrastructure.

For example, capital investment in low-carbon fuels, renewable power, and nuclear energy totaled ~\$425 billion in 2020, while fossil fuel-based projects attracted ~\$815 billion. This is significant because capital investment in fossil fuel-based energy was 10% to 25% lower in 2021 than in a business-as-usual 2019 while renewable power investments had grown over the same timeframe.

Given this background, what should we expect in 2022 for energy transition? The team at ADI Analytics got together to brainstorm and pull this outlook together.

There is now a broad consensus around the need for Energy Transition i.e. to move our global energy mix towards low-/zero-carbon resources although companies, investors, and policymakers are debating on the best way to get there.

Capital investment in low-carbon fuels, renewable power, and nuclear energy totaled ~\$425 billion in 2020, while fossil fuel-based projects attracted ~\$815 billion

We see some risk to capital spending growth for energy transition in 2022 from rising interest rates globally due to inflation.

Nothing illustrates the growing consensus around the need for Energy Transition more than ExxonMobil's commitment to cut emissions at all of its operations to net zero by 2050. The announcement came in mid-January 2022 and a couple years after the company had suggested that it would focus on its core competencies rather than pursue low-/zero-carbon investments. ExxonMobil's commitments are short of what BP and Shell have announced but reflect the broad consensus around energy transition that will only deepen in 2022 and beyond.

Investors continue to lead the charge on energy transition supported to a large extent by the focus on environmental, social, and governance issues.

While ExxonMobil's recent commitment reflects the growing consensus around energy transition, it is the handiwork of activist investors who forced the company to add new board directors in the summer of 2021. Such investor pressure will only grow in 2022 and is capable of creating significant change and quickly so. Continuing with ExxonMobil for another example, the company's low-carbon business unit has rapidly identified sites around the world where it can effectively deploy carbon capture and storage projects.

Access ADI's multi-client study on [the Jet Fuel](#) outlook

Capital has started flowing in energy transition projects.

Capital spending on energy transition projects and infrastructure amounted to ~\$750 billion in 2021. Although most of this is dominated by renewable power, diversity and complexity of new energy transition projects, their scale and size, variety of technologies deployed, regional coverage, and range of business models are all growing. Public capital is also mobilizing itself rapidly. For example, the U.S. Department of Energy recently committed to guarantee a loan for up to \$1.04

billion to Monolith's new methane pyrolysis project to manufacture turquoise hydrogen. We see some risk to capital spending growth for energy transition in 2022 from rising interest rates globally due to inflation. Tighter financing will impact the competitiveness of several energy transition projects.

ADI's modeling has shown that ... oil and gas will contribute to as much as 15% to 20% of the global energy mix in 2050.

Even so, current capital flows will be insufficient to finance the Energy Transition, which is going to be very expensive.

In recent work, ADI has estimated that the energy transition, depending on its pace and level of policy support, will need capital investments that will total \$30 to \$45 trillion over the next 30 years. While the first world will have multiple routes to financing the energy transition, emerging economies will struggle and most likely require support from the largest of the developed economies.

Energy transition should not be seen as a battle against oil & gas.

ADI's modeling has shown that even in the most aggressive and rapid energy transition scenarios, oil and gas will contribute to as much as 15% to 20% of the global energy mix in 2050. However, the last residual units of oil and gas that the world will consume post-2050 will, most likely, be the cleanest of all fossil fuel production. As a result, we anticipate oil & gas operators will in 2022 and beyond accelerate investments to eliminate fugitive emissions, cut flaring, develop circular operations, and invest in carbon capture and storage.

start-ups will likely struggle to raise capital in 2022.

On the flip side, oil & gas supply constraints cannot be blamed on the energy transition.

As natural gas prices came to a boil in Asia and Europe through the fall of 2021, a blame game got underway in newspapers, magazines, and social media. The underlying

While 2022 will see a surge of investments in these areas, returns will be lower and take longer akin to large infrastructure investments.

Understand global small-scale LNG markets with ADI's new research study

theme was how the energy transition had led to the current energy crisis. Another version of this silly game was played during the winter storm Uri that left vast parts of Texas without power for several days in February 2021. The energy transition is going to take decades and cannot be reasonably held accountable for dramatic spikes in commodity prices that respond more to near-term events. Similarly, it was insufficient investments in winterizing natural gas infrastructure that was the prime factor behind the blackouts during Uri. Policymakers and the global energy industry should pursue a mature “all of the above approach” to energy supply, and we suspect limited progress will occur towards this goal in 2022.

Energy transition innovation has truly taken off both in terms of the number of early-stage companies as well as the breadth of technologies being pursued.

In client work that ADI has completed, we identified over 300 start-ups that are focused exclusively on low- and zero-carbon technologies across a number of energy industry segments. Collectively, over \$150 billion of capital has flowed into energy transition innovation including rounds of financing completed by early-stage companies. Since a significant chunk of this capital was raised through special purpose acquisition companies (SPACs), which have now cooled off, start-ups will likely struggle to raise capital in 2022.

Energy transition technologies will have to start demonstrating their promise in 2022.

In the name of energy transition, and fueled by free flowing capital over the past few years, a number of energy transition technologies have been floated by early-stage companies. Investors will likely want to see demonstrations of these technologies at a faster pace and that process will screen several options and technologies out in 2022 and beyond.

Investors are now turning their attention to the broader infrastructure and ecosystem needs for the energy transition.

Investments in new battery technology, more efficient solar panels, and faster wind turbines are giving way to opportunities in battery recycling, installation of electric vehicles chargers, transforming port operations to use low-carbon fuels, and, carbon dioxide capture, storage, and utilization. While 2022 will see a surge of investments in these areas, returns will be lower and take longer akin to large infrastructure investments.

Business model innovation is scaling up as fast as energy transition technologies.

A number of oil & gas companies have now embraced the energy transition by creating business units that are focused on identifying opportunities that will directly contribute revenue and margin to the bottomline. In 2022, these efforts will continue to bring new energy and creativity to structuring business models that is necessary for a nascent, emerging market as the energy transition.

Uday Turaga

ADI will continue to track energy transition markets globally through [research](#), consulting, and analytics. Please [contact us](#) to learn more and discuss how we can be of help.

2022 Mining & Metals Industry Outlook: Digging deeper into recovery after 'rocky' conditions



Jacqueline Unzueta

2022 Mining and Metals Outlook: Digging deeper into recovery after ‘rocky’ conditions

January 2022

During these unprecedented times, mining operators are learning to navigate through many challenges because of the COVID-19 pandemic. Last year, mining operators pursued resiliency, investor confidence, environmental, social, and governance (ESG) performance, and capital and operational discipline. Moving forward in 2022, these megatrends will still be relevant to the mining industry with some added complexities that were discovered in 2021. ADI Analytics has been tracking the state of the mining industry and its commodities of interest for the past year and has identified the following trends and themes that will further impact mining and metals in 2022.

Rising capital intensity will result from higher inflation rates and increased growth ambition

*Apart from
inflationary
pressures
encouraging
better financial
performance,
higher capital
expenditures
are motivated
by the
industry's
growing
ambition in
'green' metals...*

Over the past year and a half, inflationary pressures have been growing for the mining industry resulting in higher production costs, with unit costs expected to rise anywhere between 5% and 10% in 2022. Consequently, mining operators will continue improving their financial performance by reducing maintenance costs, increasing mining equipment productivity, and implementing digital technologies for better mining efficiency. This year's anticipated increase in capital expenditures will also make up for underspending in 2020 and 2021 due to the supply chain bottlenecks caused by the pandemic. However, major mining companies will most likely proceed with these investments conservatively. Fiscal uncertainty in key mining regions will contain the level of investments made by major miners.

Apart from inflationary pressures encouraging better financial performance, higher capital expenditures are motivated by the industry's growing ambition in 'green' metals, the focus of ADI's

Policies were made to encourage the production of industrial metals in China as a response to the growing demand from the EV market...

... Markets outside of China are expected to remain relatively tight in 2022 because of the lack of near-term supply growth projects outside of China.

[multi-client study on critical minerals](#), and by emissions abatement capital expenditures. Brownfield projects, greenfield projects, and M&A opportunities have been openly discussed by mining majors to expand in 'green' mining. Decarbonization efforts and ESG pressures will continue to drive investments, with companies such as ArcelorMittal, Slazgitter, and Voestalpine committing to CO2 targets to reduce Scope 1 and Scope 2 emissions over the next five to ten years. Miners that have advanced growth pipelines or well-positioned portfolios, such as Glencore and Anglo American, will be in stronger positions and should face less upward pressure on capital expenditures in 2022.

Base metals demand will be driven by green policies

Prices of several major industrial metals heavily used by the electric vehicle (EV) industry such as copper, aluminum, and precious metals have risen due to supply-side issues and container shortages. However, prices are expected to stabilize during the first half of 2022 as supply constraints related to the pandemic counteract tapering industrial activity in China. Policies were made to encourage the production of industrial metals in China as a response to the growing demand from the EV market and other emerging sectors. Despite market volatility, the price sub-index for base metals is estimated to increase by 4.5% in 2022, after surging by 48% in 2021.

Global aluminum markets will remain tight in 2022 because of drawbacks in China and Guinea

Primary aluminum production in China requires a lot of power from burning coal. Aligned with China's carbon-neutral 2060 targets, new rules were introduced last year to control coal pricing. Coal pricing has more than tripled within a twelve-month span ending in October 2021 and, consequently, power companies started to ration supplies and cut down power output. Due to these high coal prices, aluminum production lowered, and the price of aluminum rose to record-high levels.

Three months after the announcement of these coal pricing controls, coal prices declined, which relieved some of the pressure out of the Chinese aluminum supply chain. However, by historical standards, coal prices have remained relatively high and an increase in Chinese primary aluminum output is unlikely in 2022.

Compared to other metals, global primary aluminum production has not been constrained by shortages of its raw materials. From January 2021 to July 2021, global alumina production increased by 6.5% and it continued to trend higher. However, [the military coup that occurred in Guinea](#) early past September grew concerns about unexpected disruptions in the supply chain and the cost of consequently increased. Contrary to popular belief, no disruptions in mine production and shipments out of Guinea were reported months after the coup, and alumina prices have fallen since.

Deficits of 558,000 metric tons in 2022 and 952,000 metric tons in 2023 are expected and reflect the growing constraints on aluminum production relative to Chinese aluminum demand. Markets outside of China are expected to remain relatively tight in 2022 because of the lack of near-term supply growth projects outside of China.

Global copper supply will rebound in 2022 but will remain in a deficit

In 2020, the refined copper market was estimated to have a deficit of approximately 900,000 metric tons exacerbated by the slump in industrial activity and consumption because of the coronavirus pandemic. However, mine production rebounded strongly in countries such as Peru during 2021. After dropping by 12.6% in 2020, Peru's copper mine production increased last year despite high infection rates and a slow vaccine rollout. Some projects have already been planned for 2022 such as the expansion of the Toromocho mine and the Mina Justa project, which is expected to ramp up its copper output by 110,000 metric tons by the end of 2022. Additionally, Anglo American and Mitsubishi Corporation announced a joint venture to develop the Quellaveco mine with a capacity of 300,000 metric tons per year. They expect to start the project this year.

... the Kamoa-Kakula project in the Democratic Republic of the Congo... is the largest copper mine to begin its operations this past May and it will ramp up its capacity to 300,000 metric tons per year by the end of 2022.

... Most of the focus when it comes to emissions from the mining industry is directed towards Scope 3 emissions.

... The industrial raw materials price index is forecast to increase by 4% in 2022...

... Market deficits... will support higher prices this year.

Chile is remaining proactive in its attempts to increase annual copper production to 7,000,000 metric tons by 2030. Juan Carlos Jobet, the energy and mining minister of Chile, announced a new national mining blueprint this past September to reach Chile's copper production goals. Projects that will increase Chile's copper capacity include BHP's Spence copper mine expansion, valued at \$2.5 billion dollars. Costing \$5 billion dollars, the Quebrada Blanca Phase 2 project planned by Teck Resources aims to extend the mine's life by more than 25 years and is scheduled to start in the second half of 2022.

Apart from Peru and Chile, the Kamo-a-Kakula project in the Democratic Republic of the Congo, owned by Canada-based Ivanhoe Mines, is the largest copper mine to begin its operations this past May and it will ramp up its capacity to 300,000 metric tons per year by the end of 2022. It has been reported that Chinese mining operators are interested in Afghanistan's vast mineral reserves ever since the United States has withdrawn its military in Afghanistan, but no definitive plans have been made since. Resource nationalism and stricter environmental oversight are likely to persist in the long term, which raises concerns that these new mine projects and planned smelter expansions will be insufficient to meet the rising demand of the future.

Decarbonization will gain sharper focus for the mining industry

Many mining companies have been making strides toward decarbonization as external pressures to reduce greenhouse gas emissions and electrification efforts grow. In the past, BHP, Anglo American, and Antofagasta Minerals have announced plans to power their operations entirely from renewable energy. Vale also committed to achieving 100% self-production from renewable resources by 2025 in Brazil and by 2030 globally. However, most of the focus when it comes to emissions from the mining industry is directed towards Scope 3 emissions. Associations such as the Australian Climate Leaders Coalition, the European Corporate Leaders Groups, the New Zealand Climate Leaders Coalition, and the We Mean Business

Coalition, are acting to accelerate low-emission or zero-carbon economies.

As global economies recover, industrial raw material prices will rise in 2022

After surging by approximately 40% in 2021, the industrial raw materials price index is forecast to increase by 4% in 2022. Base metals and crude oil drove price increases in 2021, and prices are projected to increase as countries recover from supply chain constraints from the spread of COVID-19 and the Delta variant, especially in Asia. These constraints are expected to further ease by the second half of 2022, removing some of the pressure on industrial raw material prices. In 2023, the industrial raw material price index is expected to fall by approximately 2%, driven by a 10% fall in crude oil prices.

... Advancements in electric vehicles and battery technology will mitigate the slow-growing or even falling nickel demand from the Chinese steel industry.

Battery metals supply will continue to lag behind and will support higher prices for longer

Electric vehicle penetration rates are increasing and are expected to be the largest driver for demand growth for lithium and rare earth metals in 2022. Thus, lithium and rare earth metals will continue to be in a market deficit. Consumers are showing more interest in environmentally friendly company profiles or local supply sources outside of China. The market deficits and the consumers' desire for more sustainably sourced lithium and rare earth metals supply will support higher prices this year. Companies such as Lithium Americas Corp and Piedmont Lithium are seeking partners to fund their projects, specifically the Thacker Pass and North Carolina project, respectively. MP Materials announced its plans to build a rare earth alloy and magnets facility in Texas as a long-term supply agreement with General Motors.

China's carbon neutrality targets will support nickel demand in 2022

Strong fiscal measures will support China's GDP growth in 2022, but a slower pace in investment growth due to recent policies that are aimed to reduce carbon emissions will cause China's real GDP growth to moderate to 5.3% in 2022. Due to the strong fiscal stimulus in infrastructure, Chinese nickel demand will rise at approximately 3% this year. In addition, nickel demand will be driven by the growth in new energy vehicles (NEVs) as subsidies and incentives will continue to be granted by the Chinese government. These incentives are a part of China's goal to become carbon neutral by 2060, and advancements in electric vehicles and battery technology will mitigate the slow-growing or even falling nickel demand from the Chinese steel industry. Crude steel production dropped sharply last October due to energy and emissions restrictions. Steel production was also impacted by China's property sector amid increased debt default.

South Korea and Japan are expected to rebound in economic activity and will also support a recovery in nickel demand in 2022. However, the tense geopolitical relations between the United States and China still exist. Consequently, the global refined nickel production is projected to grow by 5% this year compared to 6.3% last year. Nickel prices have yet to reach levels that would incentivize more nickel production despite the excitement around the EV revolution but will increase modestly in 2022.

The growth in nickel supply could be explained by many projects that were executed in 2021. Sumitomo Corporation planned to restart operations at the Ambatovy nickel mine in Madagascar during the first quarter of 2021. This past April, Mincor Resources began work to restart the Cassini nickel mine in Western Australia.

Other projects that are in the pipeline for the upcoming years include the Tamarack Nickel Project, which will be completed by Talon Metals and Rio Tinto in a joint venture. Canada Nickel has also announced plans to develop its Crawford project in Ontario, Canada. Kabanga Nickel entered an agreement with

the Tanzanian government to develop the Kabanga deposit, the largest development-ready nickel sulphide deposit in the world. These projects are expected to introduce substantial supply, but last year's suspended operations will slightly dampen its growth rate.

Steel consumption in the United States will have a strong recovery in 2022

The United States accounts for three-quarters of the North American steel consumption as the world's third-largest steel market, with about 30% used in the automotive industry and 45% used in construction. In 2020, construction was the leading consumer sector of U.S. steel as homes appreciated and low interest rates attracted homebuyers. On the contrary, the automotive industry demanded less steel in 2020 as manufacturing facilities halted operations and complied with COVID-19 restrictions. Other manufacturing industries were also impacted by the pandemic, and U.S. steel consumption fell by 18% year on year in 2020.

In 2021, U.S. steel demand rebounded with fiscal policy support and huge monetary policy stimulus. This past March, Congress passed the American Rescue Plan Act, which included income transfers that support consumer spending. The Infrastructure Bill was also passed in November, which will provide about \$550 million dollars towards national public works projects over the next five years. As a result, projects to build bridges, roads, ports, railways, and other infrastructure are expected to increase this year. The U.S. economy will also be supported by the successful rollout of COVID-19 vaccines, allowing labor forces to become more resilient during the pandemic.

Progress to integrate operations will continue in 2022

Over the past decade, the mining industry has built the foundation of integrated operations to improve operations and

The Infrastructure Bill... will provide about \$550 million dollars towards national public works projects over the next five years.

...The key technologies that could further transform mining operations in 2022 include blockchain, artificial intelligence, and big data.

ensure the best decision-making process for its stakeholders. There are many ways mining operators could accelerate their technology for better integration, such as: implementing automation and [digitalization](#) to their operations, creating nerve centers to consolidate data from the entire value chain, and intelligent enterprise to refine support processes. Integrated operations allow companies to deliver improved decision-making through data analytics, enable remote management of resources, and streamline workforce allocation. The discussion of integration is not new to the mining industry, but more mining operators have been highlighting it as a priority.

For example, Vale introduced their Digital Transformation program, which evaluates tools available in the market that aim to deliver more sustainable results. BHP's maintenance and innovation team developed Dash Maintainer Tools that allow front-line personnel to collect real-time data from their operations remotely. Rio Tinto is aiming to build the world's first "intelligent mine" in their Koodaideri project where all assets are networked together to make decisions in milliseconds.

Some of the key technologies that could further transform mining operations in 2022 include blockchain, artificial intelligence, and big data. These technologies will shift mining from a people-oriented operation to a process-oriented one, which will consequently provide a better level of accuracy, improve the health and safety conditions for mineworkers, and expedite decision-making processes.

Jacqueline Unzueta

ADI will continue to monitor and track these megatrends and provide valuable insights to our clients in the mining industry. Please review our [expertise](#) in this segment and [contact us](#) to learn more about our [research](#).

2022 Chemicals Industry Outlook: Stability and sustainability over growth



Panuswee Dwivedi

Chemicals: Stability and sustainability over growth

January 2022

The global chemical industry saw a steep but tumultuous recovery in 2021 following the pandemic with expectations that it will stabilize in 2022. Key trends to look out for in 2022 are as follows:

Global chemical industry drivers will grow at a stable pace in 2022 after a tumultuous recovery in 2021

Global GDP will grow at 4.4% in 2022 driven by U.S., China, and India

Global GDP is expected to grow by 4.4% in 2022 compared to 5.7% during 2021. The economies of U.S., China, and India are stabilizing and will support global GDP growth.

Another driver for the chemical industry, the construction industry is projected to grow by 4.5% through 2025 driven by Asia Pacific.

Additionally, the year 2021 was difficult for the automotive industry with muted demand, record low inventories due to lockdowns from the COVID-19 pandemic, and a global chip shortage. Global light vehicle sales are expected to increase to 83 million units in 2022 from 78 million units in 2021 with chip manufacturers also ramping up capacity to address shortage.

Finally, the Purchasing Managers' Index (PMI) across major economies is expected to remain in the range 50 to 56 in 2022 versus 53 to 60 in 2021 and will slow down over most economies except Brazil that will grow at 0.1% in 2022.

Europe, U.S., Canada, India, and China are expected to fall by 10.6%, 7.9%, 6.5%, 3.3%, and 2.4%, respectively.

Global chemical production will grow at 2.7% in 2022

Global chemical production growth will slow down to 2.7% in 2022 following a 7.0% growth in 2021

The global chemical industry grew at 7.0% during 2021 as demand picked back up post-COVID. Growth will slow down to

The inflation in polyethylene and polypropylene markets will ease in 2022

Mergers and acquisitions will continue to be robust driven by consolidation, supply chains, and ESG

2.7% in 2022 as the industry stabilizes driven by the U.S. growing at 4.3% due to easing supply chain constraints and rising demand supported by government stimulus followed by China growing at 4.0%. No other chemical manufacturing industry including Europe or Japan, South Korea, and India in Asia are expected to increase their production growth during 2022.

Capital spending across the global chemical industry will grow at a rate similar to production growth with U.S. capital spending reaching \$31.6 billion in 2022

The global chemical industry capital spending will see slower growth in 2022 compared to 2021. The U.S. chemical industry will likely grow by \$1.0 billion to reach \$31.6 billion in 2022 compared to a jump of \$3.3 billion in 2021 when capital spending grew from \$27.2 to \$30.6 billion.

Several new petrochemical plants are expected to come online in the near term mainly in Asia

Most of the capital spending growth is expected to come from Asia and U.S where several petrochemicals have been planned with start-up expected in 2022 to 2030. China is expected to start-up several petrochemical plants including the 4.8 million tons per year (tpy) Zhejiang Petrochemical Daishan Xylene Plant 2 by 2023 and the 5.2 million tpy Shandong Yulong Petrochemical Longkou Ethylene Plant 2 by 2030. A significant supply-demand imbalance in Malaysia may result in several new petrochemical plants to be built over 2022 to 2025 including Petronas Pengerang PE Plant 2 (0.40 million tpy), Petronas Pengerang PE Plant (0.35 million tpy), and Petronas Pengerang PP Plant 1 and 2 (0.45 million tpy each). In the U.S., Chevron Phillips Chemical is planning to expand its PP business with a 500,000 tpy PP unit at its Cedar Bayou complex with start-up expected in 2023.

Henry Hub prices are expected to average at \$3.98/MMBtu but U.S. ethane will remain cost-advantaged over naphtha throughout 2022

U.S. chemical industry capex will grow by \$1.0B to \$31.3B in 2022

U.S. Henry Hub price averaged \$3.97/MMBtu during 2021 rising to \$5.35/MMBtu in February and \$5.51/MMBtu in October. U.S. ethane remained fairly cost-advantaged over naphtha during 2021 and production grew from 2.02 million barrels per day (bpd) in 2020 to 2.14 million bpd in 2021 while consumption grew from 1.72 million bpd in 2020 to 1.76 million bpd in 2021. The U.S. EIA expects the natural gas price to average \$3.98/MMBtu during 2022 with low ethane rejection supported by contractual obligations and exports due to ethane's cost advantage over naphtha. U.S. ethane production and consumption are expected to grow to 2.45 and 2.03 million bpd, respectively, in 2022. U.S. ethylene exports to Europe and Asia also increased during second half of 2021. Ethylene shortages in Europe related to unplanned cracker outages as well as negative cracker margins in Asia are likely to drive U.S. ethylene exports in 2022 supporting domestic ethane demand.

Inflation in global polyethylene and polypropylene markets may ease or even turn into deflation over 2022

U.S. ethane will continue to be cost-advantaged over naphtha in 2022 supporting domestic production and demand

U.S. polyethylene (PE) and polypropylene (PP) supply were impacted by extreme weather during 2021. Europe, that relies heavily on imports from the U.S. faced higher PE and PP prices. On the other hand, while Asia can provide cost-competitive PE and PP, it was impacted by high coal prices and supply chain disruptions, worsening inflation in PE and PP markets in Europe. Now as U.S. supply comes back on track, China coal-based PE and PP capacity resumes, and supply restrictions ease coupled with mild demand, it is likely that inflation may ease or even turn into a deflation over 2022 especially as demand growth eases.

Mergers and acquisitions will continue to be robust in 2022 with consolidation, supply chains, and ESG being major drivers

Global fertilizers market will stabilize in 2022

As the effects of the pandemic eased during the second half of 2021 several merger and acquisition (M&A) deals were announced including Sika's acquisition of MBCC for \$6 billion and DuPont's acquisition of Rogers for \$5.2 billion. In addition to consolidation, major drivers for M&A activity during 2022 will include enhancing resilience, supply chains and ESG goals.

Supply issues faced by the global fertilizer market in 2021 are expected to be resolved by the second half of 2022

Global fertilizer demand grew by 5.2% in 2021 and is expected to grow at 0.9% in 2022 dampened partially due to high fertilizer prices. High fertilizer prices from high natural gas prices, especially in Europe, caused many fertilizer producers to shut down operations and created a supply shortage during 2021. Many producers, however, continued to produce fertilizers despite high natural gas prices, some even going as far as to delay maintenance. These issues are likely to subside in 2022.

Regulatory pressure towards sustainability and plastic waste reduction will tighten

Sustainability and plastic waste reduction will be at the center of regulatory activity for the global chemical industry

Regulatory pressure on the single-use plastic waste is tightening globally. For example, Canada published draft regulations prohibiting single-use plastics including plastic cutlery, stir sticks, straws, and six-pack rings in the country for public comment until March 2022. Also, the U.K. plastic packaging tax of €200 per ton will come into effect in April 2022 impacting plastic packaging containing less than 30% recycled content produced or imported into the U.K.

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France also joined the list of countries that have banned plastic packaging by banning plastic packaging for most fruits and vegetables, a move that is expected to eliminate 1 billion items of plastic waste annually. Not to be left behind, the Indian government intends to prohibit the use of single-use plastic items by the end of 2022. Additionally, several new international plastic regulations have been proposed to the United Nations by various environmental agencies to be implemented in 2022 where more than 150 countries have expressed interest in managing global marine pollution.

Apart from regulators, investors are also pushing large chemical companies on transparency on volumes and phase-out plans on toxic chemicals. While the U.S. and European regulators have published guidelines on toxic chemicals, many countries have not. Applications of 'forever chemicals', PFAS, have already resulted in payouts from companies including 3M and potential costs in the U.S. related to such chemicals could be between \$25 to \$40 billion.

ESG issues are at an inflection point in the global chemical industry with growing focus on material and substantive efforts

More and more companies are being impacted by ESG issues from regulators, consumer choices, and other stakeholders. Going forward, we expect a greater focus on material and substantive efforts. For instance, BASF acquired a 49.5% share in the offshore windfarm Hollandse Kust Zuid and signed multiple power purchase agreements (PPA) with renewable energy providers as part of their net-zero CO2 emissions goal. Additionally, in partnership with SABIC and Linde, they are developing an electric steam cracker furnace. In another example, Poland-based PKN Orlen and Orlen Poludnie are planning to build 25,000 tpy bioethanol plant. Finally, India-based Gas Authority India Limited (GAIL) and Gujarat Alkalies and Chemicals Limited (GACL) are also planning to set up a

1,428 tpy bioethanol plant. These trends are expected to continue over 2022.

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