April 25, 2022

ENERGY REALITY TODAY:

DEMAND, SUPPLY, PRICING & THE FUTURE ENERGY TRANSITION

Energy currently represents a large investment in Five Mile River (FMR) client portfolios. Why? With so many unpredictable political and economic macro events over the past two years impacting energy, this is a detailed explanation of the fundamentals leading to FMR's energy investment strategy. This is a follow-on to the FMR 3.13.22 email blast and there are two purposes for this communication: first, to provide the best real-time details surrounding energy supply, demand, inventory numbers and secondly, to address the pricing implications of the doubling of oil prices on our daily lives.

There are multiple moving parts to this global oil picture involving over 160 consuming countries, 79 non-OPEC producers and 13 OPEC members. So here are a few numbers to help explain the complexity of this worldwide commodity.

What about demand? It is not a surprise that worldwide demand for oil hit its low at 88.9 million barrels a day (BPD) at the start of pandemic in Q2 2020 after the March '20 COVID shutdowns. In Q1 2022, oil demand rebounded to 100 million BPD, surpassing the previous all-time high of 99.4 million BPD (1Q 2020). **Expected oil demand for calendar year 2022 is 100.7 million BPD, up 4.5% from the high in 2021.** The important point and trend here is that worldwide demand for oil continues to be stronger than generally anticipated. The demand trend continues to be on an upward curve.

Let's talk supply. **Expected oil supply for 2022 is 99.3mm BPD**, **up 4.3% from the high in 2021.** World-wide supply does **not** meet demand, and in fact supply is losing pace against demand. Supply in the U.S. has just not responded to this price increase because of the **two-year 60% decline in oil field development spending**. World-wide there has been a **28% decline in oil field development spending** compared with 2019. Even a sharp upward increase would have to last several years to significantly increase production here in the U.S. because it takes that long to build the facilities and hire the labor to increase output. For the present, the U.S. is now a net importer of oil, and dependent on OPEC imports to meet demand. Up to the Russian invasion of Ukraine, the U.S. had been importing oil and refined petroleum products from Russia! Interestingly, OPEC should reach full production capacity by 2H 2022, however, it will not be sufficient to offset the drop in Russian exports. Currently, OPEC and Russia (OPEC+) consortium is estimated to be behind their production quota allocation increases by as much as 800,000 BPD. In addition, there is a recent suspicion that Russian and Kazakhstan oil production has dropped as much as 3 million BPD from their normal production of 10 million BPD. At the present time there is no hard evidence of how much Russian exports and production have dropped, however, they have cut their oil price by 30% to sell their oil.

Supply and demand and the price of oil ALWAYS intersect at worldwide inventories. OPEC+ agreed in the fall of 2020 to a quota restoration of oil production to reduce world-wide inventories and thus control the pricing of oil. Why? OPEC+ wanted worldwide oil prices to gradually rise to cover their domestic budget deficits**,** which had steadily risen during the 2018-2019 drop in oil prices. Breakeven oil prices to cover these deficits are between **$80 to $95/barrel** for Russia and Saudi. This agreement provided a mechanism to control OPEC's production so the countries involved could sustain higher prices. Has OPEC+ succeeded in raising prices to cover their national budgets? Yes, and better than the consensus expected. Why? To the surprise of most forecasters oil demand was higher than forecast and the supply was reduced. This change was recently forecasted by the Paris-based International Energy Agency (IEA), a forum of 29 industrialized countries that provides authoritative analysis on energy. By judicially controlling OPEC's production, worldwide inventories have dropped about 700mm BPD since the summer of 2020 to the point of having approximately **2.6 billion barrels of oil in storage worldwide**. That inventory level comfortably supports the $100+ per barrel oil price that we see today. However, contrary to the consensus forecasts, global oil inventories are still drawing down (declining)! Only Saudi and the UAE have spare capacity and we expect that to be gone no later than year-end.

Regulatory, social, and environmental energy policies have disincentivized new capital expenditure investments in the U.S. This spending decline, in just two years, represents over $2 trillion pulled out of this industry. However, the recent energy price spike suggests that we are likely to see a governmental refocus on the necessity to return to **energy independence as a priority for national security**. President Biden announced this past week that he would reverse his previous executive order banning oil and gas drilling on federal lands, and open up the permitting process for some federal lands. However, the impact from new oil and gas production from federal lands is likely 3 to 5 years out and uncertain as a higher royalty rate (tax) will be instituted at 18.5%, up from 12.5% on new production along with additional environmental restrictions.

Five Mile River has contracted research from energy consultants whose mission is to study the world-wide oil economy. Their out-of-consensus forecasts over the last three years have been a contrarian view of higher prices, higher demand, lower supply. This research has been absolutely spot-on-accurate with regard to oil demand, supply, and inventories. Our overweighting in the energy sector over the past two years was directly supported by this forecast and has helped client portfolio performance. The S&P energy sector is up **171%** since October 2020, substantially outperforming the broad market and it is the only sector up in 2022 thus far. We believe this commodity outperformance has an extended life. Our consultant's oil balance model currently produces a "fair value" price of **$113/**barrel. This forecast does not incorporate the likelihood of a protracted war in the Ukraine. Should worldwide oil demand come in higher than the prior model forecast, along with supply lower, this could cause a further drop in inventories which brings into play the possibility of gasoline costing $6+/gallon in the U. S. with oil pricing at $115 to $130/barrel.

ENERGY TRANSITION, CO2 EMISSIONS, RENEWABELS, ELECTRIFICATION, BATTERY STORAGE

Daniel Yergin, the Pulitzer Prize winning author and highly respected expert on energy, presents in his book "THE NEW MAP, Energy, Climate, and the Clash of Nations" some macro points on the status of world energy that are especially relevant today (2020 publication) given cold wars with both Russia and China. Yergin's salient points are summarized below:

Raw numbers as prelude to thinking about the "Energy Transition":

1. One billion people lack access to electricity
2. Three billion people do not have access to clean cooking fuels (they burn wood, charcoal, crop waste, and cow dung)
3. World population estimate in 2022: 7.9 billion
4. World population in 2050: 9.7 billion
5. 2021 world car population: 1.4 billion; China #1 @ 400 million; U.S. #2 @ 350 million
6. 2021 new car sales worldwide: roughly 67 million; China is 25% of all car sales in world
7. 2021 electric vehicle worldwide total: 2 million
8. India depends on coal for 75% of electricity; depends on oil for 30% of total energy and 85% of their energy is imported
9. Estimated 2021 China population: 1.4 billion; India population: 1.3 billion. India population surpasses China within 2 to 3 years and hits 1.65 billion in 2050 (U.N.)
10. India: 300 million people live on the equivalent of $1.25/day
11. Percentage of worldwide CO2 emissions by country: #1 China at 29%; #2 U.S. at 15%; #3 Europe at 12%; all the rest of the nations between 3% to 7% with India moving up.
12. Chinese economy consumes one half of all the worldwide electricity produced.
13. China is not energy independent and is meeting demand from: adding nuclear, solar and wind, imported LNG and oil, and adding **three** new coal fired plants a **month**.

While there are significantly more numbers from Yergin's "THE NEW MAP" the above starts to frame the debate of how much more complex this challenge is, and not just in a political framework. Furthermore, the sheer magnitude and cost involved, who will pay, and how fast will the technology come to aid in providing energy for the world in the future. These are crucial hard milestones that must be answered. Today's modern world, developed and undeveloped, depends on oil, natural gas, and coal for 80% of its energy, just as it did 30 years ago.

The Paris Agreement of 2015 to keep temperatures from rising more than two degrees before the beginning of the next century galvanized many, but not all countries agreed with this lower carbon future (a phrase with multiple definitions). Disagreement rages both within countries and among nations and includes computer models, new technology, economics, politics, policy, and activism. Russia, China, India, and African nations will **not** be able to achieve net carbon zero by 2040 to 2050 as stipulated as a goal in the U.N.'s informal climate agreement.

We can see from some of the above raw statistics that "Energy Transition" (ET) is complex and means something quite different to a developing country like India, an undeveloped country in sub-Sahara Africa, or a developed country like the Netherlands. Despite developing the most wind power and at times excess electricity production, the Netherlands still had to depend on imported nuclear power from Sweden this past winter season. Germany made the colossal mistake of becoming 50% dependent on Russian oil and gas and was in the process of shutting down the last of its three nuclear plants before the Ukraine/Russia war. Renewables alone do not work unless utility scale battery storage becomes feasible, affordable, and distributable on massive scale. German electricity costs are now among the highest in Europe, restricting their dominant manufacturing industries. Germany will accelerate its withdrawal from dependency on Russia for oil and gas by importing U.S. liquified natural gas (LNG). However, the pace of this withdrawal is glacial, suggesting that Germany may still be dependent on Russia for 40% of its energy needs by 2030. Also, in a reversal, the EU will now accept new nuclear plants as "transitional activities" in order to move away from Russian oil and natural gas.

ET is not new, as Daniel Yergin discusses in **The New Map.** It took hundreds of years for the first ET that began in Britain with the shift from wood to coal. It was not until 1900 that coal supplied more than half of the world's energy demand. Although oil was discovered in Pennsylvania in 1859, it took another 100 years until 1960 for oil to supplant coal as the world's dominant energy source. Since 2000, natural gas has been the driving force behind the reliable electrification of the grid, up 60% in 20 years. Global electrical consumption is estimated to grow 60% again by 2040. Electrification of the U.S. will require more natural gas production and pipelines to provide predictable power. The U.S. still gets CO_2-free nuclear power for 20% its energy. More than 60 research projects are being funded to develop smaller, modular nuclear power plants to serve smaller population concentrations. The Gates Foundation is funding one of the more ambitious projects. Many now realize that affordable and safe modular nuclear is a game changer in the long-term CO_2 challenge.

Battery Storage Wars

Battery makers from China, Japan, South Korea, U.S., and Europe are all vigorously competing to win the storage wars by trying to solve the energy density conundrum**,** or the amount of electricity that can be stored in the battery to provide longer range. However, unless there is a dramatic breakthrough, most of the EV's coming to the market in the next five to ten years will be powered by small upgrades of the two types of lithium-ion cells currently on the market. The first type of lithium-ion cells uses cobalt, nickel, manganese, graphite, lithium, and aluminum in its cathode**.** What is the problem with this type of battery? Cobalt is the most expensive of these six metals at $80,000/ton, up 16% in 2022. The price of lithium is up 1000% in a year. Who owns and refines the cobalt is a major problem: 70% of world Cobalt is located in the Democratic Republic of the Congo (DRC), China refines 65% of the world's cobalt, 50% of the world's lithium, and 80% of the world's rare earth minerals. Key major sources of copper and lithium are in South America and major nickel sources are from Indonesia. Reducing the amount of cobalt or finding a substitute is a priority for many battery manufacturers. Currently GM's major battery focus is the new Ultium NMCA cells, which use 70% less cobalt and more nickel and aluminum.

The second cell type for EVs will use lithium-iron phosphate (LIFP) cathodes, now the focus of the Chinese because they cost less, use abundant minerals, and are less flammable. These batteries are practical for use in the lower-range and least expensive EV's (Tesla Model 3).

In conclusion, it is clear that some of the challenges of a **fast** track to a wholesale transition run up against major obstacles These new technologies are expensive and will not reach scale for three to five years out, and even if successful. For an extended time, world energy demand will be met by fossil fuels because of the huge scale and cost of the energy systems that are needed to support the modern world economy, for both developed and undeveloped nations. The major requirements to success include comprehensive solutions to: technology to build utility scale batteries so that they can store electricity for days and weeks, not hours; establish new mineral mines (five to ten year time frame); control the as yet unquantified, environmental impact of both mining and refining the very large quantity of specialty metals and minerals required; the cost of these mineral resources for solar, wind and EVs; determining how to avoid the disruptions (blackouts) that come from "intermittency"; and mitigating the inevitable conflicts that will come from requiring high energy "reliability", and "stability" during unexpected events (weather). Undoubtedly, technology breakthroughs will bring long-term solutions to this next worldwide energy transition with patience.