

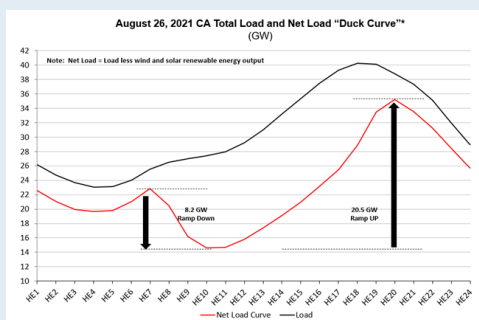


**California’s “duck curve” and natural gas**

Solar and wind energy generation are increasingly prevalent in California’s CAISO electricity market, but renewables’ intermittent generation is limiting their market share. The sun doesn’t shine continuously and the wind doesn’t always blow, leaving gaps in generation that can only be filled by nuclear, batteries, natural gas, or other sources. Subtracting out renewable generation from total load yields net load; charting this over a typical day produces something that looks like a duck. This so-called “duck curve” shows typically shows net load rising in the early daylight hours, dropping substantially during peak midday solar generation, and rising rapidly as the night comes. Every year the “belly” – or the net load during peak generation hours – has gotten shorter and shorter, limiting solar’s attractiveness. CAISO is not a growing market for natural gas, but the fuel may have a role for years and even decades due to the duck curve.

**CAISO’s electricity demand profile**

Electricity demand varies by market, temperature, and season, but it tends to follow a generally predictable pattern. Demand tends to fall from midnight to daylight as consumers sleep; rises as people wake up and enter businesses; increases throughout the day on greater business/residential activity; and peaks around 6 – 8 PM, when consumers arrive at home (and turn on appliances) or head to restaurants and retailers. In the summer this pattern is most pronounced. We’ve selected a typical day in August 2021 to show California’s electricity profile.



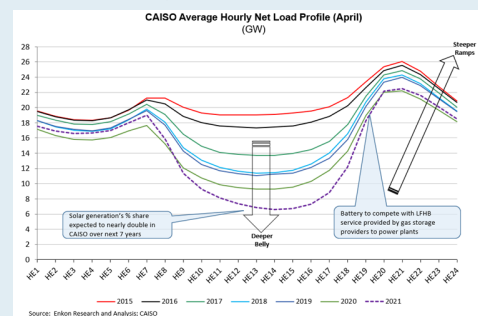
As you can see above, we’ve segmented a typical electricity demand profile into two lines: a black “load curve” line, showing total demand; and a red “net load curve” line, which subtracts renewables generation from total demand. Solar output begins at daylight, around 6AM, causing natural gas and other baseload power sources to

“ramp down.” After solar generation peaks at 11AM - 1PM, however, natural gas and other baseload sources must “ramp up” generation to provide electricity supply for 6 – 8 PM peak demand. After the sun goes down, CAISO is almost entirely reliant on natural gas, nuclear, and geothermal baseload power sources, plus some wind and coal generation.

**Seasonality and the duck curve**

August, typically the hottest month of the year, is often the most favorable for solar generation. What about when weather is more temperate, like in April? We find that net load continues to decrease amid California’s enormous solar expansion, causing significant economic and system curtailment. As electricity from solar generation enters the grid, power prices tend to drop amid increasing supply, rendering additional generation less economic.

Moreover, too much generation can lead to physical curtailment as transmission lines get clogged. These dynamics will pressure the attractiveness of solar generation – but also could give rise to a higher reliance on gas peaking plants and/or longer-duration storage such as utility-scale batteries. For a deeper dive into CAISO’s solar/battery mix, drop us a line: [info@enkonenergy.com](mailto:info@enkonenergy.com)



**A healthier duck curve?**

To make California’s duck curve more manageable, the state will require some solution: either more natural gas storage and peaking plants, greater battery storage, or, most likely, all of the above. We think California natural gas could play an important role in making the duck curve more manageable. In a future edition, we’ll discuss the duck curve’s growing impact on California gas storage operations.

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- U.S. LNG: 2021 and 2022, and Asian coal-to-gas switching 2
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## U.S. LNG: 2021 and 2022, and Asian coal-to-gas switching

With the U.S. well on its way to becoming [the world's largest liquefied natural gas export capacity by YE 2022](#), we wanted to take a step back and take stock of broader trends at home and abroad – in particular, the role of natural gas and LNG in the energy transition. While outcomes will vary sharply, perhaps even dramatically, across different markets and regions, we believe that LNG and natural gas will expand their role due to the increasing worldwide rejection and even stigmatization of coal. With coal in retreat and widespread renewables adoption years or even decades off in developing markets, we believe that many Asian energy-importing countries will increasingly turn to LNG. China's coal policies and LNG affordability for countries such as India will have decisive implications for future LNG demand.

*"With coal in retreat and widespread renewables adoption years or even decades off in developing markets, we believe that many Asian energy-importing countries will increasingly turn to LNG. China's coal policies and LNG affordability for countries such as India will have decisive impacts"*

### Green Hydrogen/Storage:

[UK can blend 20pc hydrogen from 2023 – operators—Hydrogen Economist](#)

[Could a critical raw materials shortage derail forecast massive green hydrogen growth? - Recharge](#)

[Geopolitics of the Energy Transformation: The Hydrogen Factor—IRENA](#)

[Australia's Fortescue set to supply green hydrogen to Germany's Covestro—Reuters](#)

### Crude Oil News:

[Dwindling OPEC+ Spare Capacity Sets Oil Up for Sizzling Summer—Bloomberg](#)

[Analysis: Inside OPEC, views are growing that oil's rally could be prolonged—Reuters](#)

[OPEC+ expected to stick with planned Feb output increase, sources say—Reuters](#)

[Mexico Shuns International Oil Markets to Produce More Gasoline at Home—Bloomberg](#)

### U.S. LNG: 2021 in review

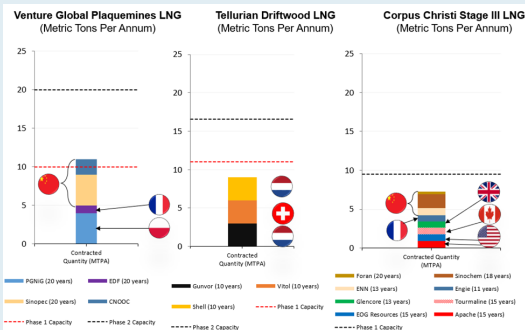
After a brutal 2020, U.S. LNG enjoyed a run of good fortune in 2021. International LNG competitors struggled to operate at full capacity, world economic and energy demand picked up on widespread vaccinations, and there were few U.S. Gulf Coast weather-related outages (besides those related to Winter Storm Uri).

U.S. LNG also created its own luck through excellent execution, as two major LNG projects, Sabine Pass Train 6 and Calcasieu Pass LNG, came online sooner than expected. Moreover, unlike other producers, the U.S. upstream and midstream supply chain remained resilient (save, again, for Winter Storm Uri). With other potential or existing natural gas producers such as Mozambique and Russia demonstrating unreliability on domestic instability and geopolitics, respectively, supply assurance continues to be a major competitive advantage for U.S. producers.

### U.S. LNG in 2022: tight markets, possible Chinese slowdown, and project FIDs

LNG markets are running red-hot across the world, particularly in Europe. Pipeline and liquefied natural gas outages are constraining supply, post-vaccine economic demand is boosting demand, and closures of nuclear and coal plants are supporting natural gas power burn. These factors have led to record natural gas spot prices in many markets, most notably Europe, which is facing a supply crunch due to tensions with Russia. Moreover, some LNG importers such as Turkey and China are facing significant economic challenges. China, which has [surpassed Japan to become the world's largest LNG importer](#), may face a real estate-led economic downturn in 2022, which would cool world economic growth, limit LNG demand growth, and put downward pressure on prices. Western-Russia tensions remain a major wildcard for natural gas markets in 2022.

We do believe that one or more U.S. LNG projects will announce a positive FID in late 2022 or early 2023. In recent months, Venture Global's Plaquemines LNG and the Cheniere's Corpus Christi Stage II have made significant commercial progress in securing bankable term offtake agreements. Still, many of their agreements have been signed with Chinese customers and are subject to significant geopolitical risks. Any new FIDs will form the 3rd (and probably last) tranche of new U.S. LNG capacity.



### Coal-to-gas switching

Finally, in 2022 we will continue to watch the most important long-term trend for the future of natural gas and LNG: China and India's willingness to convert their base-load generation profile from coal to gas. There were some signs in 2021 that the two Asian giants will reduce coal intake, at least in the long-term. China pledged to stop building coal plants abroad while committing to zero-carbon emissions by 2060 and peak emissions no later than 2030, while Delhi announced net zero emissions by 2070 and peak emissions by 2040-2045. However, these pledges are decades-long and could have no impact for years.

Coal plant construction in the Belt and Road Initiative (BRI), a Chinese economic and geostrategic initiative, is a key energy transition issue to watch in 2022. [China has pledged to stop building coal plants abroad through the BRI](#); the initiative did not invest in any new coal plants in 1H2021. Still, [the BRI project pipeline includes about 14 GW of new coal-fired plants](#). Even if China eliminates overseas coal construction, there remains the question of domestic coal consumption, as the PRC accounts for about half of world coal consumption. China's domestic and international coal policies will have huge consequences for climate – and LNG uptake.

### Some green (fuel) shoots for Asian LNG demand?

We see some reasons why China and other Indo-Pacific economies could ramp up LNG consumption. [South Korea announced it would label LNG as a green fuel](#) while phasing out coal by 2050. [A referendum to build a 4th nuclear power plant in Taiwan failed](#) at the ballot box while [voters approved construction on an LNG import terminal](#). On the other hand, however, Japanese LNG demand appears shaky amid nuclear plant restarts, a reluctance to abandon coal, and interest in ammonia and hydrogen. South and Southeast Asian LNG demand is also highly consequential, if often overlooked. (If you'd like a deeper dive on our view of long-term Asian LNG demand, drop us a line: [info@enkonenergy.com](mailto:info@enkonenergy.com)).

2022 will be an important year for coal, as well as the future of LNG demand. We'll look to see how China, India, and other Indo-Pacific economies approach the energy transition. We expect that coal will increasingly face headwinds in the energy mix, providing more opportunities for LNG.

## Commodity Outlook (90 days out)

### **Invasions, Omicron, Supply Chains, and Inflation**

A further Russian invasion of Ukraine appears [increasingly likely](#) and could have major implications for oil and gas markets. If Russia further invades Ukraine—likely leading the West to sanction Russian crude oil and gas shipments—markets could be highly volatile until some new equilibrium is established. In the event of an invasion, crude and LNG prices would likely rise, perhaps even sharply. On the other hand, some diplomatic resolution of the issue (and the initiation of Nord Stream 2 Russia-to-Europe pipeline flows) could sharply weigh on European natural gas prices and world LNG markets. Geopolitical risks are rising, leading to more volume and price uncertainty. Energy markets may become more volatile and unpredictable for at least the next few weeks and months.

China is facing its most serious COVID outbreak since the virus' first appearance in Wuhan. Chinese vaccines offer only limited protection against Omicron, the country has little-to-no infection immunity, and Beijing is about to host the Winter Olympics. Additional Chinese shutdowns appear increasingly likely. This could stress already-vulnerable supply chains, not to mention the Chinese and world economy. Additional Chinese shutdowns would limit crude price increases, all else being equal, but could also lead to even higher consumer prices.

Greater price pressures could force the Federal Reserve to lift interest rates—perhaps even more sharply and faster than currently anticipated. Higher interest rates, in turn, would increase debt-servicing costs at many energy firms. As energy prices rise, the Biden administration may be increasingly willing to open up the crude spigot. Approvals of crude offshore oil terminals are not guaranteed by any means, but they may become more likely amid severe price pressures.

### **Crude Oil Market Movers:**

Geopolitical risks are moving to center stage. Russia may invade Ukraine, almost surely triggering Western sanctions and potentially causing major supply disruptions to crude markets. Meanwhile, Western—Iran negotiations appear to be at an impasse, or even worse. Iran-aligned groups appear to have attacked the United Arab Emirates, raising tensions in the world's largest crude-producing region. We've written before that we believe that crude is unlikely to reach \$100/barrel. Simultaneous geopolitical crises in two major crude-producing regions could see oil prices reach triple-digits, at least temporarily.

As we've written before, however, triple-digit crude prices would likely prove unsustainable and could lead to significant demand curtailment. Chinese crude demand, in particular, poses major downside risks. Chinese GDP growth is already slowing on real estate troubles and omicron outbreaks, leading Beijing to cut interest rates. A Chinese omicron lockdown could pose even more severe risks for crude demand and global supply chains. If oil prices rise, Chinese GDP growth (and oil demand) could take a further hit. As the old saw goes, the cure for high prices is... high prices.

### **Natural Gas Market Movers:**

This time last year, Henry Hub spot prices stood at about \$2.50/MMBtu, only to skyrocket to nearly \$24/MMBtu amid Winter Storm Uri (some local markets saw much higher prices, of course), stabilized around \$3/MMBtu pre-vaccine, and rose to ~\$5/MMBtu through November, only to dip down to about \$4/MMBtu by January 2022 on temperate weather. It's been a wild ride, but we expect several trends to continue in 2022.

First, natural gas production is highly likely to continue to rise. Oil prices will likely continue to support expanded associated gas production, we believe there will be a more permissive ESG/regulatory environment in 2022, and Permian Gas-to-Oil (GOR) ratios will likely continue to go higher. Second, we continue to see very strong overseas demand for U.S. natural gas. We expect that LNG terminals will continue to receive strong netback prices and run at nearly 100% utilization, while Sabine Pass Train 6 and Calcasieu Pass will come online. Pipeline exports to Mexico are also expected to continue to grow. Third, natural gas volumes for power burn may face growing pressure in 2022. Natural gas' share in the ERCOT mix slipped in 2021 from the prior year on greater competition from solar, wind, and even coal. While we don't expect coal to remain viable for much longer, renewables will likely continue to eat away at natural gas power burn. Summer 2021 was a very bad time for wind generation, and batteries are entering ERCOT and CAISO markets at rapid rates.

On balance, 2022 may see more stability than the prior year, while production and demand will likely tick upwards. While LNG prices may fluctuate dramatically, they have limited impacts on the U.S. natural gas market. While weather will continue to play an enormous but uncertain role, we suspect that prices will largely remain rangebound from \$3.75-5/MMBtu this year.

### **LNG Market Movers:**

Europe-driven LNG prices are anyone's guess right now amid geopolitical concerns. An expansion of Russia's invasion of Ukraine could send European gas prices (and LNG markers) skyrocketing to unknown levels. Of course, if the latest series of Russian exercises proves to be much ado about nothing, then world LNG prices could remain flat and even trend down amid cooler weather. The LNG price outlook is extraordinarily uncertain but we expect that U.S. liquefaction volumes will continue to reach new highs, while 2022 volumes will almost certainly set records. With TX/LA likely to experience a mild winter we expect very few outages until maintenance season.

### **NGL Market Movers:**

U.S. ethane prices have showed some softness due to the climbdown from stratospheric natural gas prices. However, we expect volatility in natural gas markets and increased cracker demand to lead ethane prices to trend up. High crude prices and low coproduct prices continue to support ethane as a competitive cracker feedstock, leaving room for ethane demand to rise to 40 cpg in 2022. Propane fundamentals remain very strong, although inventory has returned to 5-year ranges. Prices have ticked down due to seasonal factors but we expect this to be temporary.

*"Energy markets may become more volatile and unpredictable for at least the next few weeks and months... Geopolitical risks are moving to center stage."*

### **Wind News:**

[Great River signs agreement to build big North Dakota wind farm—Star Tribune](#)

[A North Sea Auction Produces Big Plans for Scottish Wind Farms—NYT](#)

[Offshore Wind Energy Strategies—Department of Energy](#)

### **Electric Vehicle News:**

[Ford plans to nearly double production of its new all-electric F-150 Lightning pickup—CNBC](#)

[From the F-150 Lightning to Rivian, here are the 11 hottest electric vehicles coming out in 2022—CNBC](#)

[2024 Chevy Equinox EV Revealed, Will Start at around \\$30,000—Car and Driver](#)

[Stellantis' Chrysler brand to go all electric by 2028 -executive—Reuters](#)

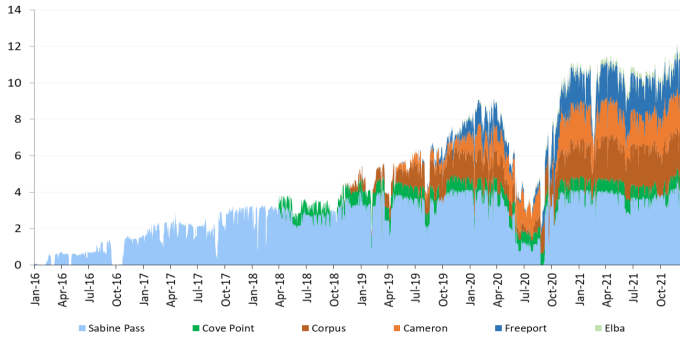
[Sales of Electric Vehicles Surpass Diesel in Europe, a First—NYT](#)

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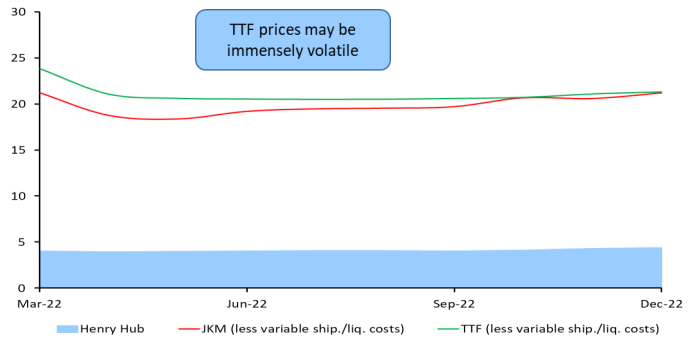
# Key Market Dashboards

**Firm Feed Gas Receipts into U.S. LNG Terminals**  
(Billion Cubic Feet per Day)



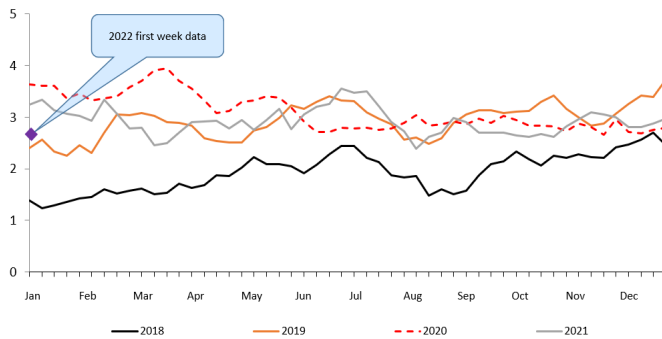
LNG volumes set to reach new highs over the coming months

**LNG Netbacks to U.S. (on Cash Basis)**  
(\$/MMBtu)



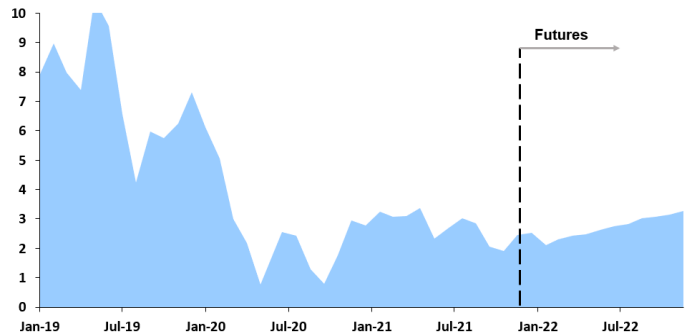
Strong netbacks—but expect European natural gas volatility on geopolitics

**U.S. Crude Oil Exports**  
(Million Barrels per Day, 4-week average)



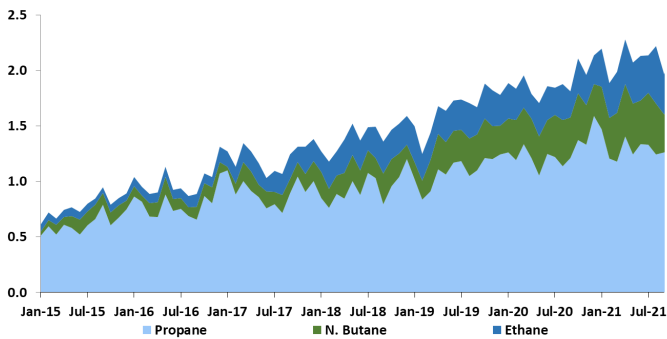
Strong domestic refinery pull still limiting exports below 2019 levels—but geopolitics could rapidly change

**Brent—WTI Spread**  
(\$/Barrel)



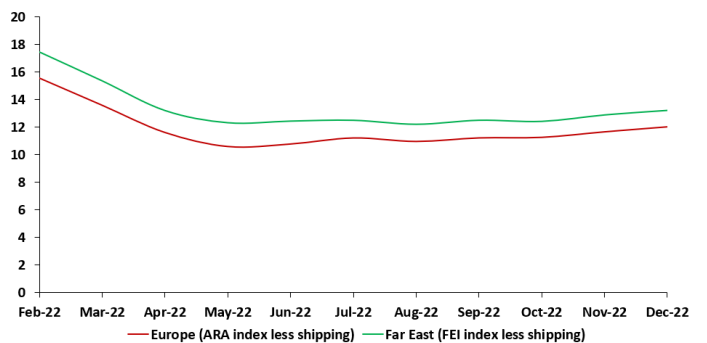
Brent-WTI differentials could widen on geopolitics and impact of COVID in Asia

**U.S. NGL Product Exports**  
(Million Barrels per Day)



Domestic propane prices have rebounded from late-December lows

**International Propane Netbacks (to Mt. Belvieu)**  
(Cents Per Gallon)

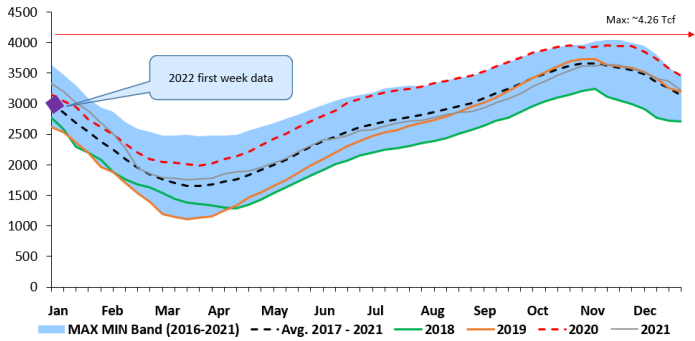


International arbs have widened front end of the curve largely reflecting ease in U.S. propane prices



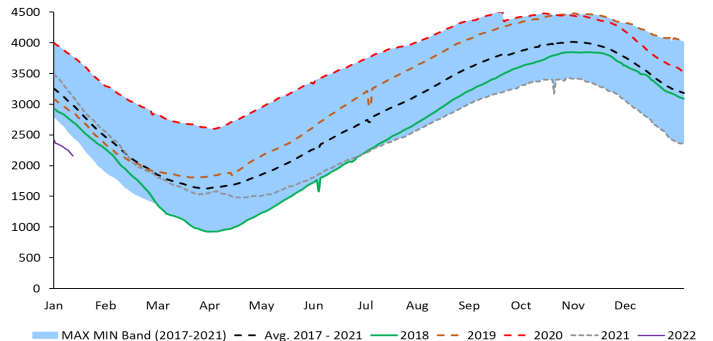
# Key Market Dashboards

### Natural Gas in Storage, Lower 48 (Billion Cubic Feet)



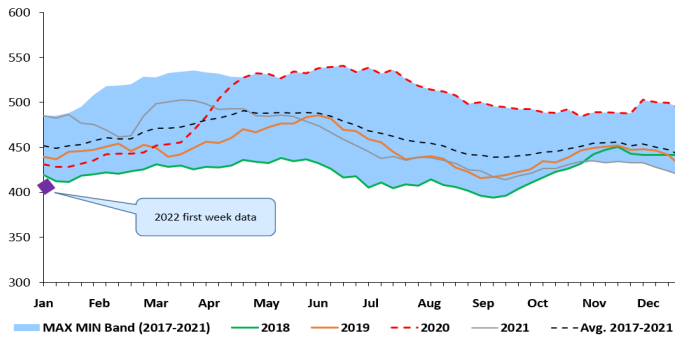
Strong export demand, a mild winter, and reasonable storage levels will help moderate volatility

### European (EU + Ukraine) Gas Storage (Billion Cubic Feet)



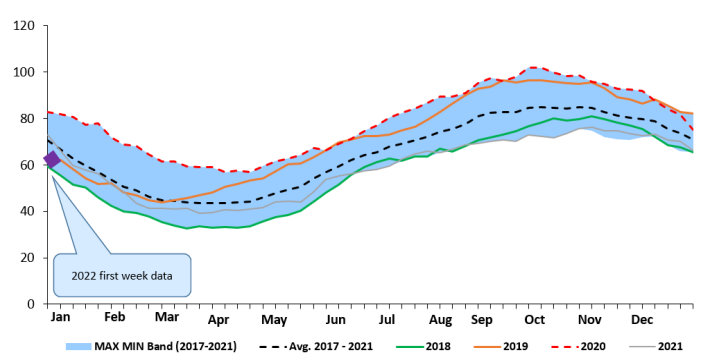
Expect immense volatility in European natural gas markets

### U.S. Crude Oil Commercial Storage Inventory (Million Barrels)



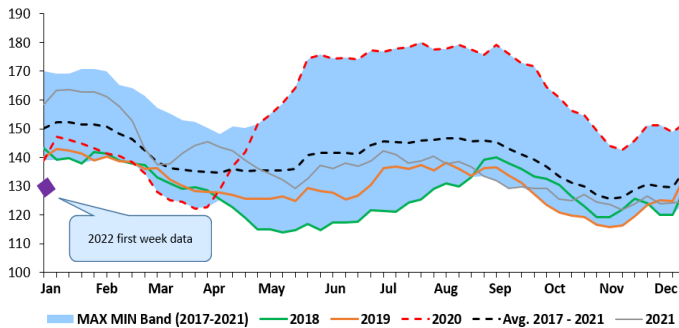
Low inventories support additional domestic production this year

### U.S. Propane/Propylene Storage Inventory (Million Barrels)



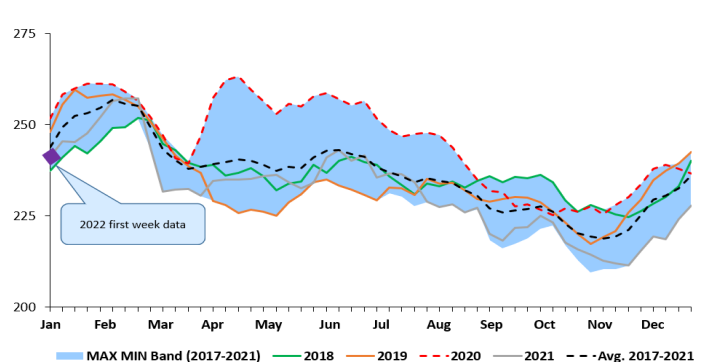
U.S. propane inventories still supportive of prices amid strong domestic + international demand

### U.S. Diesel Storage Inventory (Million Barrels)



Diesel prices retain very strong fundamental support amid low inventories

### U.S. Gasoline Storage Inventory (Million Barrels)



Expect a more normal 2022 as mild USGC weather will likely leave refineries untouched—but hurricane season remains an unknown

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Each quarter, Enkon provides clients a unique, bottom-to-top analysis of NGL supply, logistics, pricing, netbacks, product disposition and outlook for eight NGL producing basins in the U.S. The granularity of the analysis makes this product unique. The analysis identifies NGLs (by purity product) produced at each of the ~700 U.S. gas processing plants as the building block of the analysis to quantify asset utilizations across the midstream value chain.

Appalachian	Rockies	Haynesville- Bossier
Permian	Bakken	Barnett
Eagle Ford	STACK/SCOOP/MERGE	LA Gulf Coast

	Deliverables	Format	Update Frequency
1	NGL Benchmarking	Report (MS PowerPoint)	Quarterly
2	Report discussion & review	In-Person Meeting/Conf Call	Quarterly
3	Supporting data sets	Secured online portal	Quarterly
4	Market insights	Memo	Monthly

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Texas Cavern Coverage		Louisiana Cavern Coverage	
Barbers Hill (Mont Belvieu)	Hull	Sulphur	Bayou Choctow
Stratton Ridge	Spindletop	West Hackberry	Napoleonville
Markham	Fannett	Arcadia	Sorrento
Clemens	Sour Lake	Pine Prairie	Venice
Pierce Junction	Boiling	Anse La Butte	Section 28
West/Panhandle Texas	East Texas		

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Each quarter, Enkon provides clients a provide a historical benchmarking and comprehensive outlook of Y-grade NGLs in the U.S. Gulf Coast with the objective of quantifying incremental need for fractionation capacity in various locations in US Gulf Coast, namely Mont Belvieu, Sweeny and Louisiana, and adequacy of NGL export capacity in the USGC and Northeast.

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Each quarter, Enkon undertakes an exhaustive review of over 24 post and pre-FID North American LNG export terminals; summarizing the North American LNG export terminal landscape, LNG nameplate capacity and feed gas forecasts, key market trends, and a competitive assessment of pre-FID North American terminals. For each project, we report terminal attributes, commercial models, key regulatory milestones, risk assessments, and, for existing terminals, historical feed gas receipts (by pipeline), and estimated weighted average landed cost of feed gas into the terminal.

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