Energy Tidbits

December 18, 2022

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Is China Pushing to Herd Immunity? If So, Vitol Sees "J" Shaped Recovery in China Transportation Fuels as Early as Q2/23

Welcome to new Energy Tidbits memo readers. We are continuing to add new readers to our Energy Tidbits memo, energy blogs and tweets. The focus and concept for the memo was set in 1999 with input from PMs, who were looking for research (both positive and negative items) that helped them shape their investment thesis to the energy space, and not just focusing on daily trading. Our priority was and still is to not just report on events, but also try to interpret and point out implications therefrom. The best example is our review of investor days, conferences and earnings calls focusing on sector developments that are relevant to the sector. Our target is to write on 48 to 50 weekends per year and to post by noon MT on Sunday. The Sunday noon timing was because PMs said they didn't have research to read on Sundays and Sundays are a day when they start to think about the investing week ahead.

This week's memo highlights:

1. China's shift from infection control fits Vitol's Mike Muller set up for a "J" shaped recovery in China transportation fuels demand as early as Q2/23. (Click Here)

2. Been >3 weeks since BC said it was very close to Blueberry First Nations Deal, no deal is putting at risk winter drilling season and any near term LNG Canada 1.8 bcf/d Phase 2 FID (Click Here)

3. Challenge for sustainable growth in Permian oil – Dallas Fed reminds increasing decline rates in high IP wells (Click Here)

4. TASS confirms Novatek's under construction Arctic LNG 2 will only get to 0.87 bcf/d capacity, only 1/3 of planned capacity of 2.6 bcf/d before Baker Hughes pulled out its big turbines (Click Here)

5. Biden didn't shoot down Granholm's huge pivot on the need for fossil fuels and a "managed" transition. (Click Here)

6. Pease follow us on Twitter at [LINK] for breaking news that ultimately ends up in the weekly Energy Tidbits memo that doesn't get posted until Sunday noon MT.

7. For new readers to our Energy Tidbits and our blogs, you will need to sign up at our blog sign up to receive future Energy Tidbits memos. The sign up is available at [LINK].

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Table of Contents

YoY storage at -18 bcf YoY deficit

Natural Gas – Natural gas draw of -50 bcf, storage now -18 bcf YoY deficit

This winter started with a YoY storage deficit of -101 bcf YoY on Oct 28 but had flipped to a +4 bcf YoY surplus for Nov 11 storage data. This week is a -18 bcf YoY deficit. The EIA reported a -50 bcf draw (-51 bcf expectations) for the Dec 9 week, which was a smaller draw vs both the 5-yr average of a -93 bcf draw, than last year's draw of -88 bcf. Storage is 3.412 tcf as of Dec 9, with a now YoY deficit of -18 bcf YoY vs -51 bcf YoY deficit last week and is -15 bcf below the 5-year average vs -86 bcf below last week. Below is the EIA's storage table from its Weekly Natural Gas Storage Report [LINK].

Figure 1: US Natural Gas Storage

	Stocks billion cubic feet (Bcf)				Historical Comparisons			
					Year ago (12/09/21)		5-year average (2017-21)	
Region	12/09/22	12/02/22	net change	implied flow	Bcf	% change	Bcf	% change
East	822	834	-12	-12	822	0.0	827	-0.6
Midwest	1,002	1,028	-26	-26	987	1.5	990	1.2
Mountain	186	193	-7	-7	200	-7.0	197	-5.6
Pacific	203	217	-14	-14	262	-22.5	276	-26.4
South Central	1,199	1,191	8	8	1,160	3.4	1,136	5.5
Salt	337	327	10	10	328	2.7	325	3.7
Nonsalt	862	864	-2	-2	831	3.7	811	6.3
Total	3,412	3,462	-50	-50	3,430	-0.5	3,427	-0.4

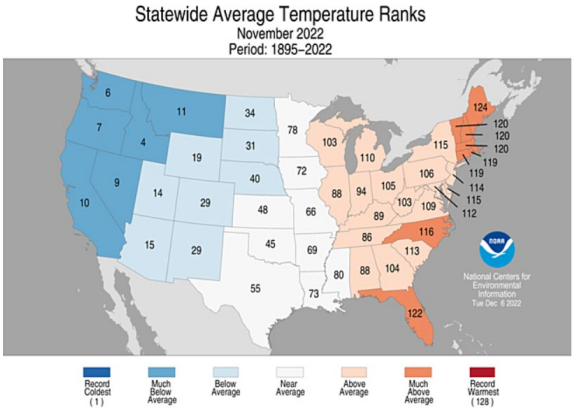
Source: EIA

November was cold

Natural Gas – NOAA says it was 44th coldest November on record

On Wed, NOAA released National Climate recap for Nov 2022, which NOAA ranks as the 44th coldest Nov in the last 128 years. The weather turned a little colder in later Nov ie. starting to see weather related natural gas demand for heating. At its press conference, NOAA said *"the contiguous U.S. average maximum (daytime) temperature during November was 51.9°F, 0.8°F below the 20th century average, ranking in the coldest third of the record."* Below is NOAA's Statewide Average Temperature Rankings for November [LINK].

Figure 2: US Statewide Average Temperature Ranks Nov 2022

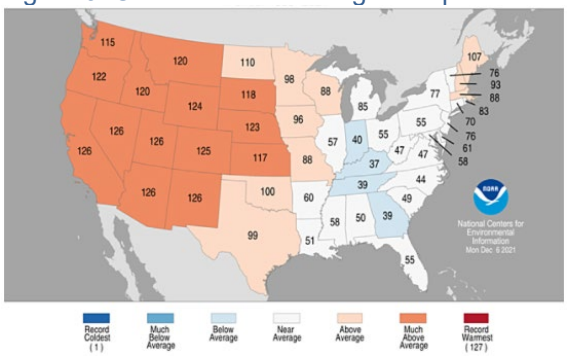


Source: NOAA

Nov 2021 was the 7th hottest November in last 127 years

The two big negative to US natural gas YoY in Nov are the continued shut-down of the Freeport LNG (approx. 15 bcf/week) and the higher YoY US natural gas production (Sept approx. 45 bcf/week). Otherwise Nov storage would have been much lower on a YoY basis considering Nov 2021 was the 7th hottest Nov in the lat 127 years. [LINK]. A year ago, Nov 2021 temperatures were significantly above average seasonal averages. The average temperature across all lower 48 states was 45.2 degrees F, 3.5 degrees F above the 20th century average for November. Below is a graphic depicting the state average temperature ranks for Nov 2021

Figure 3: US Statewide Average Temperature Ranks November 2021



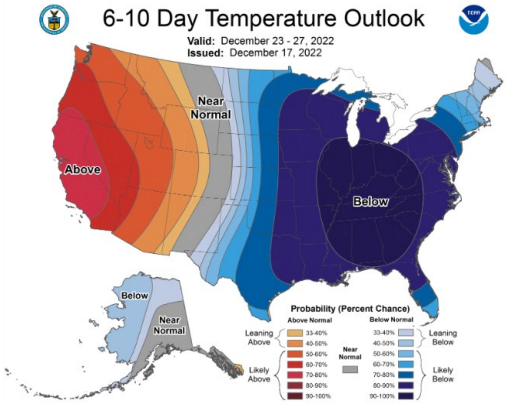
Source: NOAA

Natural Gas – NOAA expects very cold temps thru Xmas in east half of US

NOAA 6-10 & 8-14 day temp outlook

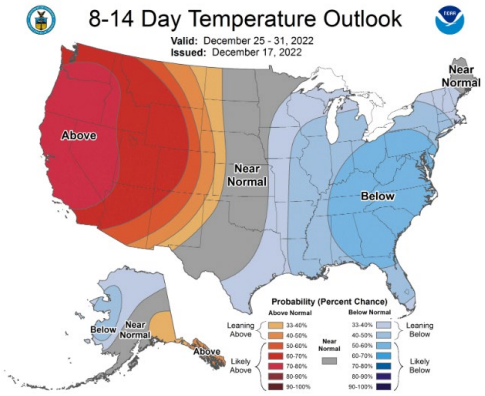
Yesterday, we tweeted [LINK] "*Near term support for HH #NatGas. Reminder vast majority of Americans live in east half of US, @NOAA's updated 6-10 day calls for very cold thru Xmas in east half of US. #OOTT.*" Our tweet inlcuded NOAA's yesterday's updated 6-10 day and 8-14 day outlook that run up to Dec 24. Below are NOAA's 6-10 day and 8-14 day temperature outlooks as of yesterday afternoon.

Figure 4: NOAA 6-10 day temperature outlook as of Dec 17



Source: NOAA

Figure 5: NOAA 8-14 day temperature outlook as of Dec 17

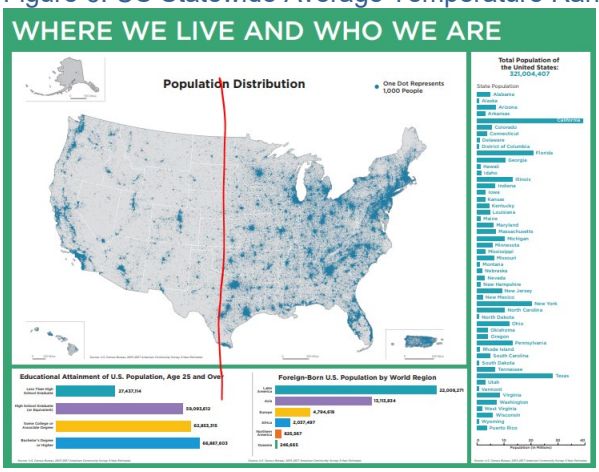


Source: NOAA

The vast majority of Americans live in the east half of the US

Our tweet yesterday reminded that the significance of the east half of the US because the vast majority of Americans live in the east half of the US. We included the below population map from the US Census Bureau "where we live and who we are" [LINK] . And we just drew a line from Texas east to illustrate the population density. The population data is based on the US Census data for 2020.

Figure 6: US Statewide Average Temperature Ranks November 2021



Source: US Census Bureau

Natural Gas – Looks for some natural gas interruptions with extreme cold over Xmas

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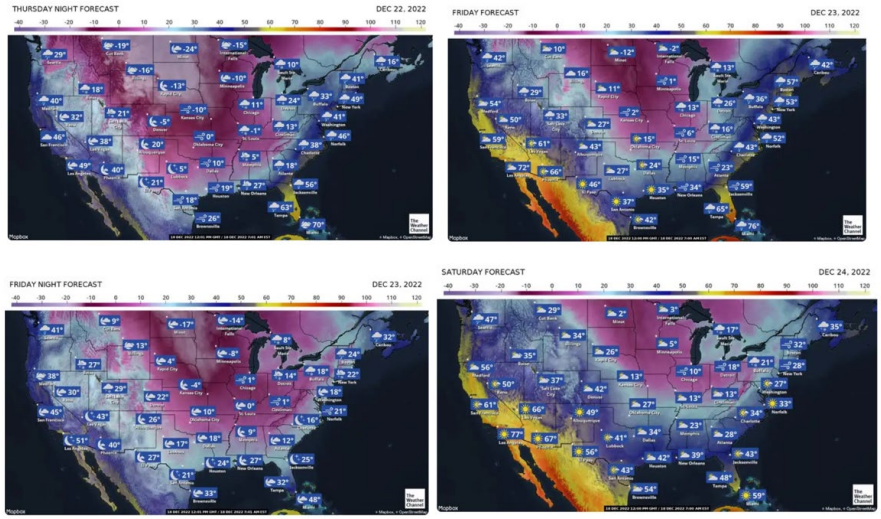
Earlier this morning, we tweeted [LINK] "*Below freezing in TX/OK should impact rigs/frac spreads moves, and likely some #NatGas freeze-offs in TX/OK, which would also back up some #Oil production as gas is associated gas from oil wells. Thx @weatherchannel.*

#OOTT." When temperatures fall below freezing in daytime and nighttime, it typically leads to natural gas freeze-offs in Texas and Oklahoma. And because the natural gas is associated natural gas from oil wells, any interruptions in natural gas flows will also back up oil volumes. We also note that this also leads to delays in rig moves and frac spread moves. We reference the below The Weather Channel maps. [LINK]

Figure 7: Temperature forecasts for Dec 22, 23, 24



Source: The Weather Channel

Natural Gas – EIA, US shale/tight natural gas forecast +7.0% or +6.453 bcf/d YoY in Jan

Shale/tight gas production

EIA's Drilling Productivity Report Dec 2022 was released on Monday, and the key takeaway is that Jan 2023 would be the 9th consecutive month of growth for US shale/tight natural gas, albeit the last few have been more modest MoM growth but growth, nonetheless. The DPR [LINK] is the EIA's forecast for oil and natural gas production from the major shale/tight oil and gas basins for the current month (in this case Dec) and the next month (in this case Jan). (i) Shale/tight natural gas is forecasted to have 9 months of consecutive growth and has been breaking out since April, as increasing US LNG export capacity out of the Gulf Coast is driving natural gas growth in Louisiana and Texas. US shale/tight natural gas was 90.100 bcf/d in April and Jan is forecasted at 96.281 bcf/d. (ii) MoM. Three of the shale/tight gas areas were basically flat – Anadarko, Bakken and Niobrara. The largest increases came from Haynesville (+0.152 bcf/d MoM), Permian (+0.119 bcf/d MoM) and Appalachia (+0.113 bcf/d MoM). (iii) Total US shale/tight natural gas production is expected +6.453 bcf/d YoY for Jan. All shale/tight plays except for the Niobrara are up YoY, with the most notable YoY increases being Haynesville +2.390 bcf/d YoY and Permian +1.451 bcf/d YoY. The two key shale/tight plays feeding growth US LNG exports. Appalachia is basically flat YoY. (iv) Remember US shale/tight gas is ~90% of total US natural gas production. So, whatever the trends are for shale/tight gas are the trends for US natural gas in total. Below is our running table showing the EIA DPR data for the shale/tight gas plays, and the MoM changes in major shale/tight natural gas production. Our Supplemental Documents package includes the EIA DPR.

Figure 8: MoM Change – Major Shale/Tight Natural Gas Production

	2022												2023			
mmcf/d	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Jan	Jan YoY	Jan YoY %	Jan less Dec
Anadarko	6,278	6,341	6,286	6,118	6,134	6,275	6,554	6,658	6,715	6,708	6,832	6,997	6,991	713	11%	-6
Appalachia	34,988	35,716	36,298	35,443	35,476	35,155	35,121	35,332	35,486	35,577	35,434	35,417	35,530	542	2%	113
Bakken	3,150	3,137	3,079	2,932	3,076	3,088	3,086	2,915	3,191	3,156	3,246	3,323	3,356	206	7%	33
Eagle Ford	6,118	6,176	6,288	6,298	6,394	6,538	6,671	6,985	7,101	7,220	7,311	7,390	7,459	1,341	22%	69
Haynesville	14,019	14,291	14,425	14,527	14,863	15,023	15,261	15,643	15,835	15,878	16,083	16,257	16,409	2,390	17%	152
Niobrara	5,339	5,293	5,196	5,254	5,187	5,195	5,205	5,212	5,223	5,062	5,074	5,124	5,149	-190	-4%	25
Permian	19,936	20,233	20,160	19,533	19,870	20,227	20,373	20,417	20,584	20,930	21,143	21,268	21,387	1,451	7%	119
Total	89,828	91,187	91,732	90,105	91,000	91,501	92,271	93,162	94,135	94,531	95,123	95,776	96,281	6,453	7%	505

Source: EIA, SAF

Natural Gas – US LNG exports +3.9% YoY in Oct at 10.0 bcf/d

US Oct LNG exports

As a reminder, the US Dept of Energy posts monthly US LNG export data two weeks before the EIA (part of the US Dept of Energy) posts US LNG export data in its monthly Natural Gas Monthly report (next report is Dec 30). Normally, the data points are the same. On Thursday, we tweeted [LINK] "*US #LNG exports Oct/22 were 9.98 bcf/d, +3.9% YoY, +1.5% MoM. Continued impact of #FreeportLNG 2.2 bcf/d June 8 shut. Oct/22 top 5 export countries: France, UK, Dutch, Korea, China. Oct/21 top 5 export countries: China, Brazil, Japan, Spain, Korea. @ENERGY data. #OOTT*." On Thursday, the DOE posted its LNG Monthly for US LNG exports in October. [LINK] The headline numbers are the US exported 10.0 bcf/d of LNG in October, which was up 1.5% MoM vs September 2022, and +3.9% YoY vs October 2021. Note that although Freeport's terminal has not restarted, Venture Global's Calcasieu Pass and Cheniere Energy's Sabine Pass terminals have ramped up. Our table below is rounded numbers to one decimal and the actual Oct exports were 9.98 bcf/d. Our Supplemental Documents package includes excerpts from the DOE LNG Monthly.

Figure 9: US LNG Exports (bcf/d)

(bcf/d)	2016	2017	2018	2019	2020	2021	2022
Jan	0.0	1.7	2.3	4.1	8.1	9.8	11.4
Feb	0.1	1.9	2.6	3.7	8.1	7.4	11.3
March	0.3	1.4	3.0	4.2	7.9	10.4	11.7
Apr	0.3	1.7	2.9	4.2	7.0	10.2	11.0
May	0.3	2.0	3.1	4.7	5.9	10.2	11.3
June	0.5	1.7	2.5	4.7	3.6	9.0	10.0
July	0.5	1.7	3.2	5.1	3.1	9.7	9.7
Aug	0.9	1.5	3.0	4.5	3.6	9.6	9.7
Sept	0.6	1.8	2.7	5.3	5.0	9.5	9.8
Oct	0.1	2.6	2.9	5.7	7.2	9.6	10.0
Nov	1.1	2.7	3.6	6.4	9.4	10.2	
Dec	1.3	2.7	4.0	7.1	9.8	11.1	
Full Year	0.5	1.9	3.0	5.0	6.6	9.7	10.6
Full Year bcf	186.8	707.5	1,083.1	1,819.4	2,390.0	3,560.8	2,913.3

Source: EIA, DOE

Europe continues to be main destination for US LNG in 2022

One of the reasons why we like the DOE LNG Monthly is that it provides LNG insights on more than just the numbers. The DOE always summarizes the top destinations for US LNG in the month. We went back to the DOE LNG Monthly report in Dec 2021 that had the comparable top LNG destinations data for Oct 2021. For September 2022, the DOE reported *"Top five countries of destination, representing 62.6% of total U.S. LNG exports in October 2022 was France (48.9 Bcf), United Kingdom (46.0 Bcf), Netherlands (40.5 Bcf), South Korea (31.4 Bcf), and China (26.9 Bcf).* For October 2021, last year's DOE LNG Monthly Dec 2021 reported highlighted

"*Top five countries of destination, representing 61.4% of total U.S. LNG exports in October 2021. China (42.2 Bcf), Brazil (40.8 Bcf), Japan (37.7 Bcf), Spain (35.6 Bcf), and South Korea (33.8 Bcf).*

Natural Gas – What if TC is right that Mexico attracts +3 bcf/d of Permian by 2030?

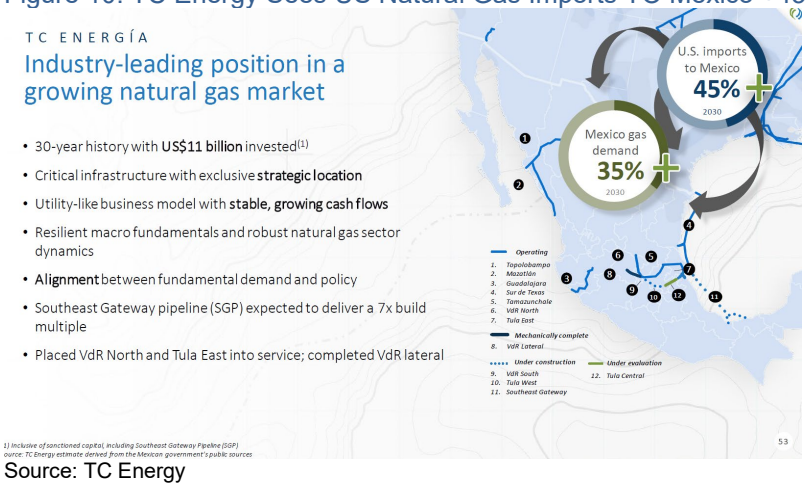
Is TC right on Permian gas exports to Mexico

It won't affect stock trading, but for those that look at capital allocation on a mid to long term basis or look at tail-end risks/opportunities, the question of Mexico's natural gas infrastructure build-out is worth tracking. We had the opportunity to listen to a major energy analysis group recent US natural gas outlook and it didn't include any slides or commentary on the potential (or expectation by some) for Mexico to ramp up its natural gas pipeline imports from the Permian in the 2020s. It's something that most either overlook or discount or just don't care about, but a factor that could a material impact on the US natural gas view. TC Energy is probably the driving force behind much of Mexico's domestic natural gas pipeline infrastructure build-out and has a very bullish view that Mexico will attract an additional +3 bcf/d to 2030. If they are right, this will attract Permian natural gas, and that means there will be less Permian natural gas for LNG export. And will raise the question is there enough natural gas to support the growth in US LNG exports? And, since US LNG export growth, it means that there will be a need to try to get Appalachia natural gas down to the Gulf Coast. And, or course, TC Energy has the solution for that. But you can see how the TC view on Mexico has a very big impact on US natural gas in the 2020s, if not necessarily in the next couple years. We highlighted this in our Dec 4, 2022 Energy Tidbits.

TC Energy sees Permian natural gas +3 bcf/d to Mexico by 2030

Here is what we wrote in our Dec 4, 2022 Energy Tidbits. "*One overlooked upside to US natural gas in the 2020s is that the growth Mexico infrastructure projects are starting to kick in. Yesterday, we tweeted [LINK] "Positive for US #NatGas for 2020s. It's not just increasing #LNG exports, it's also Mexico. Mexico #NatGas demand from 9 bcfd to 12 bcfd in 2030. @TCEnergy expects MEX #NatGas pipeline imports from Permian +45% from 6 bcfd in 2022 to 9 bcfd by 2030. #OOTT." The growth in Mexico natural gas demand is a big plus to the Permian. For the last few years, every time we write on Mexico's natural gas production, we say it is still stuck below 5 bcf/d and that any increase in Mexico natural gas demand has to be met by increasing natural gas or LNG imports. For the past 5+ years, other than a few months, Mexico gas production was below 5 bcf/d. Mexico's natural gas demand growth and growing infrastructure was one of the key growth themes at TC Energy's investor day on Tuesday. Mgmt's slide deck included the below slide and mgmt said "We expect Mexican natural gas demand to increase by 3% per year across the country from 9 Bcf to 12 Bcf in 2030, with strategic government projects creating over 1 Bcf a day of incremental gas demand in the southeast alone by 2025. Now given Mexico's limited natural gas production, this increase in demand will likely be served by supplies in the U.S. and more specifically the Permian as we believe Mexican imports from the Permian are likely to increase by 45% from 6 Bcf a day in 2022 to 9 Bcf by 2030."*

Figure 10: TC Energy Sees US Natural Gas Imports TO Mexico +45% to 2030



Source: TC Energy

Natural Gas – What is going on with BC's "very close" to Blueberry First Nations deal?

Where is BC/Blueberry First Nations deal?

Where is the BC deal with the Blueberry First Nations? We recognize that most took the BC Government at their word, but it's been three weeks since the BC press release on Nov 26 "*Ministers' joint statement on status of negotiations with Blueberry River First Nations"* [LINK] that had a very clear message that a deal is coming. BC said ""*We wish to affirm that we are very close to an agreement and are discussing final issues. As such, we have initiated early engagement with select industry groups and other Treaty 8 Nations on a proposed agreement to hear their feedback and consider adjustments.*" At that time, we noted in our Dec 4, 2022 Energy Tidbits that we were surprised by the bullish statements in the BC release, primarily because we had been hearing that the Blueberry First Nations ask was too big for even BC to accept. But clearly the BC release seemed to put to bed the chatter we had been hearing that the Blueberry First Nation had asked way too much to get a deal. But, it's now been three weeks and no word that a deal is coming and coming soon. We haven't heard any of our industry contacts say they hear a deal is effectively done. We hope, like we put in our prior memos, that our contacts are all wrong and BC is getting a deal done any day now with the Blueberry First Nations. But the silence is deafening. Our Supplemental Documents package includes the BC Nov 26 press release.

It's probably too late to save most of winter drilling season

When BC Nov 26 release came out, it looked like a big operational positive for BC's winter drilling season. There would be time to get cranked up in the short winter drilling season. But, it's Dec 18, Christmas is next week and then New Years. Drilling always declines over Xmas, but there are logistics to get drilling cranked up. And even if there is a deal before Xmas, BC producers won't be able to get all the winter drilling done that they had hoped to do going back to the summer when the first hints of a deal were hoped.

Without a deal, it's hard to see a LNG Canada Phase 2 FID

We have been tracking all the indications from Shell, LNG Canada and TC Energy that have pointed to why a FID on LNG Canada 1.8 bcf/d Phase 2 should have come in Q4/22. But we also realize that, without a BC/Blueberry First Nations deal, it will be highly unlikely to see that FID. Because without a deal, the LNG Canada joint venturers would be questioning their ability to drill to fill its under-construction Phase 1, let alone FID Phase 2. It's why, in our Dec 4, 2022 Energy Tidbits, we wrote "*We wonder if the lack of a BC deal with Blueberry First Nations is why BC hasn't either signed off or rejected LNG Canada's request for BC's views on a potential LNG Canada Phase 2 FID. It makes sense. If Blueberry First Nations had negotiating leverage given the need to crank up drilling to supply natural gas for LNG Canada's 1.8 bcf/d Phase 1, the need for another 1.8 bcf/d of natural gas supply for a LNG Canada 1.8 bcf/d Phase 2 would give even more leverage to Blueberry First Nations. Our Oct 23, 2022 Energy Tidbits noted the first BC confirmation that they were looking at LNG Canada Phase 2. We then wrote "Natural Gas – BC says it is in discussions with LNG Canada on potential Phase 2. It looks like it is coming down to British Columbia to decide if LNG Canada will proceed with its brownfield 1.8 bcf/d Phase 2. We have a clear statement from British Columbia that they are in discussions with LNG Canada on their wish for the potential Phase 2. Last week's (Oct 16, 2022) Energy Tidbits highlighted the separate comments from Canada Deputy Prime Minister Freeland and External Affairs Minister Joly that seemed to point to LNG Canada Phase 2 coming and that the Liberals would be onside. We haven't seen comments from the BC Govt on Phase 2 until this week. On Monday, we tweeted [LINK] "#LNGCanada 1.8 bcfd Phase 2 FID. Liberals seem onside see 👇 @cafreeland. BC. @brentcjang reports @BruceRalston "LNG Canada has expressed the wish to explore the possibility of proceeding with Phase 2, and we're engaged in discussions with them. #OOTT [LINK]." The Globe and Mail wrote "In a recent media briefing in Kitimat, however, LNG Canada chief executive officer Jason Klein said LNG from B.C. will play a crucial role in helping displace coal used in Asia for electricity generation. "The climate challenge isn't a B.C. challenge. It is a global challenge," Mr. Klein said. "It's not just about displacing coal. It's also about getting people out of energy poverty around the world." He said Shell, Petronas and the three other co-owners of the megaproject will ultimately decide whether it makes economic sense for Phase 2 to use lower-carbon hydroelectricity from BC Hydro to power motors to produce LNG. There isn't sufficient infrastructure today for BC Hydro to provide enough hydro power for electric-drive technology at the Kitimat facility, but new transmission lines are possible. B.C. Energy Minister Bruce Ralston, who is the cabinet minister responsible for BC Hydro, said electrification would be an important aspect of LNG Canada's potential expansion. "LNG Canada has expressed the wish to explore the possibility of proceeding with Phase 2, and we're engaged in discussions with them," Mr. Ralston said."*

Natural Gas – Russia's Arctic LNG 2 capacity only 0.87 bcf/d of pre-sanction 2.6 bcf/d

We are still surprised that most don't seem to appreciate how sanctions are hurting Russia's next wave of LNG projects. On Monday, we saw confirmation of the expected – Russia's Novatek under construction Arctic LNG 2 would be starting up in Dec 2023 with its three

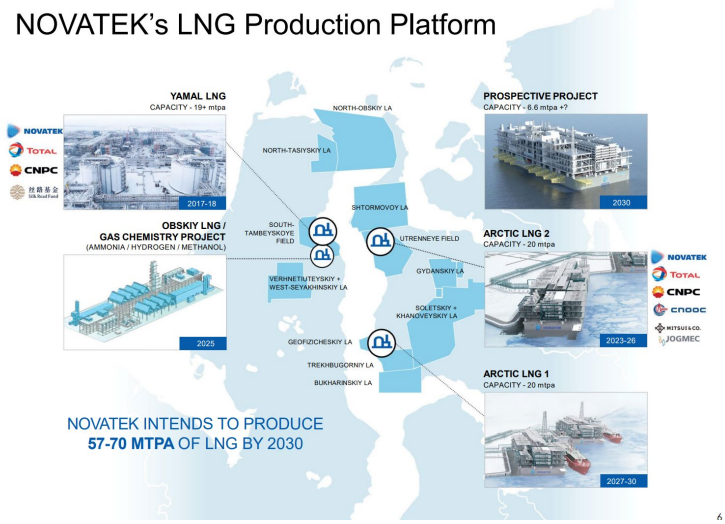
Phases only adding 0.87 bcf/d of LNG capacity in 2023 thru 2026, which is only 1/3 of the pre-sanctions planned capacity of 2.6 bcf/d in 2023 thru 2025. So a little later and a lot less LNG. And a key reason why LNG is supply short thru 2026. (i) We tweeted [LINK] "*#LNG Game Changer. No Baker Hughes big turbines = Lower RUS LNG capacity. TASS: under construction Novatek Arctic LNG 2 to add 0.87 bcfd in 2023-26, 33% of pre-BKR RUS exit capacity of 2.6 bcfd. See 👇 06/16 thread. Key reason why #LNG is supply short thru 2026. #OOTT #NatGas."* (ii) On Monday, TASS reported "*Launch of first line of Arctic LNG 2 set for December 2023*" [LINK] ""*Arctic LNG-2 is Novatek's second LNG project. It includes the construction of three lines for the production of liquefied natural gas with a capacity of 6.6 mln metric tons per year each and stable gas condensate up to 1.6 mln metric tons per year. The launch of the first line is planned for December 2023, the launch of the second and third lines is expected in 2024 and 2026, respectively."* That is 0.29 bcf/d per phase of 0.87 bcf/d for the three phases. (iii) The pre-sanctions planned capacity for Arctic LNG 2 was to add 0.87 bcf/d per phase for a total of 2.6 bcf/d. The reason for the lower capacity is that Baker Hughes is no longer providing its big gas turbines to power the LNG project. Our Supplemental Documents package includes the TASS report.

LNG game changer, Baker Hughes stops work on 6.2 bcfd RUS LNG

We have been highlighting the Baker Hughes Russia stoppage as an LNG game changer. Our June 19, 2022 Energy Tidbits memo was titled "*Game Changer for LNG: ~6.2 bcf/d Russian LNG is at Risk with Reports Baker Hughes to Stop Providing Services/Equipment".* Here is what we wrote in our June 19 memo. "*We are still surprised that others haven't jumped on what we called the game changer to LNG – the reports Baker Hughes is stopping servicing, replacing parts, etc for in operating Russian LNG projects and will not provide gas turbines for the under construction LNG projects. This is putting at risk 3.6 bcf/d of existing LNG supply and 2.6 bcf/d of under construction LNG. It is huge or, at least we think so. Don't forget Baker Hughes is the leading global services company for LNG and is involved in almost every recent LNG project. (i) On Thursday, we tweeted [LINK] "1/2. Game Changer for #LNG. 6.2 bcfd RUS LNG is now at risk incl operating 1.3 bcfd Sakhalin-2 LNG & 2.3 bcfd Yamal LNG, and under construction 2.6 bcfd Arctic LNG-2 w/ phase 1 0.87 planned 2023 in service. #OOTT #NatGas" and [LINK] "2/2. Must read, @Kommersant reports #BakerHughes stopping service/replacement parts for existing #LNG & shipping gas turbines for Arctic LNG-2. Projects are designed for specific turbines. Urgent need for LNG FIDs ie. how about @Shell #LNGCanada Phase 2 is 1.8 bcfd. #NatGas #OOTT". Baker Hughes is reportedly stopping servicing two in-service Russian LNG projects (Sakhalin-2 and Yamal LNG) and stopping deliveries on gas turbines for the under construction Arctic LNG-2 project. Sakhalin-2 LNG in operation. Think about what is happening with Nord Stream being shut down waiting on equipment repairs. The operating 3.6 bcf/d LNG will be at risk for now having Baker Hughes servicing and providing any equipment repairs/replacement. And the 2.6 bcf/d of under construction LNG can't be finished without Baker Hughes equipment. (ii) On Friday, we tweeted [LINK] "Game changer for #LNG. See 👇 Thurs thread, $BKR pullout is huge. RUS admits delays in new LNG adds, hopes no more than 1-2 yrs. Arctic LNG-2 2.6 bcfd from 3 phases, phase 1 0.87 bcfd starting in 2023, all on in 2026. Urgent need for FIDs ie. #LNGCanada Phase 2. #OOTT #NatGas." TASS reported on comments from Russia First Deputy*

*Minister Sorokin, who admitted that the under construction 2.6 bcf/d Arctic LNG-2 would be delayed and they hoped the delay wouldn't be more than 1 to 2 years. In the Kommersant Thursday report, they noted that the Baker Hughes equipment could not be replaced. Kommersant wrote ""There is, in fact, nothing to replace this equipment now: analogues are not produced in the Russian Federation, and LNG production lines have already been designed for the LM9000". (iii) There was a good example on how nothing is every clear in Russia. And that Novatek still sees Phase 1 of Arctic LNG-2 starting on time in 2023. On Friday night, Bloomberg reported "Novatek plans to launch Arctic LNG 2 on time despite all the problems amid sanctions, Interfax reports, citing CEO Leonid Mikhelson at St. Petersburg International Economic Forum. * NOTE: Novatek holds 60% stake in the Arctic LNG 2 project with three LNG production trains with a capacity of 6.6m tons/year each. The first train was expected to start production in 2023 * Novatek has revised Arctic LNG 2 financing scheme, there are no problems with that."*

Figure 11: Novatek's LNG production platform, May 2021



Source: Novatek

Baker Hughes Q2 confirmed stopped work on 6.2 bcfd RUS LNG

Our original comment on this LNG game changer was based on the Kommersant report. But we saw the confirmation, although not as clearly written as we hoped, of this Baker Hughes pull out in the Baker Hughes Q2. Here is what we wrote in our July 24, 2022 Energy Tidbits memo. "*Baker Hughes suspends all LNG equipment & services work in Russia. Baker Hughes reported Q2 on Wednesday. All the analysts focused on the impact of Russia on the financial results, but there didn't seem to be any real market concerns on what Baker Hughes suspension of all equipment and services contracts for LNG in Russia would mean to LNG markets. It is important to note Baker Hughes is clearly stating they have suspended work on all of their "equipment" and "services" contracts in Russia. Think about what is happening with Nord Stream and this is very similar. It's not just supplying new equipment for new*

LNG projects, but also servicing existing equipment in existing LNG projects. We remain surprised that this isn't a major LNG market focus. Baker Hughes LNG business is within its TPS group. In the Q2 call mgmt. said "In TPS we have suspended work on equipment and service contracts in Russia. As a result, these projects have been removed from RPO and second-quarter revenue was impacted by roughly $160 million but with minimal impact to TPS operating margins." And "So at the beginning of the year, we were expecting, around $300 million of EBITDA for Russia this year and our Russian operations are generally quite accretive to our overall mix really due to the risk premium of operating there as well as some business mix primarily in TPS services as well as in some OFS product lines".

Natural Gas – India November natural gas production -1.1% YoY to 3.34 bcf/d

India natural gas production -1.1% YoY

It looks like India's growth in its domestic natural gas production in 2021 and early 2022 hasn't been able to be maintained and it is slipping back into a flattish production profile. India natural gas production peaked in 2010 at 4.6 bcf/d. Its 2018-2019 production averaged 3.18 bcf/d, declining to 3.02 in 2019-2020 and then further declined to average 2.78 bcf/d 2020-2021. But then natural gas production. Returned to growth in 2021-2022 but that growth looks to be gone as the past few months have returned to plateau or small declines. On Friday, India's Petroleum Planning and Analysis Cell released their monthly report for November natural gas and oil statistics [LINK]. India's domestic natural gas production was down -1.1% YoY from 3.38 bcf/d in November 2021 to 3.34 bcf/d in November 2022 but up MoM from 3.29 bcf/d in October. Our Supplemental Documents package includes excerpts from the PPAC monthly package.

Natural Gas – India November LNG imports up +10.9% YoY to 2.91 bcf/d, up 5.8% MoM

India LNG imports +10.9% YoY

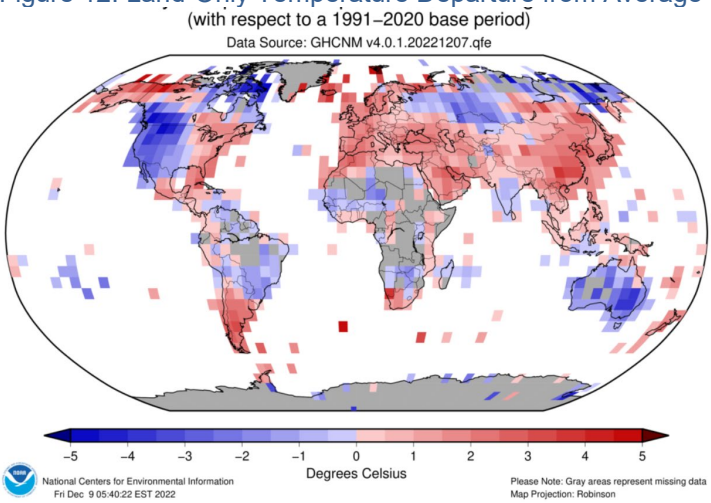
For the past several years, there has been increased India LNG imports whenever domestic natural gas production was flat or decreased. But the overriding factor in 2022 has been the sky-high LNG prices. India is always viewed as an extremely price sensitive buyer in terms of its LNG imports. We saw this in periods of low LNG prices such as June to Oct 2020 when India had a big ramp up in LNG imports. But with the sky-high LNG prices in 2022, India has done their best to minimize LNG imports. On Friday, India's Petroleum Planning and Analysis Cell released their monthly report for November natural gas and oil statistics [LINK]. Imports began to decline in November 2020 as LNG prices rose, with the price trajectory ramping up in late Dec and reaching record levels in January. This resulted in India LNG imports declining from a 2020-2021 peak of 3.84 bcf/d in Oct 2020 to just 2.85 bcf/d in Jan 2021. November imports increased MoM to 2.91 bcf/d and up +10.9% YoY.

Natural Gas – Nov was very warm in both Asia and Europe

Very warm Nov in Europe and Asia

The weather was great in November for basically all of Europe and Asia. This reinforces why there has no natural gas crisis so far in Europe. The warm weather in Asia means there hasn't been any strong weather demand for natural gas and that frees up LNG cargoes for Europe. And in Europe, was hot in Oct and Nov so there was no real weather demand for natural gas. On Wednesday, NOAA also posted its Global Climate Recap for November. [LINK] In NOAA's release on the November recap its mentioned that Europe was +2.12C (+3.82F) warmer than normal and the 3rd warmest in the last 113 years. While Asia was +1.63C (2.93F) warmer than normal, and the 14th warmest in the last 113 years. Below is a graphic showcasing the global temperature departures from average.

Figure 12: Land-Only Temperature Departure from Average Nov 2022



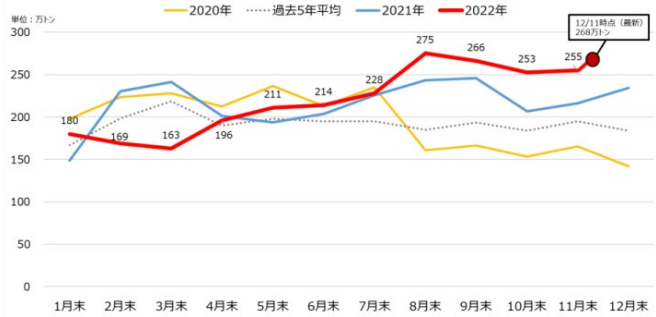
Source: NOAA

Natural Gas – Japan's LNG stocks up +1.9% WoW to 129 bcf

Japan LNG stocks +1.9% WoW

It's been warm in Japan for Nov and the first part of Dec, but the new Japan Meteorological Agency weekly forecasts just flipped to expect very cold to end Dec The risk for Japan in the winter is that they need full storage and continued LNG imports to avoid natural gas outages. Although that risk lessens the longer it stays warmer than normal in Dec, Japan's LNG stockpiles are not huge relative to LNG imports that have ranged from 7 to 14 bcf/d since Jan 1, 2021. A cold winter or interruption in LNG imports could lead to a shortage. LNG stockpiles held by Japanese power producers have exceeded both last year's level and the 4-year average. Japan's METI weekly LNG stocks data was released on Wednesday [LINK]. LNG stocks at Dec 11 were ~129 bcf, +1.9% WoW from Dec 4 of 126 bcf and above the 5-yr average of 112 bcf. Below is the LNG stocks graph from the METI weekly report.

Figure 13: Japan's LNG Stocks



Source: METI

Natural Gas – Japan LNG imports down -5.4% YoY

Japan Nov LNG imports -5.4% YoY

On Wednesday, Japan's Ministry of Finance posted its import data for Nov. Japan' has worked in 2022 to reduce natural gas consumption in response to sky-high LNG prices and has been maximizing petroleum products and coal power generation to minimize sky-high LNG prices. It has been working. Japan Ministry of Finance released its October LNG import data Wednesday [LINK]. Japan's Nov LNG imports were 8.88 bcf/d, which was down -5.4% YoY, but up 9.1% MoM from 7.88 bcf/d in October. Plus, Nov was warm as well as the start of Dec so no big weather driven electricity demand. No surprise LNG import were down as thermal coal down -18.5% YoY. Below is our table that tracks Japan LNG import data.

Figure 14: Japan Monthly LNG Imports

bcf/d	2015	2016	2017	2018	2019	2020	2021	21/20	2022	22/21
Jan	13.06	11.22	12.85	12.79	11.69	11.63	12.48	7.3%	10.51	-15.8%
Feb	13.26	12.30	13.36	14.23	12.61	10.99	13.84	25.9%	12.19	-11.9%
Mar	12.60	12.62	12.61	12.28	11.30	11.16	11.04	-1.1%	10.07	-8.7%
Apr	10.56	10.21	10.52	8.97	9.00	8.31	7.96	-4.3%	8.92	12.0%
May	8.91	8.55	9.66	9.92	8.62	7.09	7.67	8.1%	8.92	16.3%
June	10.61	10.02	9.90	8.88	8.32	8.42	9.13	8.5%	9.29	1.7%
July	10.77	10.19	10.19	10.55	10.56	9.35	9.58	2.5%	9.54	-0.4%
Aug	10.93	11.96	11.24	11.73	9.45	9.04	9.75	7.8%	9.71	-0.4%
Sept	11.06	10.67	9.31	10.04	10.30	10.41	8.66	-16.8%	8.52	-1.6%
Oct	9.38	9.73	9.50	10.12	9.75	9.20	7.17	-22.1%	7.88	9.9%
Nov	10.71	12.07	10.26	10.15	10.03	9.63	9.38	-2.6%	8.88	-5.4%
Dec	12.51	11.69	12.31	11.23	10.54	11.96	10.89	-8.9%		

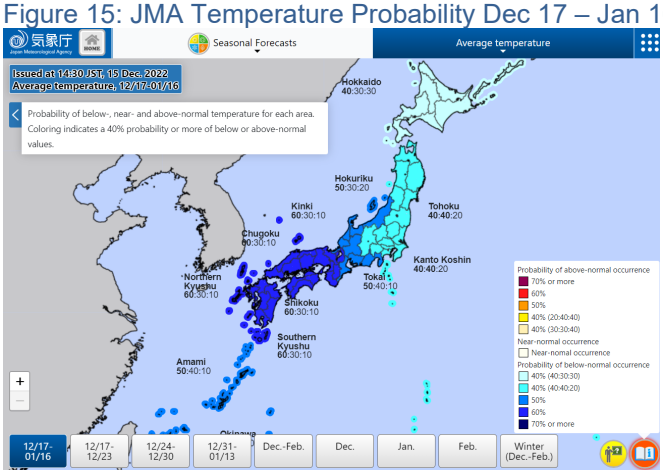
Source: Japan Ministry of Finance

Natural Gas – Japan now expects a very cold end to Dec

Japan temperature outlook

There was a good reminder on how unpredictable weather is and how quickly weather forecasts can change. We have been noting how Japan changed their weather forecasts. At the end of Oct, Japan expected a cold Dec, but changed that in Nov and early Dec to a warmer Dec. That flipped back this week from expectations for a warmer than normal Dec to a very cold end to Dec. Every Thursday, the Japan Meteorological Agency provides an updated 30-day temperature probability outlook. The expectation has been that the warmer than normal weather would continue in November, but then to give way to a cold. The new weekly JMA forecast reverts from the last two weeks and calls for a very cold end to December. Below is the JMA's Dec 8 updated 30-day outlook. [LINK]

Figure 15: JMA Temperature Probability Dec 17 – Jan 16



Source: Japan Meteorology Agency

Natural Gas – UK's advice on how households can save energy/natural gas

UK's energy saving advice

The big push in Europe is now on getting people to cut back on energy consumption. Yesterday, the UK launched "It All Adds Up" campaign, which is the government's advice on how households can save energy with no or low cost actions. UK writes "*The guidance focuses on simple measures which are not already adopted by the majority of households in the UK. How energy use can be reduced may be different for each individual household, but simple measures in the campaign can offer significant financial savings this winter without reducing comfort or putting people's health at risk."* The It All Adds Up webpage [LINK] lists all the suggest actions. One example is "*Turning appliances off at the socket could save you up to £70 a year Almost all electrical appliances in your home, such as computers, televisions, smart devices and video game consoles, draw power continuously unless unplugged. Turn off the power switch at the socket or unplug appliances from the socket when they are not in use. "* Others are items like "*Turning down radiators in rooms you aren't using or use less could save you up to £70 a year."* They also include low-cost home improvements like "*Switching to energy saving lightbulbs could save you up to £55 a year*." Our Supplemental Documents package includes the UK release and the Independent listing of all the suggestions.

UK is like IEA May 2021 Net Zero pathway ie. back to 60's before clothes dryer

After reading the UK's advice to households, we couldn't help think that some of their energy saving advice are what the IEA's May 2021 Net Zero Pathway recommended and that everyone really overlooked. One of the UK's energy saver recommendations is "*Using your tumble dryer less could save you £70 a year. Tumble dryers are one of the most energy-intensive devices in the home. Use your tumble dryer less frequently by ensuring you have a full load, around three-quarters of the drum. Or use a clothes airer to dry clothes outside, or inside with a window open for ventilation. You should also avoid overfilling your dryer as this could lengthen the drying time."* Here is what we wrote in our May 30, 2021 Energy Tidbits memo. "*Wouldn't it be interesting if the IEA Net Zero pathway was adopted as a*

plan? There are many little tidbits in the pathway/plan that would catch people by surprise. Hopefully its never to Putin's extreme warning of sending people back to the caves if natural gas is gone. Rather for baby boomers in North America, it would be a back to the future of what it was like in the 60's to watch your mom do laundry. The IEA pathway/plan talks about needed behavioural changes "Behaviour changes are also important in the NZE, with a reduction of almost 250 Mt CO2 in 2030 reflecting changes in temperature settings for space heating or reducing excessive hot water temperatures. Additional behaviour changes such as greater use of cold temperature clothes washing and line drying, facilitate the decarbonisation of electricity supply." if this were to be the plan, then countries would ban the sale of clothes dryers much like they banned wood burning fireplaces. We didn't have a clothes dryer until the 70s and prior to that, my mom had the tub washing machine that had the hand ringer on the top to wring out the clothes so she could then go hang the clothes to dry on the clothes line in the back yard. The problem was during winter, when my dad would put up some makeshift clothes line anywhere he could find in our 900 sq ft post war house. Don't forget the 60's really pre-high rise apartment/condo living, it was move to suburbia. Clothes line drying is still common in most of the world outside developed western countries, but could you imagine seeing the typical family back to line drying in the backyard or from the apartment like in parts of Hong Kong?"

Figure 16: Rigging a clothes line, Hong Kong clothes drying in highrise 2017

Source: Martha Stewart, A Day in the Kitchen

Europe energy saver push brings back memories of Jimmy Carter in the 1970's

We have referenced this several times, but energy saver tips like Tokyo's recent wear a sweater or Macron's wear a turtleneck really aren't a big sacrifice for anyone. And all of the energy saver ushes remind of something that was done in the 70s'. Anyone who lived in the US in the 1970s knows what the US did post the Arab Oil Embargo to cut energy consumption. We have referenced President Jimmy Carter many many times as being the leader for energy conservation and efficiency. And we are still surprised that Biden, being a new Senator when Carter was President, didn't put the no brainer energy conservation as the first priority for energy. The recent Tokyo Governor wear turtlenecks was a direct reminder of Jimmy Carter's ways to cut energy consumption. It brings back memories of Jimmy Carter's first address on taking office to the nation on Feb 2, 1977 on the energy crisis. The interview opens with the wide angle view of Carter in his cardigan with a burning fireplace. And a clear part of the Carter need to save energy consumption was

turning down the thermostat in the winter to reduce how much oil was burnt for furnaces. Don't forget the push to natural gas was still in a relatively early stage in the 1970s.

Figure 17: Jimmy Carter Address to Nation Feb 2, 1977

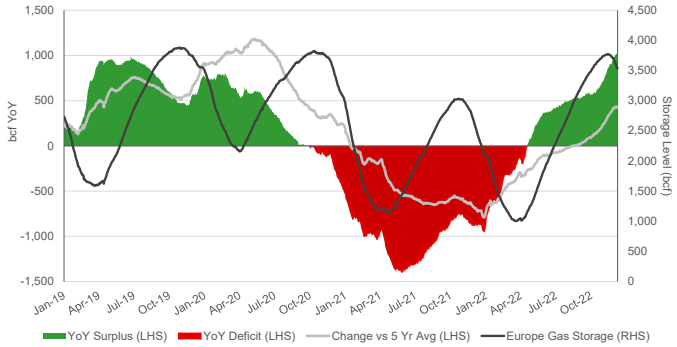
Source: C-Span

Natural Gas – Europe storage is now +25.48% YoY ie. 85.18% full vs 59.70%

Europe storage now 85.18% full

It was a very good Oct/Nov for lower natural gas consumption driven by warmer than normal weather and industrial demand destruction. But at least, the last two weeks colder weather brought draws in Europe gas storage levels that are still at very high levels. Europe gas storage began the year in a YoY deficit, but the YoY Europe storage deficit changed to a YoY storage surplus. Europe gas storage started the winter 17.86% YoY and is now a YoY surplus of 25.48%. Europe gas storage started 2020 winter (Nov 1/20) at basically full levels at 94.66% and had dropped by 65.77% to be 28.89% at Apr/21. Europe storage levels bottomed in late Apr/22 at 29%, which was the lowest level since Apr 2018. Last winter began (Nov 1/21) with gas storage at 77.14% capacity, down 18.52% YoY. The YoY deficit has turned to surplus after months of the deficit tightening. This winter (Nov 1/22) began with gas storage at 94.94% capacity, up 17.86% YoY. Thanks to the warm weather and US LNG, storage as of Dec 15 is at 85.18%, which is +25.48% greater than last year levels of 59.70% and are +9.89% above the 5-year average of 75.29%. Below is our graph of Europe Gas Storage Level.

Figure 18: Europe Gas Storage Level



Source: Bloomberg

Oil – US oil rigs down -5 rigs to 620 oil rigs on Dec 16

US oil rigs down WoW

Baker Hughes released its weekly North American drilling activity data on Friday. US rigs don't typically have a big Christmas drop like in Canada. Normally rigs are relatively flat over Christmas, but, with oil down over the past few weeks, its more likely to have declines. Plus, the extreme cold forecast in the Bakken and overnight freeze temperatures in Texas/Oklahoma is likely to cause some rig moves and frac spared moves delays especially given it is Xmas. This week US oil rigs fit the trend of being down -5 rigs at 620 oil rigs. The big change came from the smaller basins which decreased -3 rigs this week. US oil rigs hit a 15-week low of 591 on September 9. US oil rigs are still +441 oil rigs since the Covid Sept 17, 2020 oil rigs of 179 oil rigs. And US oil rigs are +145 oil rigs YoY. US gas rigs were up +1 WoW at 154 gas rigs.

Figure 19: Baker Hughes Total US Oil Rigs

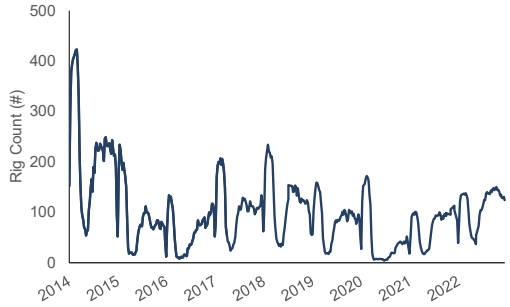
Source: Baker Hughes

Oil – Total Cdn rigs down -3 WoW to 199 total rigs, +32 rigs YoY

Cdn rigs -3 WoW

Total Cdn rigs were -3 to 199 rigs as of Dec 16, 2022. Cdn oil rigs were -7 to 124 oil rigs. Cdn gas rigs were +4 to 75 rigs. Cdn rigs normally start to decline in the 3rd week of December and then more thru Xmas week and New Years week. There was only a small decline this week, we expect big declines next week. Total rigs are now +97 vs the comparable Covid period of 102 rigs on Dec 18, 2020. Cdn drilling has recovered YoY, a year ago Cdn oil rigs were 104 and Cdn gas rigs were 62 for a total Cdn rigs of 167, meaning total Cdn oil rigs are +20 YoY to 124 oil rigs and Cdn gas rigs are +13 to 75 gas rigs.

Figure 20: Baker Hughes Total Canadian Oil Rigs



Source: Baker Hughes

Oil – US weekly oil production down slightly at 12.1 mmb/d

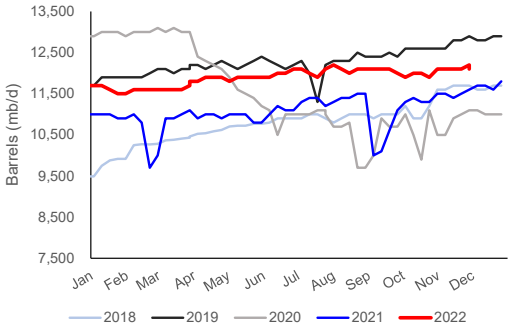
The EIA estimates US oil production was down 0.1 mmb/d WoW to 12.1 mmb/d for the week ended Dec 9. US oil production, based on the weekly estimates, has been mostly range bound between 11.9 to 12.1 mmb/d since the 2nd week of May. But broke above 12.1 mmb/d to 12.2 mmb/d last week for the first time since it touched 12.2 mmb/d in the 1st week of August. Lower 48 production was flat WoW at 11.7 mmb/d this week and Alaska was down 0.1 mmb/d WoW at 0.4 mmb/d. US oil production is up +0.400 mmb/d YoY at 12.1 mmb/d but is still down significantly at -1.1 mmb/d since the 2020 peak of 13.1 mmb/d on March 13.

Figure 21: EIA's Estimated Weekly US Oil Production

	Week 1		Week 2		Week 3		Week 4		Week 5	
Year-Month	End Date	Value	End Date	Value	End Date	Value	End Date	Value	End Date	Value
2021-Jan	01/01	11,000	01/08	11,000	01/15	11,000	01/22	10,900	01/29	10,900
2021-Feb	02/05	11,000	02/12	10,800	02/19	9,700	02/26	10,000		
2021-Mar	03/05	10,900	03/12	10,900	03/19	11,000	03/26	11,100		
2021-Apr	04/02	10,900	04/09	11,000	04/16	11,000	04/23	10,900	04/30	10,900
2021-May	05/07	11,000	05/14	11,000	05/21	11,000	05/28	10,800		
2021-Jun	06/04	11,000	06/11	11,200	06/18	11,100	06/25	11,100		
2021-Jul	07/02	11,300	07/09	11,400	07/16	11,400	07/23	11,200	07/30	11,200
2021-Aug	08/06	11,300	08/13	11,400	08/20	11,400	08/27	11,500		
2021-Sep	09/03	10,000	09/10	10,100	09/17	10,600	09/24	11,100		
2021-Oct	10/01	11,300	10/08	11,400	10/15	11,300	10/22	11,300	10/29	11,500
2021-Nov	11/05	11,500	11/12	11,400	11/19	11,500	11/26	11,600		
2021-Dec	12/03	11,700	12/10	11,700	12/17	11,600	12/24	11,800	12/31	11,800
2022-Jan	01/07	11,700	01/14	11,700	01/21	11,600	01/28	11,500		
2022-Feb	02/04	11,600	02/11	11,600	02/18	11,600	02/25	11,600		
2022-Mar	03/04	11,600	03/11	11,600	03/18	11,600	03/25	11,700		
2022-Apr	04/01	11,800	04/08	11,800	04/15	11,900	04/22	11,900	04/29	11,900
2022-May	05/06	11,800	05/13	11,900	05/20	11,900	05/27	11,900		
2022-Jun	06/03	11,900	06/10	12,000	06/17	12,000	06/24	12,100		
2022-Jul	07/01	12,100	07/08	12,000	07/15	11,900	07/22	12,100	07/29	12,100
2022-Aug	08/05	12,200	08/12	12,100	08/19	12,000	08/26	12,100		
2022-Sep	09/02	12,100	09/09	12,100	09/16	12,100	09/23	12,000	09/30	12,000
2022-Oct	10/07	11,900	10/14	12,000	10/21	12,000	10/28	11,900		
2022-Nov	11/04	12,100	11/11	12,100	11/18	12,100	11/25	12,100		
2022-Dec	12/02	12,200	12/09	12,100						

Source: EIA

Figure 22: US Weekly Oil Production



Source: EIA, SAF

Oil – Blizzard cuts North Dakota oil production by 200-250,000 b/d temporarily

Blizzard hits North Dakota

We haven't seen reports yet of Permian impacts from the cold weather, but Bakken oil has been impacted from the blizzard this week. (i) On Friday, Reuters reported [LINK] "*A winter blizzard sweeping across the northern United States has cut North Dakota's oil output by 200,000 to 250,000 barrels per day (bpd), or 18% to 22%, state Pipeline Authority Director*

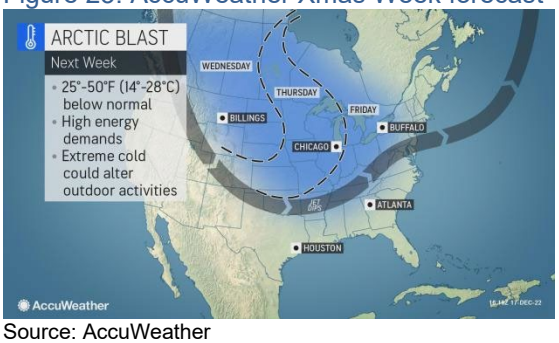
Justin Kringstad estimated on Friday. A winter storm pounded the heart of the United States, bringing heavy snow and freezing rain to Northern Plains and Midwestern states. Oil and gas wells suffer freeze-ins when temperatures drop. Kringstad said in an emailed statement that he anticipates a relatively quick return of oil production over the next several days as visibility improves and roads are cleared, adding that there were some limited, localized power issues. Major oil and gas processing plants and pipelines have remained operational to the best of his knowledge, he said, adding that most roads remain closed." (ii) In addition to the production disruption, there will be operational delays. There will also be catch up time required on rig moves, frac spread moves, trucking by oil, water handling trucks, etc. given truck transport came to a halt in parts of North Dakota. On Thursday, Bismarck Tribune reported [LINK] "*The Highway Patrol banned oversize vehicles from operating throughout the state, and cautioned drivers of other high-profile and long-load type vehicles about hazardous travel conditions. The state Department of Transportation said parking for commercial vehicles was limited at the interstate closure points, and it urged truckers to stop at earlier points."* (iii) Government offices were closed part of the week, which we expect is the reason why the North Dakota Industrial Commission didn't release the monthly North Dakota oil data on Friday.

US oil rigs down WoW

Oil – Extreme cold this week in North Dakota will also likely impact Bakken production

We would expect to see some temporary impact on North Dakota production and takeaway from the extreme cold forecast this week. The oil patch in North Dakota is much like in Saskatchewan in that industry is used to dealing in very cold winter weather conditions. However, there are limits and periods of extreme cold do impact operations. It's been that way for decades, operating in extreme cold adds safety risk. This extreme cold will delay some operations, rig moves, and also likely impact some crude by rail loading. Yesterday, AccuWeather's Xmas weather outlook [LINK] wrote "*By the middle of the week, a reinforcing burst of Arctic air will send temperatures well below zero. Temperatures could dip as low as 30-40 degrees Fahrenheit below zero in some areas of Montana or North Dakota, which would come close to a stretch of extreme cold observed back in 1983 and 1989. Records from the cold outbreaks during those years still set the standard for cold air around Christmastime in much of the northern and eastern U.S. In Grand Forks and Fargo, North Dakota, temperatures map dip close to the respective record lows of 29 and 31 degrees below zero on Thursday night. These records were originally set in 1951 and 1983, respectively."* Our Supplemental Documents package includes the AccuWeather forecast.

Figure 23: AccuWeather Xmas Week forecast



Source: AccuWeather

Oil – EIA DUC's basically flat in November

DUCs basically flat in Nov

We have been warning that we see a key risk to how much US oil production can grow in 2022 and 2023 is the need to increase rig counts (not have less frac spreads) to replenish the inventory of Drilled UnCompleted wells at higher levels and the challenge for oilfield services to add capacity to increase frac spreads and completions. Later in the memo, we note how DUCs in the Permian are really about the same level as five years ago when Permian production was about half current levels. One wildcard is our previously noted caveat that DUCs do not take into account potential refracs. The biggest problem in the past with the EIA's Drilling Productivity Report [LINK] estimate of Drilled UnCompleted wells was that the data had been constantly revised and sometimes significantly. (i) However, the DUC estimates provide a clear picture of the trend that DUCs still haven't really increased since Feb. It's why there is the need for drilling rigs to pick up to replenish the DUC inventory if the US is to have strong oil growth in 2023. (i) It is also important to remember that a portion of the DUCs will never be completed as there are drilled wells that don't look like they can justify the higher cost of completion. (ii) Drilled Uncompleted Wells are up 22 MoM in November to 4,443 DUCs, which compares to 4,387 DUCs in Feb. (iii) But at 4,443 DUCs, it means that a total 4,431 DUCs were worked down since the Jun/20 peak of 8,874. The largest work downs are coming from the Permian (-494 YoY) and Eagle Ford (-202 YoY). With DUCs being worked down so significantly we will need to see rig counts go up to replenish DUCs in the near future. (iii) Note that shale/tight oil is approx. ~70% of total US production, so whatever the trends are for shale/tight oil are normally the trends for US oil in total. Below is our table of running DPR estimates of shale/tight oil production and our graph of MoM changes in major shale/tight oil production. Our Supplemental Documents package includes the EIA DPR.

Figure 24: EIA - Estimated Drilled UnCompleted Wells

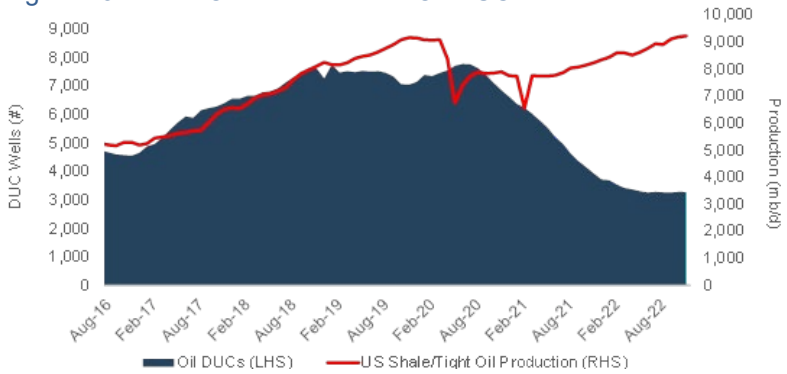
				2022												
Drilled UnCompleted	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Nov YoY %	Nov YoY
Anadarko	799	787	773	758	753	740	724	727	723	716	722	723	710	707	-10%	-80
Appalachia	537	513	565	457	473	471	497	526	524	529	562	576	597	594	16%	81
Bakken	516	485	464	436	426	426	429	425	427	426	474	494	501	499	3%	14
Eagle Ford	796	760	685	683	653	642	612	598	611	620	593	582	561	558	-27%	-202
Haynesville	392	386	372	369	371	395	419	441	466	483	513	535	558	568	47%	182
Niobrara	372	362	354	343	331	317	320	310	328	345	362	393	443	474	31%	112
Permian	1,669	1,537	1,444	1,482	1,380	1,302	1,294	1,244	1,218	1,180	1,117	1,097	1,051	1,043	-32%	-494
Total	5,081	4,830	4,657	4,528	4,387	4,293	4,295	4,271	4,297	4,299	4,343	4,400	4,421	4,443	-8%	-387

Source: EIA, SAF

DUCs vs US oil production

We continue to be in the camp that believes we need to see increases in US oil rigs to rebuild the inventory of DUCs. Our regular monthly graph below shows US shale/tight oil production plotted against oil DUCs There has been a clear correlation with the drawing down of DUCs inventory with increasing shale/tight oil production.

Figure 25: Shale Oil Production vs Oil DUC Wells



Source: EIA, SAF

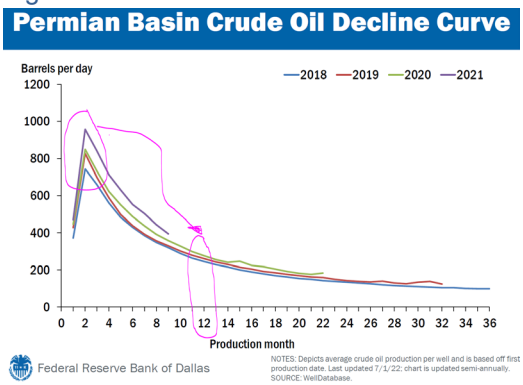
Oil – Permian oil growth challenge – increasing decline rates in Permian oil wells

Increasing decline rates in Permian oil wells

The Permian has been and is expected to be the major growth engine for US oil production for the coming years. Our concern is that there is a key overlooked factor as to why the math points to Permian oil growth rate will be slowing down and challenged for sustainable growth unless industry cranks up drilling. (i) On Tuesday, we tweeted [LINK] "*Hmm! Overlooked @DallasFed new high IP #Permian wells are down to same prod 12 mths out as lower IP wells ie. steeper decline/faster treadmill. How can #Permian sustainably grow unless rigs crank up big as DUCs/rigs are ~5 yrs ago levels when oil prod was ~1/2 today. #OOTT.*" (ii) The Dallas Fed regularly posts a slide deck recap of energy data/indicators. [LINK] that doesn't drive many comments. But there were a few slides that jumped out at us and suggest that, unless the oil sector changes and starts cranking up drilling and completions big time, it's hard to see why Permian oil growth won't be slowing down and soon be challenged for any sustainable growth. (iii) Please remember if the Permian oil growth rate is less than expected, it also means Permian associated natural gas and NGLs will be less than expected. (iv) It's math. There is one big overlooked data point by almost everyone. Most people don't realize that Permian wells, no matter how high the initial production rate is will basically normalize to around the same level in 12 months or within a small differnce. This means that newer vintage wells have higher IP but also much higher decline rates so the treadmill is running faster such that 12 months out, their oil production isn't much different than older vintage wells. This is not what most people expect. (v) Please note we are saying about half. We don't have the data to the graphs to know it it's 50% or 55% or 48%, but the graphs show it about half. (vi) Permian oil production has basically doubled in the past five years in a significant part by the drawdown of DUCs. Drilling rigs are basically around the same level as five years ago, which production was bout half today's levels. The work down of DUCs means DUCs are about the same level as five years ago when DUCs only had to support a production level about half today's levels. (vii) Then the overlooked factor – the Dallas Fed data shows that no matter how high the initial production, the production rate falls to close to the same level 12 months out. Maybe 50 b/d a month variance. So drilling rigs and DUCs area about the same level as five years ago, when production was about half of the Permian's 5.2 mmmb/d. And the new wells have higher IP rates to support the recent growth, but also decline more so the treadmill is running faster. That makes the challenge to replace and grow even tougher. Again, unless oil industry cranks up and starts drilling more.

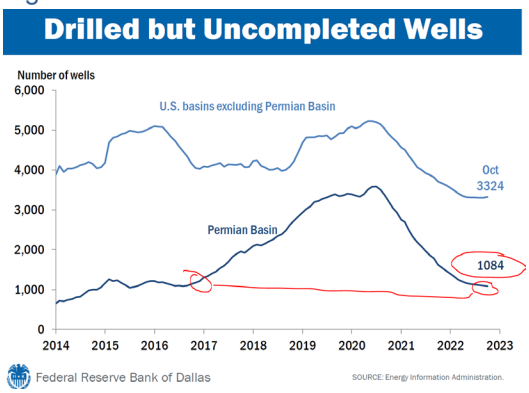
(viii) Note for the below Dallas Fed graph says oil production. We are am assuming that there is no real change in gas/oil ratio in the first 12 months. Remember that in any oil plays that produce associated natural gas & NGLs (ie. Permian, Bakken) see the gas/oil ratio increase overtime. (ix) This overlooked factor is the Catch 22 of drilling bigger wells, they tend to normalize to the same production level after 12 months so the higher rate newer wells must decline faster and the treadmills runs faster. So unless industry drills and completes more and more wells every year, the math says its hard to see how the Permian sustainably grows as what many expects. Below are the three key Dallas Fed slides.

Figure 26: Permian Basin Crude Oil Decline Curve by well vintage



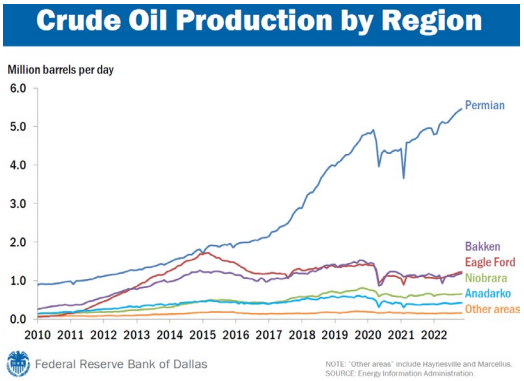
Source: Dallas Fed

Figure 27: Permian Basin DUCs



Source: Dallas Fed

Figure 28 Texas Crude Oil Production by Region



Source: Dallas Fed

Exxon sees lower Permian oil growth with DUCs caught up

Last week's (Dec 11, 2022) Energy Tidbits featured comments from Exxon CEO Woods at Exxon's Dec 8, 2022 investor webcast. Here is what we wrote "*There was a good reminder of why the math supports lower US oil growth rates post 2022 from the Exxon webcast on Thursday – the build up of DUCs in 2020 have been worked down in 2021 and 2022 and that has led to stronger YoY growth rates in 2021 and 2022. As the Q&A was going on, we tweeted [LINK] on the first question in the Q&A on Permian growth. We tweeted [LINK] "Lower Permian #Oil growth rate as DUCs worked thru in 21/21. 7:40am MT, #Exxon Q&A. CEO Woods expect ~20% Permian growth this year, but "going forward, i would say a more ratable growth of 10% per year roughly". DUCs down = less US growth is for US in total, not just XOM. #OOTT" CEO Woods said "And thank you for the question. I mean, just maybe give some context, you know, we've increased our Permian production into 21 at 25% this year, we expect to finish at around 20%. As we go forward, I would expect that to come down as we work through the DUC inventory that we generated during the pandemic and have been working off in '21 and 2022. And so, going forward I'd say more ratable growth of about 10% per year roughly."*

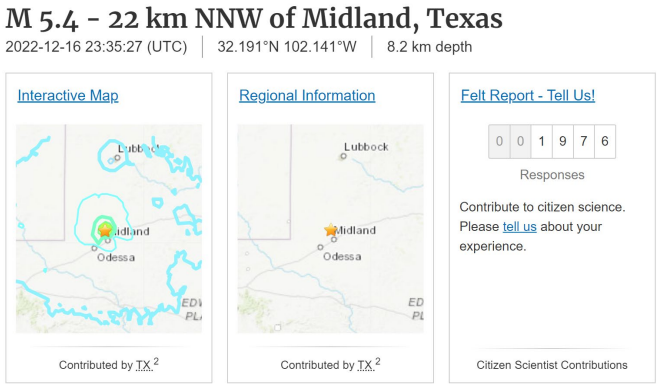
Oil – Another 5.4 earthquake to add more costs/time for Permian water disposal

Another Permian 5.4 earthquake

On Friday night, we tweeted [LINK] "*Looks like @txrrc will have to do another expedited measure given another big earthquake earlier tonight, a 5.4 that is 22 km NW of Midland. Permian water handling logistics are only going to get more complicated, expensive and add time. #OOTT."* (i) On Friday night, there was a big 5.4 earthquake only 22 km NW of Midland. This follows a recent 5.4 earthquake on Nov 16 to the west of Midland. (ii) Our tweet forward the Texas RRC Dec 13 "*Railroad Commission Taking Expedited Action in West Texas Seismicity Response",* which was their response to the Nov 16 earthquake. The RRC said they were "*implementing several revisions to the seismicity reduction response plan in the Northern Culberson-Reeves Seismic Response Area (SRA). The SRA was created to address the intensity and frequency of earthquakes in the area and reduce the occurrence of high-magnitude seismicity such that recurrence of 3.5 magnitude events is decreasing by December 31st, 2023. The response plan sets curtailments on the injection volumes of*

produced water (which is water produced during oil and gas production) into disposal wells. The scope of the plan is being revised following reviews of seismicity data and injection volumes. The SRA boundary is being expanded northward to the New Mexico border, which will increase the size of the SRA from 2,366 square miles to 2,601 square miles. There are 78 active disposal wells in the revised SRA. The target for reducing daily injection volumes in deep disposal wells is being reduced even further. Operators of deep disposal wells in the Revised Response Plan have agreed to reduce the collective volume of disposal from the original target of 298,000 barrels per day by June 30, 2023 to 162,000 barrels per day by that date. This would be about a 68% drop in disposal volume compared to January 2022 before the plan went into effect." As noted in our tweet, this means water disposal is only getting more complicated, more expensive and will take more time. Waste water disposal will be more restricted and we have to wonder if this 5.4 earthquake being close to a higher population area (Midland ~135,000 people) will cause at least a little bit tougher response. (iii) And our tweet also says Texas RRC will have to take another expedited action to deal with Friday's big earthquake. There is no new RRC action posted post Friday's earthquake to our 7am MT news cut off this morning. (iv) Note that the Texas RRC was quick to get out a release on Friday night that it was deploying inspectors and "*Today, RRC inspectors will be examining disposal activity at injection well sites near the earthquake, which took place within the Gardendale Seismic Response Area (SRA). In December 2021, the RRC ordered the indefinite suspension of all produced water disposal in deep injection wells in the SRA. Staff will review permit requirements for other injection wells in the area as it prepares for a response to reduce the frequency and intensity of earthquakes".* Our Supplemental Documents package includes the Texas RRC Dec 13 action and Dec 17 release.

Figure 29: 5.4 earthquake on Dec 16, 22 km NNW of Midland



Source: USGS

"Things to know ... about the 5.4-magnitude quake near Midland"

The Midland Reporter-Telegram posted a report "*Things to know ... about the 5.4-magnitude quake near Midland*" [LINK] that included "*It was the strongest earthquake in the world through at least 9 p.m. (CST) on Dec. 16, according to the USGS. It was the strongest quake inside the United States since the 5.4-magnitude earthquake west of Mentone on Nov. 16. One has to go back to Jan. 21 to find a stronger quake when a 6.2-magnitude earthquake took place south-southwest of*

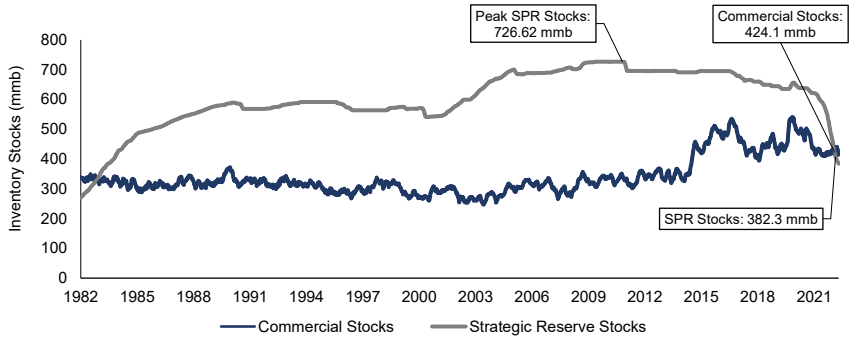
Unalaska, Alaska. The most recent quakes to happen so close to Midland took place southeast of Midland on Nov. 24. They were measured at 2.2 and 2.3 magnitude respectively and took place less than 5 miles from Midland. The previous strongest quake in or around Midland was a 4.6-magnitude quake near Stanton on Dec. 27, 2021. It is tied for the third strongest quake in the state's history. As of Friday evening, there had been three quakes around Midland during the previous 24 hours, five quakes during the previous seven days, 14 quakes during the previous 30 days and 170 during the previous 365 days. The National Earthquake Information Center (U.S.) reports there are 1,000 "moderate" (or magnitude 5.0-5.9) earthquakes in an average year."

Oil – US SPR reserves now -41.9 mmb lower than commercial crude oil reserves

SPR reserves remain lower

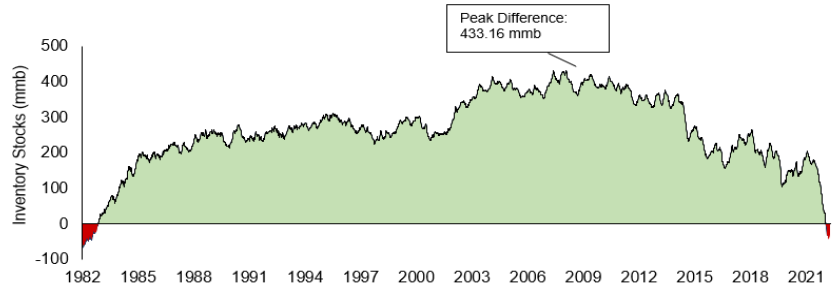
Oil in US Strategic Petroleum Reserves (SPR) moved below total US commercial crude oil reserves in the Sept 16 week for the first time since 1983, with the deficit narrowing this week. The EIA's new weekly oil data for Dec 9 has SPR reserves at 382.3 mmb vs commercial crude oil reserves at 424.1 mmb. The below graphs highlight the difference between commercial and SPR stockpiles.

Figure 30: US Oil Inventories: Commercial & SPR



Source: EIA

Figure 31: US Oil Inventories: SPR less commercial



Source: EIA

Oil – US starts pilot approach to buy oil for SPR with 3 mmb purchase in Feb

SPR reserves remain lower

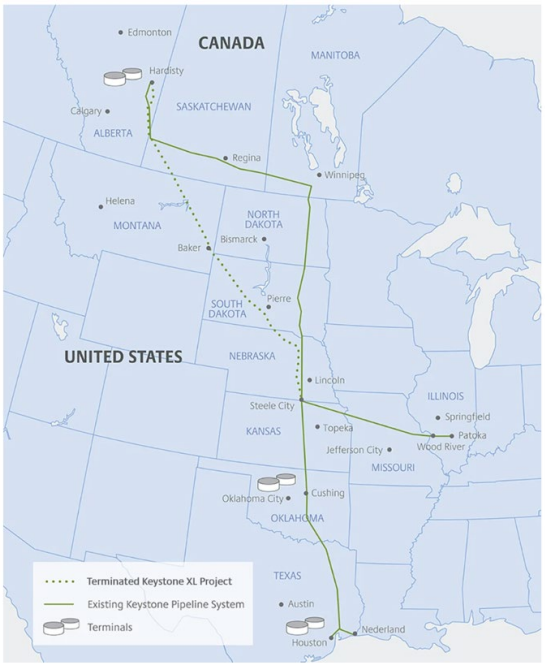
On Friday, the Dept of Energy announced [LINK] "*that it will start repurchasing crude oil for the Strategic Petroleum Reserve (SPR). This repurchase is an opportunity to secure a good deal for American taxpayers by repurchasing oil at a lower price than the $96 per barrel average price it was sold for, as well as to strengthen energy security*." The DOE said the initial purchase will be 3 million barrels for injection into the SPR in Feb. The DOE said this "*will pilot this new approach by starting with a purchase of up to 3 million barrels of crude oil*. " and called it "*this initial step*". It will be interesting to see if this develops into a broader purchase There was nothing in the release that mentioned any plan or intent to repurchase more of the >180 million barrel sales from the SPR.

Oil – TC Energy partial restart means 300,000 b/d moving on Keystone

Keystone pipeline partial restart

As expected, Keystone did a partial restart of Keystone pipeline on Wed to move oil from Alberta south to Steele City (Nebraska) and then on the unaffected easter leg to Patoka (Illinois). This was expected as the PHMSA corrective action order only addressed the Affected Segment of the pipeline and the Keystone eastern leg was not affected. The latest updates from TC Energy do not give any estimation for when they expect to restart the Affected Segment that goes south to Cushing. TC Energy has not disclosed any volumes level for the partial restart, but NBC included the below graph of Keystone pipeline flows from Wood Mackenzie/Genscape that indicate the flows are ~300,000 b/d.

Figure 32: Keystone pipeline



Source: TC Energy

Source: TC Energy

Oil – Risk for longer shutdown and for Keystone Affected Portion to stay at 80%

Keystone pipeline risk

We can understand that TC Energy is not in a position to give any guidance of when they expect PHMSA to sign off on a restart of the affected portion and at what volumes. But on Friday, we tweeted [LINK] *"#Keystone. Hard not to read this @NGInews report + GAO Pipeline Safety: Information on Keystone Accidents & DOT Oversight and worry Affected Segment restart will take longer than expected & 80% limit may not be lifted. #OOTT [LINK].* (i) On Friday, Natural Gas Intelligence posted its report "*Corrosion Left Keystone Pipeline 'Less than Half the Thickness of a Dime,' Says U.S. Government Accountability Office*" [LINK] written by long-time Cdn oil patch writer Gordon Jaremko. Jaremko's report was based on the US Government Accountability Office July 2021 report "*Pipeline Safety: Information on Keystone Accidents and DOT Oversight*". [LINK]. (ii) As a reminder, last week's (Dec 11, 2022) Energy Tidbits memo highlighted PHMSA's corrective action order that wrote "*Operating Pressure Restriction. TC Oil must reduce and maintain a twenty percent (20%) pressure reduction in the actual operating pressure along the entire length of the Affected Segment such that upon restart the operating pressure along the Affected Pipeline will not exceed eighty percent (80%) of the actual operating pressure in effect at the failure location, immediately prior to the failure on December 7, 2022."* (iii) After reading the GAO report, we have to wonder if there is the risk that the restart of the Affected Segment won't be raised back above the 80% limit at restart. And we also wonder if it will take longer than expected for a restart of the Affected Segment. (iv) One thing that has missing from the Keystone oil leak is that it seems there hasn't been the expected big uproar by Democrat politicians to shut it down permanently given the history of prior Keystone leaks. Especially since the GAO report was July 21 ie. during the Biden Administration. (v) In addition to the thickness/corrosion issues highlighted in the NGI report, we thought there were other fundamental issues from the GAO report. One that jumped out at us is the issue of quality and construction issues that were noted before the thinness issue. On the opening paragraph of the problems, the GAO wrote "*In response to each of Keystone's four largest spills, PHMSA issued Corrective Action Orders requiring TC Energy to investigate the accidents' root causes and take necessary corrective actions. These investigations found that the four accidents were caused by issues related to the original design, manufacturing of the pipe, or construction of the pipeline. PHMSA also issued other enforcement actions and assessed civil penalties to TC Energy for deficiencies found during inspections, such as inadequate corrosion prevention and missing pipeline markers*." (vi) We assume the issue of quality may be linked to the timing of the leg south being with steel/pipe ordered during the big economy boom prior to the 2008 crash. (vii) Our concern is that the GAO report identified issues with Keystone and then the biggest oil leak happens a 17 months after this report, it just makes wonder if the issues from the GAO July 2021 report get readdressed and stepped up a level in terms of corrective/preventative requests, which adds to the time to restart the Affected Segmetn. The GAO report highlights the PHMSA gave special approval for Keystone to operate at higher levels. This is from day 1, not the recent temporary higher levels. It's a good report. Our Supplemental Documents package includes the NGI report and excerpts from the GAO July 2021 report.

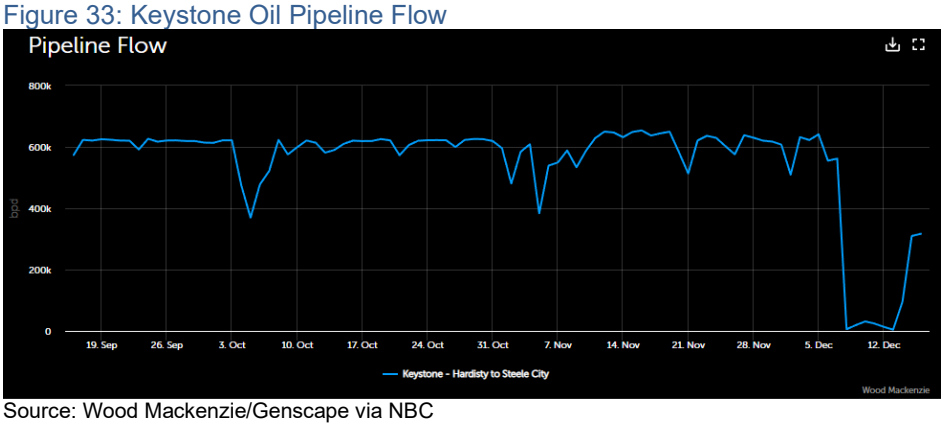
Oil – Keystone partial shutdown = risk Alberta oil storage is full around Jan 7

Alberta oil storage could be full in 3 weeks

There was a great comment from the NBC Energy and FX Commentary on Friday morning that has been overlooked in the Keystone oil pipeline shut down – Alberta oil storage could be full around Jan 7 if Keystone only runs at partial volumes. NBC's comment referenced

Wood Mackenzie/Genscape data that Keystone was flowing ~300,000 b/d with the partial reopening. NBC wrote *"Keystone's BACK, well sort of. TC Energy indicated that the damaged section to Cushing will not be restarted until safe to do so and when it has regulatory approval. Flows remain at ~300 Mb/d and there's no indication that this will be resolved imminently – until then, it is likely that all of the shut-in flows amass in Alberta storage, which means that the full ~600 Mb/d were added to tanks for the entire 6-day outage - roughly 3.6 MMb. Based on this, that leaves around 8 MMb of excess capacity and another ~25 days before storage completely fills if the line runs at 300 Mb/d for an extended period. In other words, the line would have to remain under repair until roughly January 7th before Alberta storage ultimately brims, based on our math. Last outage also saw several months of restricted volumes – the line went down on October 29, 2019 and was fully shut until Nov 11. It was not until early December that the line was consistently back to ~600 Mb/d, so this could take a while and January 7th might not be far off."*

Figure 33: Keystone Oil Pipeline Flow



Source: Wood Mackenzie/Genscape via NBC

Oil – Cdn oil differentials narrowed by $2 with the partial Keystone restart

WCS less WTI differentials

It's been a rocky last two weeks for Cdn oil differentials with the Keystone shut-in, expectations for less of an impact, then moving to uncertainty for a return, and finally this week the partial restart. The partial restart led to a narrowing of the WCS-WTI differential by $2 to narrow from $30 to $28 as of the close Friday Dec 16. Below is Bloomberg's current WCS–WTI differential as of Friday Dec169 close.

Figure 34: WCS less WTI oil differentials up to Dec 16 close

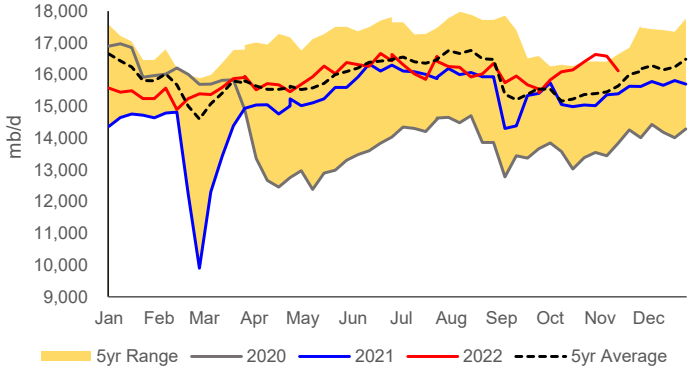
Source: Bloomberg

Oil – Refinery inputs -0.459 mmb/d WoW to 16.126 mmb/d

Refinery inputs down slightly WoW

November and December are typically months that see increasing crude oil inputs to refineries following the fall refinery turnaround seasonal as refiners push to produce more winter fuels. But there can always be down weeks within this normal seasonal trend. This week saw a slight decrease to inputs into refineries. Nov is normally the start of the seasonal increase in crude oil inputs to refineries as they have finished their normal Sept/Oct seasonal refinery maintenance period as refineries change from summer to winter fuel blends. Crude oil input into refineries tends to increase in Nov and Dec. On Wednesday, the EIA released its estimated crude oil input to refinery data for the week ended Dec 9. The EIA reported crude oil inputs to refineries down -0.459 mmb/d WoW to 16.126 mm/d, which is +0.456 mmb/d YoY from 15.670 mmb/d for the week ended Dec 10, 2021. Note last year's week ended Dec 10, refineries saw a slight decrease which was against the usual trend of refineries normally ramping up oil processing to year end. Total products supplied (i.e., demand) increased WoW, up +0.330 mmb/d to 19.956 mmb/d, and Motor gasoline was down -0.103 mmb/d at 8.255 mmb/d from 8.358 mmb/d last week. The 4-week average for Motor Gasoline was down -0.827 mmb/d YoY to 8.314 mmb/d.

Figure 35: US Refinery Crude Oil Inputs (thousands b/d)



Source: EIA

Oil – US "net" oil imports down -0.031 mmb/d WoW to 2.551 mmb/d

US "net" oil imports down WoW

US "NET" imports were down -0.031 mmb/d to 2.551 mmb/d for the Dec 9 week. US imports were up +0.855 mmb/d to 6.867 mmb/d. US exports were up +0.886 mmb/d to 4.316 mmb/d. The WoW increase in US oil imports was driven almost equally by Top 10 and "others" with an increase of +0.428 mmb/d and +0.427 mmb/d, respectively. Some items to note on the by country data. (i) Canada was up this week 0.372 mmb/d to 3.795 mmb/d. (ii) Saudi Arabia was up 0.043 mmb/d to 0.317 mmb/d this week. (iii) Colombia was down -0.044 mmb/d WoW to 0.248 mmb/d. (iv) Ecuador was relatively flat, but slightly down this week -0.002 mmb/d to 0.157 mmb/d. (v) Iraq was up 0.030 mmb/d to 0.282 mmb/d. (vi) Mexico was up +0.017 mmb/d to 0.602 mmb/d.

Figure 36: US Weekly Preliminary Oil Imports by Major Countries

(thousand b/d)	Oct 7/22	Oct 14/22	Oct 21/22	Oct 28/22	Nov 4/22	Nov 11/22	Nov 18/22	Nov 25/22	Dec 2/22	Dec 9/22	WoW
Canada	3,300	3,372	3,483	3,410	3,235	3,076	3,844	3,354	3,423	3,795	372
Saudi Arabia	370	230	325	533	519	211	685	338	274	317	43
Venezuela	0	0		0	0	0	0	0	0	0	0
Mexico	759	747	509	748	503	528	495	300	585	602	17
Colombia	242	214	215	218	341	143	170	290	292	248	-44
Iraq	109	130	220	134	503	141	385	363	252	282	30
Ecuador	136	134	201	0	102	101	42	242	159	157	-2
Nigeria	0	29	42	81	119	181	43	50	159	171	12
Kuwait	0	0	0	0	0	0	0	0	0	0	0
Angola	0	0	0	0	0	0	0	0	0	0	0
Top 10	4,916	4,856	4,995	5,124	5,322	4,381	5,664	4,937	5,144	5,572	428
Others	1,147	1,052	1,185	1,081	1,132	1,178	1,399	1,100	868	1,295	427
Total US	6,063	5,908	6,180	6,205	6,454	5,559	7,063	6,037	6,012	6,867	855

Source: EIA

Oil –Still waiting on Putin's final decree on Russia response to price cap

$60 Russia oil price cap

As of our 7am MT news cut off, we still have not seen any formal Russia position on the oil price cap on Russian oil. Last week's memo noted how a decree from Putin was to come in the next few days. There was a similar comment this week that it should be coming soon. On Friday, TASS reported [LINK] "*Russia's response to the Western oil price cap is expected soon, all details are being finalized, Russian presidential spokesman Dmitry Peskov told reporters on Friday. "The last points are being finalized. We expect it to [be ready] soon," he said.*"

Oil – OPEC MOMR: slight negative with narrowing of oil + products stocks deficit

OPEC MOMR

On Tuesday, OPEC released its Monthly Oil Market Report at ~7:15 am MT. (i) We thought the overall takeaway from the OPEC MOMR Dec is a slight negative. No surprises that oil demand growth is unchanged, basically unchanged changed growth in non-OPEC supply, OPEC production in Nov down by less than the big quota cut was expected. The one slight negative is that there is a narrowing of the products stocks deficit, which more than offsets the widening of the crude oil stocks deficit for an overall narrowing of the combined oil + products deficit. (ii) Oil demand growth was relatively unchanged. YoY average demand lowered slightly to 99.56 mmb/d from 99.57 mmb/d, and for 2023 by -0.05 to 101.77 mmb/d. This now means 2022 YoY growth is +2.55 mmb/d and 2023 is +2.22 mmb/d. 2023 is above pre-Covid 2019 of 100.8 mmb/d (revised up from 100.2 mmb/d). (iii) China demand. The MOMR continued on theme that it's still uncertain how China moves out of Covid. The Dec MOMR turns more optimistic on China's reopening. In Dec MOMR, they write *"By the end of 1Q23, China is expected to relax COVID-19-related restrictions in most regions. This,*

combined with the expected loosening of COVID-19-related restrictions, will pave the way for an uptick in mobility and manufacturing activity. Similarly, domestic and international air travel should improve considerably. Furthermore, petrochemical requirements for feedstock are expected to remain stable from 2Q23 onwards. Accordingly, these factors are expected to boost oil demand from 2Q23 onwards up to 4Q." (iv) Non-OPEC supply. Immaterial decreases to YoY growth for 2022 of +1.89 mmb/d to 65.57 mmb/d (was +1.90 mmb/d to 65.58 mmb/d), and for 2023 of +1.54 mmb/d (was +1.54) to 67.11 mmb/d (was 67.12 mmb/d). (v) OPEC Secondary Sources for Nov -744,000 b/d MoM to 28.826 mmb/d. For OPEC10 (the countries in the quota), they produced 24.478 mmb/d in Nov, well below the quota of 25.416 mmb/d. (vi) There were no major variances to highlight in Direct Communications (what the OPEC countries report). Nigeria says it produced less than secondary sources, at 1.186 mmb/d in Nov vs 1.159 mmb/d in secondary sources. (vii) Note the one significant difference vs the IEA OMR below is their views of MoM changes in global oil stocks from Sept to Oct. OPEC estimates OECD inventories at October 31 and another MoM widening of the deficit in "crude only" stocks -99.9 mmb (vs September -100), product stocks -117.9 mmb (vs September -118) below 2015-2019 average. Our Supplemental Documents package includes excerpts from the OPEC MOMR Dec.

Oil – IEA OMR "*tighter balance in 2Q23, another price rally cannot be ruled out*"

IEA Oil Market Report

On Wednesday, the IEA released its monthly Oil Market Report for Dec at 2am MT. They only release very limited public info, but Bloomberg provided detailed tables and added color from the report. So big thanks, as usual, to the Bloomberg team. (i) We thought the OMR message was positive for oil but not as bullish a message as the Nov OMR. Oil demand YoY growth increased for both 2022 and 2023. Message is still positive for oil. The IEA writes "*While lower oil prices come as a welcome relief to consumers faced by surging inflation, the full impact of embargoes on Russian crude and product supplies remains to be seen. As we move through the winter months and towards a tighter oil balance in 2Q23, another price rally cannot be ruled out*." (ii) The other positive was a modest increase in oil demand. (i) 2022 oil demand growth increased by 0.1 mmb/d to 99.9 mmb/d in 2022 and 0.2 mmb/d to 101.6 mmb/d in 2023. (ii) 2022 is still below pre-Covid of 100.4 mmb/d in 2019. (ii) China demand drops in addition to risks in European and developing economies. The EIA wrote "*despite the seasonal slowdown in world oil demand and continued macro-economic headwinds, recent oil consumption data have surprised to the upside. This was especially apparent in non-OECD regions, including China, India and the Middle East. By contrast, OECD oil demand remained depressed as weak European and Asian petrochemical activity outweighed ongoing gas-to-oil switching in manufacturing processes. Oil demand is now forecast to rise by 2.3 mb/d in 2022 and a further 1.7 mb/d next year, up around 140 kb/d compared with last month's Report*." Nov OMR has China 2022 at 15.0 mmb/d, flat MoM from the Nov OMR. (iv) Non-OPEC supply YOY growth is unchanged for 2022, but 2023 was increased +0.6 mmb/d. Dec OMR non-OPEC supply is +0.2 mmb/d to 65.7 mmb/d for 2022, and +0.6 mmb/d to 66.1 mmb/d for 2023. (v) Changes to call on OPEC for 2022 were unchanged at 28.9 mmb/d and for 2023 at 29.9 mmb/d (+0.1 mmb/d). (vi) OPEC Nov production was -770,000 b/d to 29.02 mmb/d led by Nigeria -61,000 b/d, Angola -36,000 b/d MoM, but UAE was up +27,000 b/d, MoM. (vii) Saudi of 10.48 mmb/d for Nov is in line with what OPEC MOMR reported as Direct Communications from Saudi of 10.47 mmb/d. (viii) OECD crude oil inventories on October 31 were 150.2 mmb below the five-year average vs 198.0 mmb at September 30. The IEA wrote, "*global observed inventories fell by 23.2 mb in October as product stocks fell for the*

first time since March and crude oil saw a smaller build. OECD industry stocks increased by 17.3 mb, to 2 765 mb, narrowing the deficit versus the five-year average to 150.2 mb" And "*Preliminary data show OECD crude oil stocks drew in November, reflecting a sharp rise in refinery demand."* Our Supplemental documents package includes the IEA release and the Bloomberg reports.

Figure 37: IEA Global Demand Forecast By OMR Report Month

mmb/d	2020	2021	21-20	Q1/22	Q2/22	Q3/22	Q4/22	2022	22-21	Q1/23	Q2/23	Q3/23	Q4/23	2023	23-22
Dec 22	91.0	97.7	6.7	99.5	98.7	100.7	100.8	99.9	2.2	99.7	100.6	102.7	103.4	101.6	1.7
Nov 22	91.0	97.7	6.7	99.4	98.7	100.3	100.7	99.8	2.1	99.6	100.5	102.3	103.0	101.4	1.6
Oct 22	91.0	97.7	6.7	99.4	98.5	100.0	100.6	99.6	1.9	99.5	100.4	102.1	102.9	101.3	1.7
Sep 22	91.0	97.7	6.7	99.5	98.4	99.9	100.9	99.7	2.0	100.2	101.0	102.6	103.3	101.8	2.1
Aug-22	91.0	97.6	6.6	99.4	98.5	100.0	100.8	99.7	2.1	100.3	101.1	102.5	103.3	101.8	2.1
July 22	91.0	97.5	6.5	99.3	97.8	99.4	100.2	99.2	1.7	99.8	100.8	102.0	102.7	101.3	2.1
June 22	91.0	97.5	6.5	99.3	98.2	99.8	100.4	99.4	1.9	100.5	101.1	101.9	102.7	101.6	2.2
May 22	91.0	97.5	6.5	98.8	98.2	100.0	100.4	99.4	1.9						
Apr 22	91.0	97.5	6.5	98.5	98.3	100.1	100.5	99.4	1.9						
Mar 22	91.0	97.5	6.5	99.0	98.8	100.2	100.6	99.6	2.1						
Feb 22	91.0	97.4	6.4	98.9	100.1	101.7	101.6	100.6	3.2						
Jan 22	91.0	96.4	5.4	97.8	99.3	100.9	100.8	99.7	3.3						
Dec 21	91.0	96.2	5.2	97.9	99.1	100.8	100.3	99.5	3.3						
Nov 21	91.0	96.3	5.3	98.5	99.2	100.6	100.3	99.7	3.4						

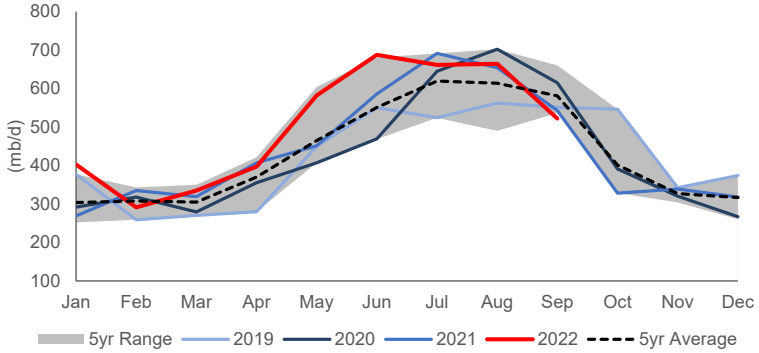
Source: IEA, SAF

Oil – Saudi use of oil for electricity is now in seasonal decline ie. more oil for export

Saudi to have more oil for export

We remind that Saudi Arabia has more oil for export in winter as they consume significantly less oil for electricity generation than during the peak really hot summer months. Oil used for electricity declined to 522,000 b/d in Sept, which is normally the start of the seasonal decline. A reminder a normal peak to trough decline of ~400,000 b/d. Saudi used 142,000 b/d less oil MoM in Sept for electricity ie. volumes freed up for export or to add to inventories. If Saudi sees the normal seasonal decline of ~400,000 b/d, it should mean Saudi's oil exports shouldn't decline anywhere near as much as their new lower quotas. Saudi's OPEC quota are being reduced: Aug 11.004 mmb/d. Sept 11.030 mmb/d. Oct 11.004 mmb/d. Nov/Dec 10.478 mmb/d. There is one additional wildcard that isn't in the JODI data but could lead to more Saudi oil for export -the JODI data doesn't include how much fuel oil Saudi imports and we saw reports in Q2 that Saudi was importing some Russian fuel oil via Fujairah terminal. The latest JODE data is for September, October data should be released this week. audi used less oil for electricity in September vs August. This is attributed to the cooler temperatures experienced throughout September. September saw varying temperatures that were close to the higher average range for most of the month. It is important to note that the higher range is still a lower temp compared to previous months. September was 522,000 b/d (vs September 2021 of 543,000 b/d) and August was 664,000 b/d (vs August 2021 of 654,000 b/d).

Figure 38: Saudi Arabia Direct Use of Crude Oil For Electric Generation



Source: JODI

Oil – Libya NOC says oil production continues to be ~1.2 mmb/d

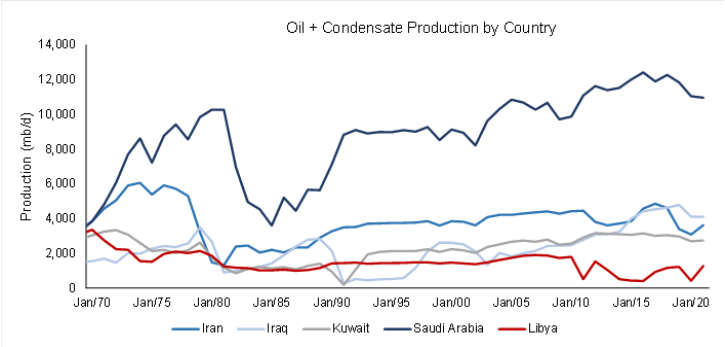
We have to give the Libya National Oil Corporation credit that it's been able to keep oil production pretty stable right around 1.2 mmb/d. On Thursday, the Libya National Corporation posted on its Facebook [LINK] a short update on oil production. The Google Translate was "*Crude oil production reached 1.213 million barrels, and condensate production reached 52 thousand barrels during the past 24 hours*."

Libya oil production stable at 1.2 mmb/d

Libya NOC targets oil production to hit 2 mmb/d in 3 to 5 years

Our Nov 6, 2022 Energy Tidbits memo highlighted two excerpts posted on Nov 1 on the Libya National Oil Corporation Facebook [LINK] of NOC Chair Farhat bin Qadara comments at ADIPEC 2022. Qadara said "*We annually need up to 4 billion dollars in investments to modernize the infrastructure of the oil sector in addition to developing services at the oil sites. We aim to raise production to 2 million barrels per day over a period of 3 to 5 years. We expect oil revenues for this year to reach between 35 and 37 billion dollars."* We also highlighted that Libya has big oil production growth if there is lasting domestic peace. Libya's oil growth all comes is there a stable lasting domestic peace. Because if Libya returns to east vs west fighting, Libya oil production could drop to almost zero again. But, and a big but, if there is a stable lasting peace, we believe Libya's oil production growth potential is much more than the Libya NOC Chair's target of 2 mmb/d. One we saw the Libya NOC Chair oil target, we tweeted [LINK] "*Imagine if #Libya ever gets lasting peace? Could blow away @NOC_Libya Chair target to get to 2 mmbd in 3 to 5 yrs. Current 1.2 mmbd. Gaddafi took over 09/01/69 & #Oil went down from there. #OPEC 1970: Saudi 3.85 mmbd, Iran 3.85 mmbd, Libya 3.34 mmbd, Kuwait 3.04 mmb. #OOTT."* Those numbers remind of how Saudi Arabia benefited by being the US ally whereas Iran and Libya got creamed for decades.

Figure 39: Iran, Iraq, Kuwait, Libya & Saudi Arabia oil + condensate production



Source: BP

Goldman's super cycle for oil

Oil – Goldman reminds super cycle for oil is a sequence of spikes going higher

On Thursday, Bloomberg posted a clip [LINK] of its interview with Goldman's Jeff Currie (Global Head of Commodities Research) including Currie's explanation of his super cycle view for commodities including oil. His explanation was essentially the same as Trafigura's Sept explanation to expect a series of sequence of spikes. The only difference was Trafigura (see below) added the comment that each subsequent low is actually higher. We tweeted [LINK] "*#Goldman's Currie a super cycle is not this big upward trend in prices that we have envisioned in our heads, it's a sequence of spikes...See 👇09/14 tweet, #Trafigura @saadrahim series of spikes, each subsequent low is actually higher..." @adsteel @GuyJohnsonTV #OOTT #Oil."* We created a transcript of Currie's comments. Items in "*italics*" are SAF Group created transcript. At 1:10 min, Currie "*bottom line, when we think about what a super cycle really is, it's not this big upward trend in prices that we have envisioned in our heads, it's a sequence of spikes. And because commodity prices provide an economic function, they have to rebalance supply and demand, bring them back in a line when they get out of line like they did in 2021 and early part of this year. Well, markets are rebalanced right now today. Why? Because China is being locked down, so demand came back down on top of supply, prices collapse back down. But we have not been investing in supply. Supply is stagnant. So I have to just simply ask what happens when China, the largest commodity consumer in the world, the largest oil importer in the world begins to rebound significantly in the first part of next year. It's going to tighten all of these markets tremendously and put a lot of upward pressure on prices. And I think the key point is you basically have the largest commodity consumer in the world essentially hibernating over the course of the last year and that's been hiding a lot of this underinvestment. Really the core point here - underinvestment, weak demand today, but we see sequential growth in 2023 begins to tighten these markets.*"

Last week, Trafigura reiterates its view on commodities underinvestment

Here is what we wrote in last week's (Dec 11, 2022) Energy Tidbits memo. "*On Thursday, we tweeted [LINK] "#Trafigura The Year Ahead, @saadrahim reiterates 👇09/14 tweet theme - realities of structural under-investment, low inventories, lack of spare capacity set up risk moving away from world of commodity cycles to one of*

commodity spikes. ie. each subsequent low is higher. #OOTT." On Thursday, Trafigura posted its 2022 results including their annual report. Trafigura includes its outlook views on all the key commodities, including oil in the Annual Report section "The Year Ahead". Trafigura continued to highlight the same bullish oil themes driven by underinvestment and concluded The Year Ahead section "However, renewed demand growth will run up against the realities of structural under-investment across commodities. Given how low inventories are for key raw materials already, together with a lack of readily available spare capacity, any sustained rebound in consumption could lead to significant tightness and a supply crunch. Indeed, we appear to be running the risk of moving away from a world of commodity cycles to one of commodity spikes, where a lack of production capacity results in prices rising to levels that cause demand destruction, before falling. But even then, prices will remain elevated, given how long it takes to bring online new projects and the unyielding focus on capital discipline and shareholder returns of the major mining houses and big oil companies." Our Supplemental Documents package includes excerpts of the Trafigura annual report on commodities.

Why Trafigura sees spikes/drops as the case for a serious upcycle in oil

In Sept, Trafigura Chief Economist gave a good explanation of what it means to oil prices to have moved to a series of oil price spikes and drops, and why he believes this paints a picture for a "*serious upcycle in oil*". Here is what we wrote in our Sept 16, 2022 Energy Tidbits. ""*We weren't able to see Trafigura Chief Economist Saad Rahim's presentation at the Pareto Securities conference on Wednesday, but did see the subsequent webcast Q&A. [LINK]. Rahim clearly had a very bullish view for oil. Rahim highlights the lack of investment in oil, and that investment never gets a chance to get caught up so the end result is a series of upward spikes with the lows keep getting higher. We tweeted [LINK] "#Trafigura case for a serious upcycle in #Oil. Prices spike to where causes demand destruction, but because haven't had enough time to catch up on investment, each subsequent low is actually higher. See 👇 SAF Group transcript. Thx @saadrahim @paretosec. #OOTT." We created a transcript of his comments. At the 9:00 min mark, Pareto asks ".. you believe that you believe we are in the start of a serious upcycle in oil. And saw in your presentation this morning you describe the current market as spike. I think it's time we debate." Rahim replies ".. for me, I don't think these things are mutually exclusive. I think you can have a series of spikes that actually when you put them together, effectively are a cycle. Or at least an upcycle. If you are in a position where you're ultimately, the spikes I was referring to because of the underinvestment, you get to a point where prices spike to a level that then causes demand destruction. And you come off, but because you haven't had enough time to catch up on investment, your lows. Each subsequent low is actually higher. Right, so again if you put all those series together you maybe end up in a cycle."*

Oil – Vitol: J curve recovery in China demand in Q2 if herd immunity shows up quickly

Great food for thought on China's Covid relaxation from Mike Muller (Head, Vitol Asia) in his monthly appearance on the Gulf Intelligence Daily Energy Markets podcast on Thursday.

Herd immunity in China soon?

[LINK]. (i) China is clearly relaxing its Covid restrictions with the key assumption that Omicron version of Covid is not anymore deadly than the flu. And Muller notes that Covid is spreading quickly. So is China effectively moving to herd immunity strategy near term by letting the less deadly Covid version spread quickly? If so, it means that the next few months should see choppy, up and down non-broad recovery, But if China gets to herd immunity, does it set up "J" shaped recovery in Q2/23? (ii) Early Thursday morning, we tweeted [LINK] "*Nike swoosh or J shaped recovery in China demand transportation fuels. See 👇Vitol @michaelwmuller inbound international air travel to China as soon as Q2. Freedom of travel + population less scared of Virus = China move faster to herd immunity. @sean_evers @CrystolEnergy. #OOTT."* (iii) Our tweet included the transcript we made of Muller's comments. Items in "*italics*" are SAF Group created transcript. 14:40 min mark. *"Covid headlines out of China have all been rather constructive of late. There are clear signs that public policy has shifted towards no longer Zero tolerance and restrictive measures and a realization, that's probably guided by their chief medical scientists, that this particular variation of Omicron that is running thru the population a lot faster, I think if you just go through the small sample of my own colleagues in China, many of them have it right now, they all know somebody n their family or in their close circle of friends that has it and that's across three different cities. So it looks like China is in the process of becoming self immunized if you like by a more liberal policy of allowing the virus to spread in a way that is reasonably contained."* 15:50 min mark. "*there is a lot more freedom of movement. There has not yet been an edict from central government that the grand migrations for Chinese New Year, where you can get half a billion people getting on trains, cars, public buses and going to their families at Chinese New year is going to be discouraged as was the case for the last two cycles. Chinese New Year falls early and this is going to start around January 7/8. Air travel is up, public transport is being made free of charge in certain cities. China Eastern came out with a headline today they have 1,380 scheduled domestic flights that compares to five hundred and forty odd flights on the first of December. The population of China seems less scared of the Virus than was the case just a few weeks ago, and self-immunizing in a way that might happen a lot faster than we think*". 17:15 min mark. "*.. and, as such, it stands a reasonable chance of not suffering the same toll that was the case in many other large countries. So with that degree of confidence in the economy, we have colleagues in China suggesting that international inbound air travel in China could be a reality as soon as Q2 next year, which was not in most people's balances in supply demand predictions going forward. So that gives you a bit of a Nike swoosh or "J" shaped sort of view on demand for transportation fuel in China, notably jet fuel which is the big absent portion of the oil demand barrel. And has people getting quite bulled up for the second half of next year, if not somewhat sooner. But in the near term, of course, one has to be cautious because the public has been conditioned to self-isolate themselves and to avoid getting this virus if they can*."

Vitol's timing for herd immunity fits to China's timing for peak Covid

Vitol's Muller noted the feedback from his co-workers at three cities in China on how fast Covid is spreading. Other non-China commentators and guests on Bloomberg TV and CNBC are all out with a similar message – Covid is spreading with great speed. Muller's comment that rebound could be as soon as Q2 would seem to fit to the commentators feedback and also the comments last week from China's top respiratory disease expert on the Covid peak in key southern China region. Last

week's (Dec 11, 2022) Energy Tidbits wrote "*Earlier this morning we tweeted [LINK] "Covid cases likely to peak mid-Jan to mid-Feb in Guangzhou, a major city in south China's Greater Bay Area that is >10% of China GDP. #Oil markets will keep waiting to see if China's economy can sustainably reopen after Covid relaxation this week. #OOTT." The peaking timing is from a Global Times (communist party media) report today [LINK] "The first wave of COVID-19 infections in Guangzhou, South China's Guangdong Province, is likely to peak between mid-early January and mid-February in 2023, and t local society will return to pre-epidemic conditions in the first half of 2023, China's top respiratory disease expert Zhong Nanshan said on Friday."*

China says moved from "infection control to case treatment" with low deaths

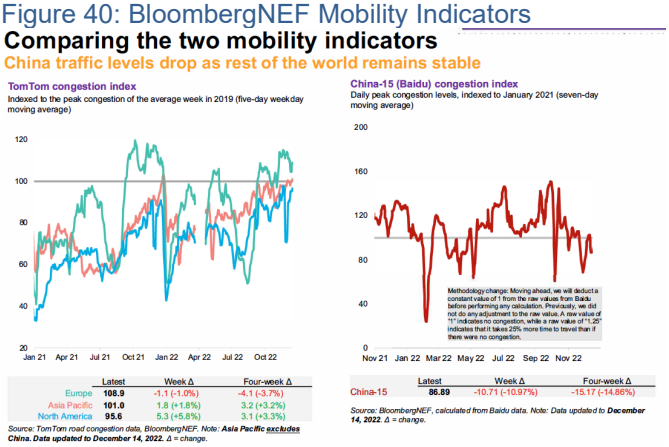
Earlier this morning, we tweeted [LINK] "*Hmm! Seems China wants to get to herd immunity quickly. #Xinhua today "China has shifted the focus of its COVID-19 response strategy from infection control to case treatment ....in accordance with the weakened pathogenicity of the virus" Fit 👇Vitol @michaelwmuller view. #OOTT."* There isn't any doubt that China has more or less given up on the approach that it should try to contain Covid spreading. We probably should have started our tweet something like Let it Rip is China's new approach to Covid. Our tweet was referencing a Xinhua (official state media) commentary this morning [LINK] "*Xinhua Commentary: Lives protected to utmost in China's three-year battle against COVID-19*" starts off "China has shifted the focus of its COVID-19 response strategy from infection control to case treatment with the objective of preventing severe cases. The shift was made in accordance with the weakened pathogenicity of the virus." Our Supplemental Documents package includes the Xinhua report.

Oil – Mobility indicators, rapid China Covid spread is winning vs travel reopening

China mobility falls with rapid Covid spread

We are big fans of the BloombergNEF weekly indicators reports as they provide updates on WoW changes, but also remind that WoW changes do not necessarily mark a trend. On Friday we tweeted [LINK], "*Rapid Covid spread in China winning right now VS removal of travel restrictions. Fits 12/15 tweet re @vitolnews @michaelwmuller China moving to herd immunity ie. set up for J shaped recovery in China transportation fuels demand as soon as Q2.Thx @BloombergNEF. #OOTT #Oil".* The mobility indicators imply that the rapid spread of Covid in China is forcing more people inside and more than offsetting the relaxation of regional travel restrictions. On Friday, BloomergNEF posted its Global Road Traffic Indicators which included a WoW increase in mobility across the globe, with the exception of China and Europe which posted declines. Over the previous weeks TomTom trends moved lower relative to 2019, but two of the three major regions increased WoW, again China posts a decline. So, it's worth keeping an eye on these indicators as they are happening at the same time as places like the US have seen lower gasoline prices. TomTom congestion index showed Europe down -1.0%, Asia Pacific up 1.9%, China down 11.0%, and North America up 5.8% from last week. Europe and North America are bullish and subject to drivers responding to rising cost, including high gasoline prices. Our Supplemental Documents package includes excerpts from the BNEF Global Road Traffic Indicators report.

Figure 40: BloombergNEF Mobility Indicators



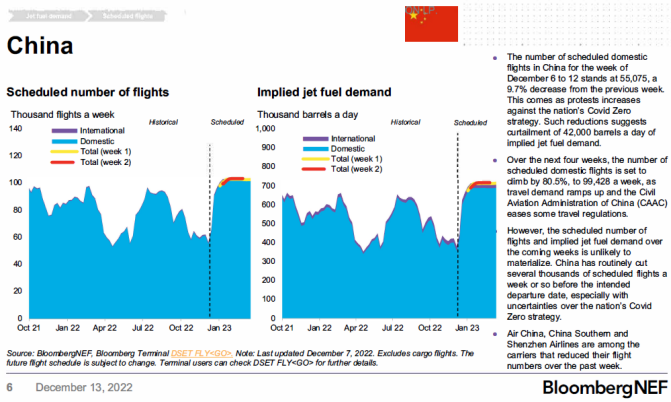
Source: BloombergNEF

Oil – Chinese domestic flights; a decrease WoW with rapid covid spreading

Scheduled China air flights

Just like road mobility, it looks like rapid Covid spread in China is also winning out versus the relaxation of travel restrictions across regions. There was a decrease of -9.7% in China domestic scheduled air flights for the Dec 6 – Dec 12 week following a slight uptick the Nov 29 – Dec 5 week. Although there was a relaxation, in particular not needing a negative test for cross region travel, we should've expected to see a continued increase this week and over the coming weeks, but we did not because Covid is spreading rapidly. And with Covid spread increasing, we might see continued flattish air travel for the next couple weeks. The big question will be what happens around Jan 7/8, when travel should pick up for Chinese New Year. BloombergNEF reported scheduled domestic airflights were -9.7% WoW to 55,075 flights for the Dec 6 to Dec 12 week. The prior Nov 29 to Dec 5 week was an increase of +0.5% WoW, and the prior week was +3.5% WoW. The number of scheduled domestic air flights is supposed to increase by 80.5% to 99,428 per week. Below is the BloombergNEF graph from its Aviation Indicators Weekly report.

Figure 41: China Scheduled # of flights & Implied jet fuel demand Dec 6 – Dec 12 week



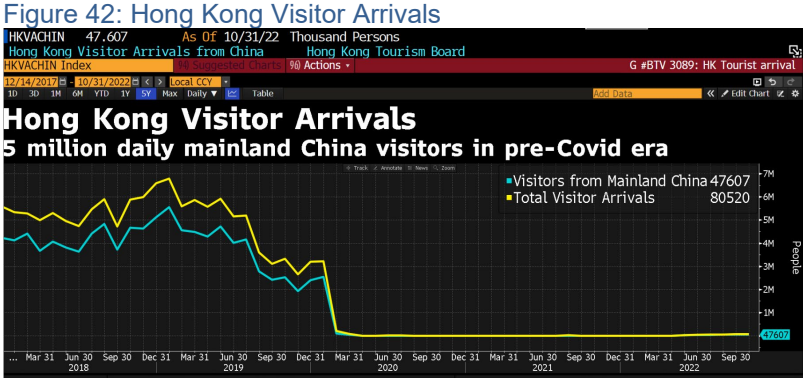
Source: BloombergNEF

Oil – Great reminder of how Covid has hit China/Hong Kong road/air/train travel

Hong Kong travel hit

We saw a great illustration this week on how much travel to Hong Kong has been hammered since Covid. And how a reopening of travel to Hong Kong will add big demand for jet fuel, diesel for buses/trains, and gasoline. We try to tape and watch the CNBC and Bloomberg evening shows, which are the Asian opening business shows as they offer the reporting from Singapore, Honk Kong, etc. Early Tuesday morning, we tweeted [LINK] "*Great reminder on how much Covid has hit China and road/air travel. DAILY arrivals to Hong Kong. Pre-Covid: 5.6 mm Mainland China + 1.3 mm Other = Total 6.9 Million. Now: Total 80,520! Thx @DavidInglesTV @business. #OOTT #JetFuel #Gasoline."* Bloomberg provided the below graph that show Daily arrivals to Hong Kong divided between Mainland China visitors and Others. We opened the graphs to get the data for the graphs.These numbers are crazy high and are probably like Venice have a huge number of workers supporting hospitality industry. Regardless, there will be a big demand lift when Hong Kong gets reopened.

Figure 42: Hong Kong Visitor Arrivals



Source: Bloomberg

Oil – Vortexa crude oil floating storage 65.35 mmb as of Dec 17, -23.2 mmb WoW

Vortexa crude oil floating storage

We are referencing the Vortexa global crude oil floating storage data posted on the Bloomberg terminal as of 10am MT yesterday. Note that these estimates get revised over the course of the week and the revisions can go back months. We do not check daily for the revisions, so our comments on the new estimates are compared to the prior weeks Vortexa estimates posted on Bloomberg on Dec 10 at 10am MT. (i) As of 10am MT yesterday, Bloomberg posted Vortexa crude oil floating storage estimate for Dec 16 at 65.35 mmb, which is -23.2 mmb vs downward revised Dec 9 of 88.55 mmb. Note Dec 9 of 88.55 mmb was revised -1.25 mmb vs 89.80 mmb originally posted on Bloomberg at 10am on Dec 9. (ii) We will have to see if the trend holds, but 65.35 mmb is the lowest level since Covid hit in 2020. The last time it was this low was 65.24 mmb on March 27, 2020. But the caveat is that there is an argument for lower floating storage if there is an increasing number of unaccounted for dark tankers floating around the world that escape Vortexa tracking. (iii) The last several weeks were all revised down. The revisions from the estimates posted yesterday at 10am MT vs the estimates posted on Bloomberg at 10am on Dec 10 are as follows: Dec 9 revised -1,25 nnb Dec 2 revised -1.49 mmb. Nov 25 revised -1.80 mmb. Nov 18 revised -1.47 mmb. Nov 11 revised –3.49 mmb. Nov 4 revised -1.94 mmb. Oct 28 revised -4.33 mmb. (iv) There is still a wide range of floating storage for the past several

weeks, but a simple average for the past seven weeks is down to approx. 87 mmb, vs last week's average of around ~95 mmb. (v) Also remember Vortexa revises these weekly floating storage estimates on a regular basis and we do not track the revisions through the week. (vi) Dec 16 estimate of 65.35 mmb is -155.04 mmb vs the post-Covid peak on June 26, 2020 of 220.39 mmb. (vii) Note that the below graph goes back 3 years and not just 2 years as floating oil storage was in the big ramp up period in Q2/20 as Covid started to have a huge impact. Dec 16 estimate of 65.35 mmb is +10.37 mmb vs pre-Covid Dec 16, 2019 of 54.98 mmb. Dec 16 estimate of 65.35 mmb is -19.70 mmb YoY vs Dec 17, 2021 of 85.05 mmb. (viii) Below are the last several weeks of estimates posted on Bloomberg as of 10am on Dec 17, 10am on Dec 10, and 10am on Dec 3.

Figure 43: Vortexa Floating Storage posted on Bloomberg Dec 17 at 10am MT

Source: Bloomberg, Vortexa

Figure 44: Vortexa Estimates Posted Dec 17 10am MT, Dec 10 10am MT, Dec 3 10am MT

Posted Dec 17, 10am MT

Date	Last Px
Fr 12/16/2022	65351
Fr 12/09/2022	88547
Fr 12/02/2022	90188
Fr 11/25/2022	101.218k
Fr 11/18/2022	96973
Fr 11/11/2022	76573
Fr 11/04/2022	88482
Fr 10/28/2022	99988
Fr 10/21/2022	89570
Fr 10/14/2022	87538
Fr 10/07/2022	81918

Dec 10, 10am MT

Date	Last Px
Fr 12/09/2022	89796
Fr 12/02/2022	91676
Fr 11/25/2022	103.023k
Fr 11/18/2022	98439
Fr 11/11/2022	80061
Fr 11/04/2022	90422
Fr 10/28/2022	104.324k
Fr 10/21/2022	92152
Fr 10/14/2022	86547
Fr 10/07/2022	82070
Fr 09/30/2022	84505

Dec 3, 10am MT

Date	Last Px
Fr 12/02/2022	84560
Fr 11/25/2022	102.426k
Fr 11/18/2022	99390
Fr 11/11/2022	81568
Fr 11/04/2022	90847
Fr 10/28/2022	104.752k
Fr 10/21/2022	92757
Fr 10/14/2022	88119
Fr 10/07/2022	82746
Fr 09/30/2022	85376
Fr 09/23/2022	101.147k

Source: Bloomberg, Vortexa

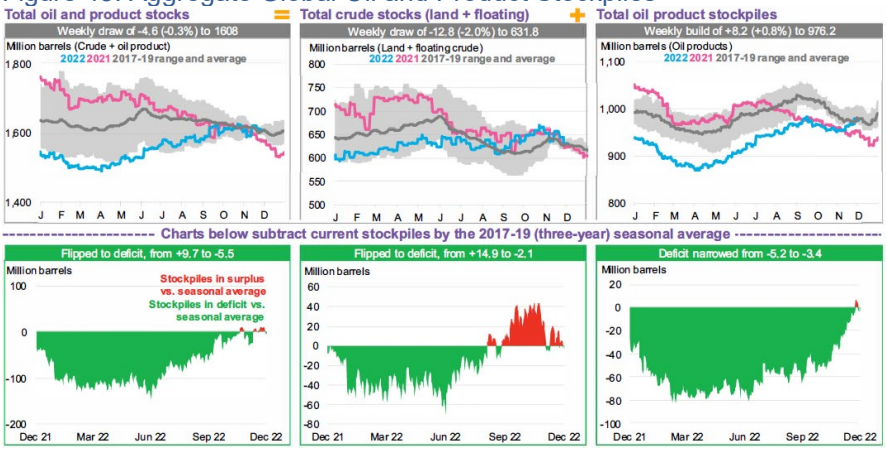
Oil – BNEF: global oil and product stocks flipped to as deficit

BNEF's global oil inventories

For those with a Bloomberg terminal we recommend flipping thru BloombergNEF's "Oil Price Indicators" weekly that came out on Tuesday as it provides good charts depicting near-term global oil demand and supply indicators. The global oil and products stockpile surplus for crude and products went from a 14.9 mmb surplus to a 2.1 mmb deficit. The stockpile deficit

against the five-year average (2015-19) widened from 55.5 mmb to 56.0 mmb. Total crude inventories decreased by 2.0% to 631.8 mmb, including global floating inventories. Product stocks was up 1.5% WoW with the stockpile deficit against the 3-year average widening from 3.4 to 5.8 mmb. Gas oil and middle distillate stocks have narrowed against their three-year average deficit (2017-2019) from 18.5 mmb to 12.1 mmb. Jet fuel consumption by international departures increased by 18,400 b/d WoW while consumption by domestic passenger departures increased by 65,400 b/d. Below is a snapshot of aggregate global stockpiles. Our Supplemental Documents package includes excerpts from the BloombergNEF report.

Figure 45: Aggregate Global Oil and Product Stockpiles



Source: BloombergNEF

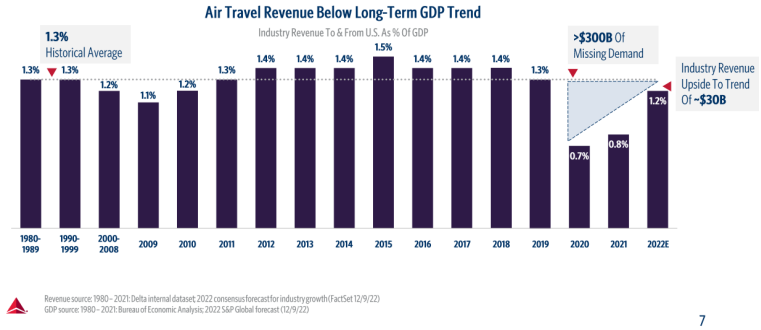
Oil – Delta Airlines expects continued growth in air travel

Delta bullish on air travel growth

The big wildcard for oil demand is air travel. It has been recovering in many areas, certainly not yet in China, but, even apart from China, there is still a lot of growth potential. The question can it keep growing over the next few years. One person who sees a lot of upside for air travel is Delta Airlines CEO Ed Bastian. He gave a very bullish air travel growth outlook on CNBC Squawk Box early Wednesday morning ahead of the Delta Financial Outlook & Strategic Update investor day. We tweeted [LINK] *"Buckle up! @Delta CEO on why see bullish air travel outlook. "relationship of air travel demand to GDP in this country, it's at 1.3% and has been per year for the last 40 yrs", look at last 3 yrs what demand should have been, the gap is $300b. thx @SquawkCNBC. #OOTT."* Later in the investor day, the first industry slide was on Bastian's Squawk Box highlight. The slide shows that 2022 is still only estimated at 1.2% of GDP, so still below the 1.3% long term historical average, which implies another $50b gap still to be filled assuming it goes to the 1.3%.

Figure 46: Delta's View of Air Travel Demand

Industry Demand Continues To Recover To Long-Term Trend



Source: Delta Airlines

Oil & Natural Gas – TIPRO Texas oil natural and gas jobs up MoM in Nov

TIPRO November jobs update

Employment continues to increase in the Texas oil and gas sector. The Texas Independent Producers and Royalty Owners Association (TIPRO) updated their employment figures for the Texas upstream sector for November [LINK]. The release noted that employment for November totalled 209,900 marking an increase of 2,600 jobs from the October numbers. The release stated, *"Texas upstream employment for November 2022 totaled 209,900, an increase of 2,600 jobs from October employment numbers, subject to revisions. Texas upstream employment in November 2022 represented the addition of 37,600 positions compared to November 2021, including an increase of 7,900 jobs in oil and natural gas extraction and 29,700 jobs in the services sector."* There has been strong job posting data for November in upstream, midstream, and downstream sectors, showing a continued demand for talent in the Texas oil and natural gas industry. From the release *"TIPRO in its analysis once again noted strong job posting data for upstream, midstream and downstream industries for the month of November. According to the association, there were 11,111 active unique jobs postings for the Texas oil and natural gas industry in November, including 3,596 new job postings added in the month by companies."* Our Supplemental Documents package includes the TIPRO release.

Energy Transition – Granholm makes a huge pivot on fossil fuels/energy transition

Granholm's big pivot on fossil fuels

We didn't see Biden shoot down a huge Energy Secretary Granholm speech on Wed that has This is a huge speech unless Biden shoots it down as it has major implications for energy for 2020s/2030s because of two apparent major assumption changes to the Biden Energy Transition approach - adding renewables doesn't replace fossil fuels, or only replaces a small portion of fossil fuels, and the energy transition needs fossil fuels for longer if it wants to have energy security, economics security and climate security. Granholm also is rewriting history by her new messaging on how the Biden Administration has a "managed" transition. (i) We had a 4-part tweet [LINK] "*WOW! @SecGranholm is latest to come out of closet on the need for a managed #EnergyTransition to have energy, economic, climate security. Fits 👇12/09/21 #2022Predictions tweet. A return to #EnergySecurity = #Oil #NatGas #LNG strong thru 2030. #OOTT 1/4."* [LINK] "*Major assumption changes for #Oil #NatGas in Biden*

"managed" transition. @SecGranholm "further ahead, this transition hinges, I think you all agree, on making sure it's done well, making sure we acknowledge that fossil fuel is not going to go away anytime soon" #OOTT 2/4." [LINK] *"Renewables don't replace #FossilFuels, rather expand the energy supply pie. @SecGranholm "there is a moment for diversification at hand right now. Our energy security, and when I say diversification I'm talking about expanding and growing the pie on this... " 3/4 #OOTT"* [LINK] *""... our energy security, our economic security, our climate security, I think all compel us to meet our needs today but then expand, invest in a widening array of energy sources." See 👇SAF Group transcript 4/4. #OOTT."* (ii) We didn't see Biden shoot down this speech or the concepts that point to a major pivot to finally admitting, but not directly saying, the Energy Transition plan wasn't working and that it needs fossil fuels for much longer. (iii) Timing makes sense. Mid-terms are over. They and everyone understands the risk for Europe Energy Crisis is even worse in 2023 than in 2022, and the last thing they want to do wait until the 2024 election cycle to make this type of change. And they are doing it without saying it's a change. (iv) Biden has been committed to a "managed" energy transition. This is one of their new messages. What they are doing now is part of the commitment Biden has had to a managed energy transition. Remember, if you say it enough, people will believe it. But this is more than messaging. It gives them some cover to do things they wouldn't do pre-midterms. (v) They admit no agreement with industry on production and refining issues. This is carefully drafted ie. having "*productive*" conversations on production and refining issues means they speak but don't agree and no clear view they will ever agree. But it sounds like progress. Productive isn't progress to any meeting of the minds. (vi) "Managed" energy transition. Careful drafting. Granholm notes how industry has noted the risk of too fast a transition could have unintended consequences. She then says "*This has got to be done in a smart and thoughtful way in partnership*". It infers a lot more than she actually says, which is why we think it's test marketing. Now, they wouldn't test market if they weren't leaning this direction. But what we would expect that in the future, it will move from industry has noted the risk to something more like "we" have noted the risk of moving too fast. Regardless, the setup is par of a clear message that the energy transition isn't ready for prime time. (vii) Note she is embracing the what industry has been saying- need energy security for economic security and climate security. (viii) Big concept that they don't say directly but is inferred – fossil fuels don't get replaced by renewables, or only a small portion of fossil fuels. This is a huge shift as most just assume add renewable capacity and eliminate fossil fuel capacity on a 1-for-1 basis. Fossil fuels are needed for longer. It's not so much she says not going to eliminate the use of fossil fuels. Rather she says about how the need is to expand the energy supply pie ie. don't stop what the industry is doing with fossil fuels today, but expand to add renewables. This expanding the pie is a clear messaging this isn't a replacement process, it's an additive process. This is a key concept. Granholm said "*That's the now, but further ahead, this transition hinges, I think you all agree, on making sure it's done well, making sure we acknowledge that fossil fuel is not going to go away anytime soon, but that there is a moment for diversification at hand right now. Our energy security, and when I say diversification, I'm talking about expanding and growing the pie on this. our energy security, our economic security, our climate security, I think all compel us to meet our needs today but then expand, invest in a widening array of energy sources. We need this industry to play a lead role developing, deploying these additional resource*s"(ix) Also a specific shout out on the need for natural gas. This is another big pivot. Our Supplemental Documents package includes the transcript we made of Granholm's comments.

Granholm's huge pivot fits our #1 prediction for 2022

Throughout 2022, we have seen political and business leaders step back from their actions that the energy transition plan was working. The beauty is they have the cover to blame it on Russia/Ukraine and, no question, that has had a big impact. But this was happening a year ago. It really started with Macron on the eve of COP26. In 2022, we are seeing leaders not want to directly say it isn't working, but they will craftly draft their messages (as Granholm did this week) that clearly show a huge pivot in their view on the Energy Transition. This fits our #1 prediction for 2022. Our Dec 12, 2021 Energy Tidbits memo was titled "*Time for 2022 Predictions: Our #1 is More Leaders Have a #MacronMoment & Admit Energy "Transition" Needs Changes*". Here is what we wrote a year ago "*It's December and so analysts will soon be coming out with 2022 predictions, so we thought we would beat them with one of our main 2022 predictions. On Thursday, we tweeted [LINK] "Time for #2022Predictions. My #1 is more #EnergyTransition #NetZero leaders come out of closet, have a #MacronMoment ie. have "transition" not self inflicted shortage so 2021 energy crisis isn't every year. A return to #EnergySecurity = #Oil #NatGas #LNG strong thru 2030. #OOTT." This should not surprise readers as we have been noting the start of energy transition leaders starting to admit, in a politician's manner, that the energy transition isn't working as per aspirations and energy costs will be a lot higher than aspired. We have said for years that the energy transition will happen, but it will take longer, be bumpy road and cost more than the aspirations. Last week's (Dec 5, 2021) Energy Tidbits wrote on the ADNOC CEO speech There was much more in the speech, which is why we tweeted [LINK] "If more leaders have a "Macron Moment" in 2022, maybe COP28 UAE in 2023 can be catalyst for getting down to work on practical, commercial, sustainable energy solutions: pro climate/pro growth? See SAF Group transcript of @SultanAhmedalj8 #ADIPEC keynote. #EnergyTransition #OOTT." We do wonder if we will see more world leaders accept that the energy transition isn't working according to their aspirations and that there is an increasing risk of a decade of energy crisis like seen in Europe in H2/21 unless the world puts in an achievable energy transition plan." We think COP26 will turn out to be turning point, but a turning point to force energy transition leaders into changing their plan. It why we think we will more of the energy transition leaders come out of the closet and admit this in 2022. But what got us to tweet this week was after seeing Saudi Aramco CEO Nasser speech at the WPC in Houston. Nasser said "There is one more thing that can no longer remain unsaid. A majority of key stakeholders agree with these realities as much as they believe in addressing climate change. We know this, because they say so in private. They should say it publicly too. I understand their dilemma. Publicly admitting that oil and gas will play an essential and significant role, during the transition and beyond, will be hard for some." So our #1 2022 Prediction is that we will see leaders come out of the close and admit, in a politician's way, that the energy transition plan needs to be changed. The key result will be that fossil fuels are needed for way longer and the outlook for oil, natural gas and LNG will be stronger thru 2030 and beyond."*

A #MacronMoment can take three forms

Also from our Dec 12, 2021 Energy Tidbits was "*We use the term "Macron Moment" and the #MacronMoment as when an energy transition leaders come to the realization that the energy transition will take longer, be bumpy and cost more ie. it just won't be ready for prime time and they need to change their plans on how quickly they get rid of oil and natural gas. We are already seeing politicians start to publicly have a #MacronMoment but, so far, it has come in three forms of admission as noted below."*

First, a direct #MacronMoment clearly saying it isn't working as planned

Also from our Dec 12, 2021 Energy Tidbits was "*We aren't picking on Macron, but he recently said it the clearest when he warned the energy transition aspiration has to be modified/reduced or else there will be years of an energy crisis. And, even more importantly, he wants to bring a more pragmatic Energy Transition plan to the EU. On Nov 9, we tweeted [LINK] on Macro's address to the nation [LINK] that closed with his call for a more practical approach to the CO2 emissions and one that will include Europe. Macron said "But France will not be strong alone. With the European Union:➔ We will be able to build a credible strategy for reducing our CO2 emissions, compatible with our industrial and technological sovereignty." The Macron release had at the bottom a reminder "Next January, it is a new model of investment and growth that the President will defend with the French presidency of the Council of the European Union." The day before COP26 started, we tweeted [LINK] on Macron's comments to the FT [LINK] that was a clear view on higher fossil fuel prices for the foreseeable future. Macron said "on demand for fossil fuels isn't going away for the foreseeable future. Macron said "What is happening now is ironic, because we are building a system where in the medium and long term fossil energy will cost more and more, that's what we want [to fight climate change]." he said." Japan is another calling for a pragmatic time frame ie a change in the plan."*

Second, Japan says must have a "pragmatic time frame" for decarbonization

Also from our Dec 12, 2021 Energy Tidbits was "*No one should is surprised to see how Japan says their #MacronMoment. They don't say it isn't working, they don't say energy costs are way higher than expected. But they do clearly make the point. They say it important to have a pragmatic time frame for decarbonization. That sounds like Japan-speak for the energy transition aspirations plan isn't working and needs to be changed. On November 9, Japan and the IEA issued a press release and we tweeted [LINK] "Today's Japan "go slow" getting rid of #Oil #NatGas fits Japan's Nov 9 on acceleration of decarbonization that must have "the importance of measures with pragmatic time frame". Japan is having a "Macron Moment". See Nov 9 tweet [LINK] #OOTT." On Nov 9, we tweeted [LINK] on Japan's release [LINK] on its conference with IEA Executive Director Faith Birol. Japan wrote "The two sides also exchanged views on acceleration of decarbonization efforts following COP26, and shared the importance on measures with pragmatic time frame based on individual circumstances that each countries face including its renewable energy potentials". A pragmatic time frame or a go slow process, whatever you want to call it, it means the same thing – Japan doesn't want to get rid of fossil fuels too quickly."*

Third, US doesn't say it isn't working, just higher energy costs for yrs to come

Also from our Dec 12, 2021 Energy Tidbits was how Granholm previously illustrated another way to say the energy transition wasn't working as planned – it was costing a lot more. We then wrote "*US Energy Secretary Granholm has shown the third way of admitting the energy transition plan isn't working. She doesn't say specifically the energy transition plan isn't working or needs to be changed. She just avoids saying that. But she puts on the record that high energy costs are here for years. No one ever heard the Biden sales pitch on accelerating the push to Net Zero and reducing emissions including the warning that this will mean higher energy prices are here for years. That wasn't in the sale pitch. Here is what we wrote in our November 14, 2021 Energy Tidbits "Last week's (November 7, 2021) Energy Tidbits noted Biden seemed to also acknowledge a longer life for oil and natural gas. On Oct 31, we tweeted [LINK] "Is #Biden following #Macron & finally realizing demand for #Oil #NatGas is going to be more for 2020s than in his #NetZero aspiration? Oops, cancel #KeystoneXL, do zero to support US oil supply growth, etc. 2020s will be very good for #Oil #NatGas prices & #OPEC+. #OOTT." Biden wasn't as direct as Macron the week before on demand (see our Oct 31, 2021 Energy Tidbits), but seemed to be acknowledging demand for oil isn't going away as fast as he had planned. And, as everyone now knows, supply has been hurt by lack of oil investment so its sets up the tighter oil market for the 2020s. In his closing G20 press conference, Biden said "Well, on the surface, it seems like an irony, but the truth of the matter is — you've all known; everyone knows — that the idea we're going to be able to move to renewable energy overnight and not have — from this moment on, not use oil or not use gas or not use hydrogen is just not rational." Energy Secretary Granholm was on MSNBC Morning Joe on Monday. We tweeted [LINK] on her comments and noted she that US/Can voters weren't warned in the recent elections that the Energy Transition will happen but will lead to higher prices on oil, natural gas and electricity for years to come. We created a transcript of her saying "So the long term strategy is that. and yes we have a short term cost issue because the economy is still coming back on . we have a supply, demand that does not, the supply doesn't meet the demand. that is an issue we are going through. The president is all over this both in the short term and in the long term."*

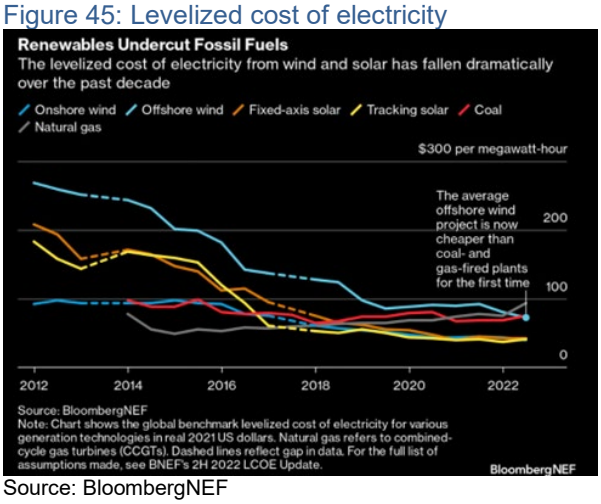
Energy Transition – Will others follow? New Zealand can't afford to keep fuel subsidy

New Zealand to cut petrol subsidies

We really have to believe other developed countries that are energy importers will be following New Zealand's move to end some fuel subsidies as they can't afford to keep it going. Perhaps this wouldn't be an issue if the world wasn't slowing down and interest rates were still increasing, but the economic reality check has to be force other developed countries to look at how much more debt can they or do they want to take on? On Wednesday, New Zealand announced [LINK] "*The Government is providing more cost of living support by extending the petrol excise discount until the end of February then phasing it out by the end of March. Half price public transport will also be extended until the end of March. "Many households are still struggling with the cost of living, which is why the Government is continuing to provide support for New Zealanders through the global economic uncertainty caused by COVID and the war in Ukraine," Grant Robertson said. "The*

fuel price and public transport discounts directly helped people struggling with cost of living pressures, while also helping to take the edge off inflation by about half a percent. "The Government has invested over $1 billion over the past year to reduce fuel prices. However it is not sustainable to continue to subsidise the cost of petrol indefinitely for everyone. "We have to strike a balance between broad ongoing support and careful management of the Government accounts. That's why we are transitioning to more targeted support for those most feeling the pinch." Our Supplemental Documents package includes the New Zealand release.

Figure 45: Levelized cost of electricity



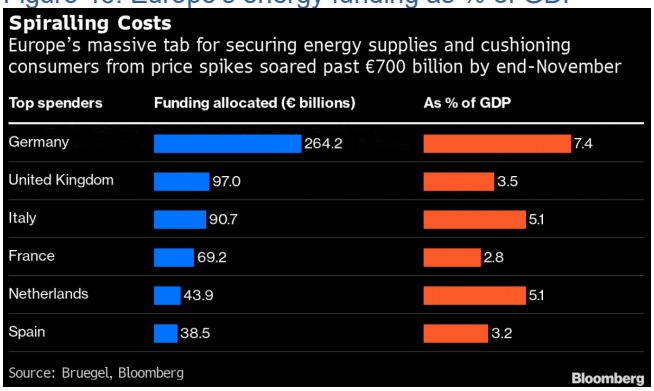
Source: BloombergNEF

Energy Transition – Europe's $1 trillion energy bill, how long can it keep it going?

Europe's $1 trillion energy bill

How long can Europe keep subsidizing fuel costs in the face of economic slowdown and rising interest costs on debt? New Zealand is saying it can't afford more because it has spent >$1 billion or 0.4% relative to its 2022 GDP of approx. $240 billion. It was interesting to see Bloomberg's Friday report "*Europe's $1 Trillion Energy Bill Only Marks Start of the Crisis*". Bloomberg writes '*While governments were able to help companies and consumers absorb much of the blow with more than $700 billion in aid, according to the Brussels-based think tank Bruegel, a state of emergency could last for years. With interest rates rising and economies likely already in recession, the support that cushioned the blow for millions of households and businesses is looking increasingly unaffordable. Once you add everything up — bailouts, subsidies — it is a ridiculously large amount of money," said Martin Devenish, a director at consultancy S-RM. "It's going to be a lot harder for governments to manage this crisis next year." Government fiscal capacity is already stretched. About half of European Union member states have debt exceeding the bloc's limit of 60% of gross domestic product."* New Zealand is different as it can't count on other countries to help it, but to put in perspective, the estimated $700 billion for Europe is 4.2% relative to EU;s approx. GDP of $16.61 trillion. Our Supplemental Documents package includes the Bloomberg report.

Figure 46: Europe's energy funding as % of GDP



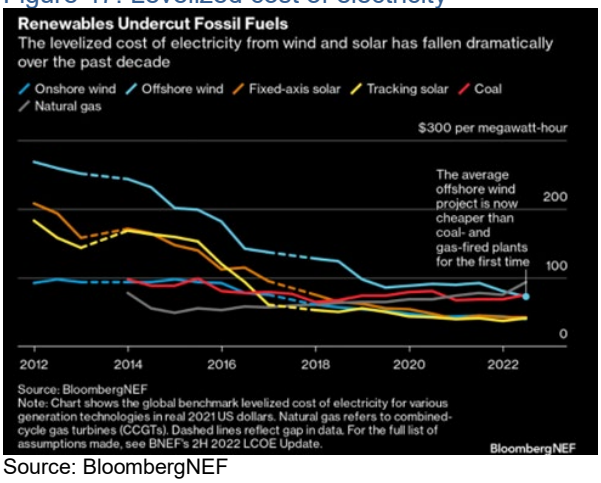
Source: Bloomberg

Wind/solar nameplate capacity costs

Energy Transition – Wind/solar cost to add nameplate capacity less than gas/coal

Last night, we tweeted [LINK] "*2022 was a great year for #NatGas #Coal prices, but also means it's cheaper to add #Solar #Wind electricity capacity. Note this compares cost to add capacity and not adjusted for lower capacity utilization of renewable. Thx @BloombergNEF Nilushi Karunaratne Amar Vasdev. #OOTT.*" We were fortunate that the BNEF analysts got back to our questions on Friday on their graph so we could confirm that the comparative costs of electricity were based on nameplate capacity and do not adjust for the lower utilization and intermittency of renewables. Regardless, it is still positive for renewables that the cost to add nameplate capacity went cheaper than natural gas and coal in 2022. On Friday, BloombergNEF wrote "*Let's start with the good news. Renewable energy has been getting ever cheaper to produce thanks to improved technology, economies of scale and stronger supply chains. The so-called levelized cost of electricity, or LCOE, for solar and wind projects has fallen by at least 60% versus a decade ago. Inflation did make its mark this year as raw materials, freight and financing all became more expensive. Nonetheless, with fossil-fuel-powered generation also being squeezed by high commodity prices, renewables have retained their competitive edge. In fact, for the first time ever, the LCOEs for onshore and offshore wind, and fixed-axis and tracking solar are now all lower than for coal and natural gas. Offshore wind finally undercut fossil-fuel plants in the second half of this year, propelled by tumbling turbine prices in China. This means that, on average, gas is now the most expensive source of bulk power generation, with its LCOE more than double that of solar and onshore wind.*"

Figure 47: Levelized cost of electricity



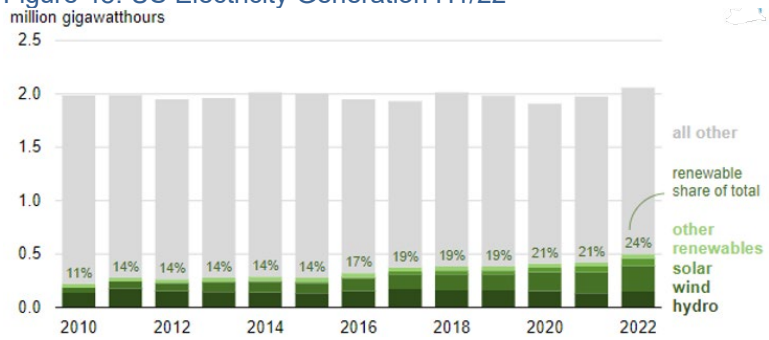
Source: BloombergNEF

Energy Transition – Renewables generated 24% of H1/22 US electricity

24% of US electricity was from renewable sources

Renewable energy continues to increase its share of US electricity generation. On Thursday, the EIA's *Today in Energy* [LINK] wrote 24% of electricity generation came from renewable sources. Renewable electricity generation of 24% is up from 21% for the same time last year as hydropower, wind, solar, geothermal, and biomass continue to make up more of the energy generation share. Snowpack melting and more windy days occur in the first half of the year, so we should expect a decline in renewable generation in the second half of 2022. In its H2/22 forecast, the EIA wrote, *"in the second half of 2022, we expect that renewables will make up a smaller share of generation than they did in the first half of the year (20%) as wind and hydroelectric generation decline."* Below is the EIA graph highlighting the electricity generation source breakdown. Our Supplemental Documents package includes the EIA blog.

Figure 48: US Electricity Generation H1/22



Source: EIA

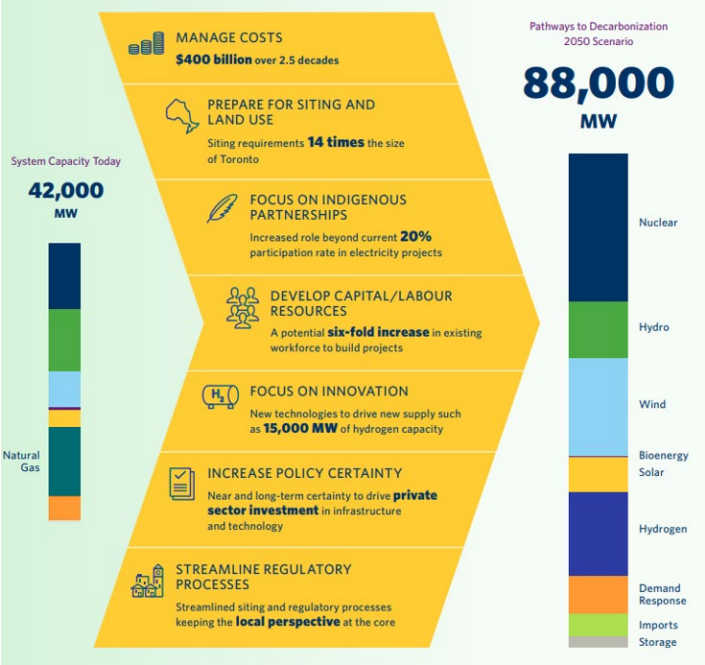
Energy Transition – Ontario IESO's decarbonization will be complex & challenging

Ontario's path to decarbonize

There are many points to come out of the Ontario's Independent Electricity System Operator (IESO) posted its Pathways to Decarbonization report on Thursday, but there were three

points that jumped out at us that reflect the changing views, like seen in our comments on Energy Secretary Granholm earlier, that the energy transition isn't delivering as planned. (i) The IESO required electricity capacity is much like Granholm's comments that point to renewables don't replace fossil fuels, rather they are additive to the electricity capacity such that IESO forecasts Ontario will need to more than double its system capacity from 42,000 MW to 88,000 MW. (ii) Renewables don't replace natural gas generation. Rather it seems IESO sees either nuclear or blue hydrogen not green) hydrogen that will be expected to replace Ontario's natural gas generation. And as everyone knows, blue hydrogen is expected to come from natural gas. IESO highlights the challenge to replace natural gas. One inference is "*Imported blue hydrogen combusted in a new single-cycle turbine was used as a proxy for low-carbon fuels and was assumed to be available after 2035."* (iii) IESO also reminded that they can't have the problems of their coal phase out apply to any plan to phase out natural gas. IESO writes *"As learned during Ontario's coal phase-out initiative, shutting down large facilities while maintaining reliability can take many years to achieve. Some of the learnings from Ontario's previous experiences include the following: • Replacement resources should be procured, built, commissioned and operated at a satisfactory level of performance prior to the shutdown of facilities. Careful scheduling and demonstration of operation are critically important to ensuring that reliability can be maintained during transition years. • Replacement resources are unlikely to have the same attributes as natural gas facilities. Low carbon fuels such as renewable natural gas, for example, may be suitable replacements, but significant work must be done to ensure that they have both the right technical characteristics and that they are market ready in sufficient quantities by 2035. In the end it may be necessary to procure additional resources to ensure that all reliability attributes are replaced. • Shutting down larger facilities can impact the transmission system. Studies should be conducted as each facility shuts down to understand the broader effects on the transmission system and to develop adequate infrastructure to maintain the security of the grid."* (iv) It won't be cheap at a cost of $400 billion. (v) IESO highlights some logistical/supply chain constraints that are often overlooked such as siting requirements will be 14 times the size of Toronto and they will need a six-fold increase in labor to build out this plan. (vi) IESO's key graphic highlights this will be challenging. IESO says "*bridging the work of today with the needs of a decarbonized world will be challenging and complex. Ontario's electricity system is well positioned to make the transition, but will need to address a series of challenges in order to achieve decarbonization*." And its opening paragraph on the pathway was that it "IESO ""*finds that Ontario could begin moving toward a decarbonized grid starting with a moratorium on new gas generation beginning in 2027, as long as sufficient non-emitting supply were to be in place to meet growing electricity demand. By 2035, the system could be less reliant on the natural gas fleet, lowering emissions by 60 per cent below the IESO's original forecasts. The report also finds that attaining a decarbonized electricity sector by 2050, alongside aggressive electrification targets, would require a system more than double the size it is today at an estimated cost of around $400 billion."* Our Supplemental Documents package includes excerpts from the IESO Pathways to Decarbonization.

Figure 49: IESO's Decarbonizing Ontario's Electricity System



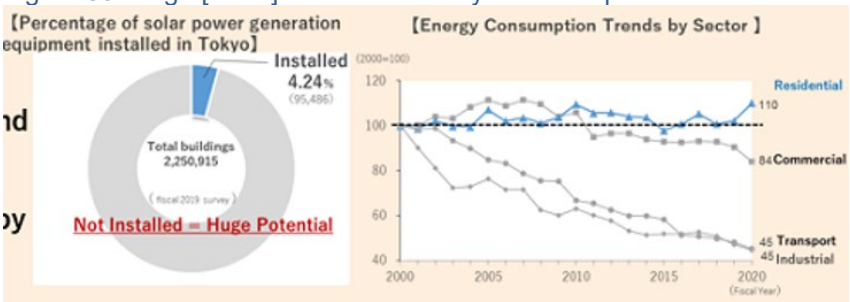
Source: IESO

Energy Transition –Tokyo mandating new home rooftops to go solar

Tokyo' solar rooftop mandate

Everyone has to acknowledge western leaders are still not stopping from their regulatory push to mandate the use of more renewables. This is happening. Our biggest concern to these western leaders is just don't make your plans on the naïve assumption that renewable capacity eliminates fossil fuel capacity on a 1-for-1 basis or anywhere close to 1-for-1. That is what we saw was a huge takeaway from the Granholm huge pivot noted earlier. Regardless, the mandated use for more renewable isn't stopping. A good example this week was the Tokyo Metropolitan Government, on Friday, approving a mandate that its 50 major housing developers must install solar panels on all new housing effective April 2025. Tokyo writes this solar generation mandate applies to "*Major housing suppliers that supply over 20,000 m^2 of housing on a yearly basis (approx. 50 companies) will be subject to this mandate. ✓New buildings are subject; existing buildings are exempt. ✓This is a system in which housing suppliers and homeowners/buyers work together to improve the environmental performance of buildings."* Tokyo's Solar Power page [LINK] has the below graphic with a text "*Huge Potential of Tokyo's Rooftops. Installation of solar power generation equipment on residential roofs in Tokyo has been limited. Rooftops present Tokyo as a unique advantage as a metropolis and should be utilized to the maximum extent. The residential sector was the only sector to record an increase in energy consumption since 2000 (compared by sector). Further strengthening of measures is needed."*

Figure 50: Huge [Solar] Potential of Tokyo's Rooftops



Source: Tokyo Metropolitan Government

Capital Markets – Tax Foundation's corporate tax rates around the world

Corporate tax rates around the world

There was a good Tax Foundation Dec 13 blog "Corporate Tax Rates around the world, 2022." It is their annual compilation of corporate tax rates by country so is a handy reference table. Tax Foundation writes "*The worldwide average statutory corporate income tax rate, measured across 180 jurisdictions, is 23.37 percent. When weighted by GDP, the average statutory rate is 25.43 percent. Asia has the lowest regional average rate at 19.52 percent, while South America has the highest regional average statutory rate at 28.38 percent. However, when weighted by GDP, Europe has the lowest regional average rate at 23.59 percent and South America has the highest at 32.64 percent."* For perspective, Tax Foundation estimates Canada at 26.21%, UK at 19.00%, and US at 25.81%. Tax Foundation notes 16 countries are without general corporate income tax in 2022 including Anguilla, Bahamas, Bahrain, Belize, Bermuda, British Virgin Islands, Cayman Islands, Guernsey, Isle of Man, Jersey, Saint Barthelemy, Tokelau, Turks and Caicos Islands, UAE, Vanuatu, and Wallis and Futuna Islands. Our Supplemental Documents package includes the Tax Foundation blog. [LINK]

Demographics – Tokyo wants to alleviate overpopulation

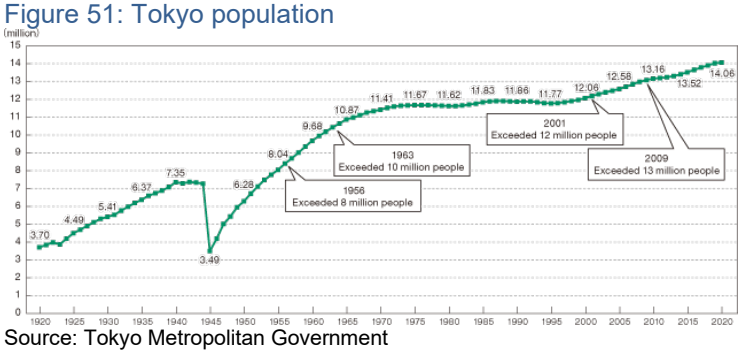
Tokyo overpopulation

We have to believe that one of the demographic challenges for many cities around the world will be how to make sure there isn't urban overpopulation. The world has been and continues to be, to the most part, into the continued wave of population moving into urban areas. There was some respite in areas with Covid. But the trend has been into urban areas. On Friday, we saw Japan looking to alleviate this problem in Tokyo. On Friday, Mainichi reported [LINK] that "*Japan aims to alleviate overcrowding in Tokyo by arresting population flight to the metropolitan area by the end of fiscal 2027, a new five-year regional revitalization plan released by the government showed Friday. The draft strategy, which will be finalized at a Cabinet meeting next Friday, specifies measures and numerical targets to be implemented from fiscal 2023 to eliminate net population inflow into Tokyo and the neighboring prefectures of Saitama, Chiba and Kanagawa. In fiscal 2021, which ran from April last year until March, the number of people moving into the four prefectures exceeded those moving out by around 84,000. The five-year plan includes using tax incentives to encourage companies to relocate to regional areas, establishing satellite offices, and increasing opportunities for the urban population to contribute to local communities as part of measures to increase population outflow."*

Tokyo has a growing and aging population

We went to the Tokyo Metropolitan Government "Population of Tokyo" page [LINK] for some population background. Tokyo's population has been on fairly steady growth for the last 20 years. But prior to that, there was a long period of slow population growth, which makes sense as it looks like it happened after the massive energy shock to Tokyo following the Arab Oil Embargo in 1973/74. Prior to that Tokyo was adding 1 million people very seven or so years, but then it went thru a period of taking about 20 years to go from 11 to 12 million people in 2001. But in the last 20 years, Tokyo doubled that population growth adding 2 million people in the last 20 years. And Tokyo is what is considered a "super-aged society". Tokyo Metropolitan Government wrote "*according to the National Census, as of October 1, 2015, the population of Tokyo was 13.515 million (Statistics Bureau, Ministry of Internal Affairs and Communications). This number was divided into three age categories: child population (ages 0 - 14) at 1.518 million; the working-age population (ages 15 - 64) at 8.734 million; and the aged population (ages 65 and over) at 3.006 million. These figures are 11.5%, 65.9% and 22.7%, respectively, of the overall population. The percentage of aged persons exceeded the United Nations standard of 14% for an "aged society" in 1998, and Tokyo is now a "super-aged society," with senior citizens making up 21% or more of the population.*"

Figure 51: Tokyo population



Source: Tokyo Metropolitan Government

Twitter – Look for our first comments on energy items on Twitter every day

@Energy_Tidbits on Twitter

For new followers to our Twitter, we are trying to tweet on breaking news or early views on energy items, most of which are followed up in detail in the Energy Tidbits memo or in separate blogs. Our Twitter handle is @Energy_Tidbits and can be followed at [LINK]. We wanted to use Energy Tidbits in our name since I have been writing Energy Tidbits memos for over 20 consecutive years. Please take a look thru our tweets and you can see we aren't just retweeting other tweets. Rather we are trying to use Twitter for early views on energy items. Our Supplemental Documents package includes our tweets this week.

LinkedIn – Look for quick energy items from me on LinkedIn

Look for energy items on LinkedIn

I can also be reached on Linkedin and plan to use it as another forum to pass on energy items in addition to our weekly Energy Tidbits memo and our blogs that are posted on the SAF Energy website [LINK].

Misc Facts and Figures.

During our weekly review of items for Energy Tidbits, we come across a number of miscellaneous facts and figures that are more general in nature and often comment on sports.

World Cup 2002 final is about to start

We have a 7am MT news cut off, which means we stop looking for any last minute news items and work for final items/editing. For today, it's also good timing so we can have uninterrupted view of the World Cup final between Argentina and France. We won't be alone in watching the final, which is expected to have a huge viewership. FIFA's optimistic estimate is that 1.5 billion will watch the final, which would be a huge jump over the 1.12 billion who watched the 2018 final (France beat Croatia 4-2) and 1.01 billion who watched the 2014 final (Germany beat Argentina 1-0).

Banff goes smoke free in public places

The town of Banff, Alberta is going smoke free in all public places starting Feb 1. Banff, Alberta in the Cdn Rockies is probably the #1 mountain travel destination for Canadian and international travelers. And the town of Banff is within the Banff National Park. Banff passed "*Bylaw 467 – Smoke Free Public Places*" [LINK]
"*Starting in February 2023, smoking and vaping of tobacco and nicotine products will not be allowed in many public places in the Town of Banff. Banff Town Council approved a new bylaw that improves alignment with their cannabis smoking and vaping restrictions implemented in 2018. The new rules provide a safer place for residents and visitors to enjoy Banff without the health risks of second-hand smoke. The new bylaw also helps reduce fire risks and reduces littering in the national park community. Council approved a new bylaw that would restrict smoking or vaping in the following areas throughout Banff (where smoking is currently permitted as per the provincial act): Municipal parks/parkettes/green spaces. Trails and Pathways. Outdoor markets. Outdoor events. Bus stops. Public sidewalks and pedestrian zones and; Smoking in proximity to children not in one's custody, care or control. Smoking and vaping tobacco and nicotine products will still be allowed on private property, outdoor parking areas and Banff's network of alleys."*