3rd Quarter Commentary:

Abridged Summary

October 2020

This Abridged Summary condenses a more complete response to the urgent questions many investors have asked about energy stocks. They fear the fossil fuel divestment movement and rapid growth of solar and wind power presage a permanent collapse in oil and gas use, and perhaps a near elimination of fossil fuel use in the next few decades. The term "stranded assets" has been used.

That is not going to happen. The great risk, actually, is the opposite: a near-term oil supply shock that could initiate an extended inflationary period. How do you turn that 180°, from the consensus viewpoint of oil *collapse* to oil *shortage*? It just requires knowing some essential and eye-opening facts about this very complex topic area, facts that are almost completely absent from everyday reporting.

To make best use of this Abridged Summary, it is important to understand its limitations. People want quick answers, but sometimes the best answers take a little longer. The full 32-page report was comprised mostly of relevant facts, not assertions or arguments, yet, even at that length, it was incomplete. This Abridged Summary is, well, just a summary.

> I am sorry to have made such a long speech, but I did not have time to write a shorter one.
> *Winston Churchill*

The importance of the long answer is that most of the everyday reporting about the displacement of fossil fuels is just *assertions*; they rely on a few observations, but exclude some of the most essential facts about how basic processes work.

Example: A new solar or wind project often requires pairing with a new fossil fuel plant to ensure continuous power during periods when output drops. Or: U.S. natural gas consumption just reached an all-time high, partly for this reason, despite the deepest recession in generations. Or: the most comprehensive 20- and 30-year projections of global energy usage, by domestic and international government agencies, show rising renewable energy *and* rising oil and natural gas use.

A great many similar critical facts are missing from common understanding about the near-term fate of the energy sector and about limiting factors to the growth rate of alternative energy sources. The challenge to this understanding is that if our answers are too short, they would sound much like – and hold no more authority than – the assertions one hears elsewhere and which are often devoid of basic research or factual grounding.

The *facts themselves* are what is revealing, not the assertions. Confidence in any point of view – the kind that comes with the ah-hah moment upon reading a certain fact, that transforms it into information, makes it your own – can only come from the longer answer.

That is the limitation of this Abridged Summary: to serve the goal of concision, it has been stripped of much of the animating data in favor of summarized conclusions. The hope is that it is still sufficient to reveal the enormous information divide in this topic area – information advantage is how the best investments are made. For this reason, references will be made to the associated page numbers in the original report, as well as to relevant charts in the appendix to this Summary. That is where the reader will find the animating data.

Finally, this report is not about the imperative to develop and use any and all renewable energy technology that will assist in reducing carbon emissions on our planet, which I fully advocate. If my intended audience were environmental advocates rather than investors, the fact-set would be the same, even if the narrative arc might bend toward a different set of actions. Knowledge enables.

Section Guide to the Condensed Report

Section I – The Reference Case Studies

20- and 30-Year Projections from the U.S. Energy Information Administration, Int'l Energy Agency, and BP *Energy Outlook:*

- Population and per-capita GDP growth in developing nations offset global energy efficiency gains.
- Total energy demand in the next 30 years increases nearly 50%.
- Oil and natural gas use are maintained or *increase* for decades.

Section II – Some Facts About: Renewables = Interruptibles, Renewables ≠ Fossil-Free, & Limiting Factors

- Wind and solar power's interruptibility limit their use for baseload, on-demand capacity.
- Wind and solar must be paired with an always-on fossil fuel plant, which can *increase* demand for natural gas.
- Solar and wind plants cannot be built (silicon wafers, steel, cement, fiberglass, copper, etc.) without:
    - Intense fossil fuel-based energy for heating raw materials to their melting points;
    - Carbon (coal) to facilitate chemical reactions;
    - Refined petroleum products (plastics).
- Land is a limiting factor in utility-scale solar due to orders-of-magnitude lower energy intensity.

Section III – Other Limiting Factors, and Technological Advances

- Solar panels and wind turbines will require *multiples greater* supply of silver and other critical metals than the entirety of current global mining capacity.
- The U.S. electric grid is past its life expectancy. Power outage rates are increasing as renewables strain its ability to balance loads and avoid equipment damage. The spending gap to improve reliability and accommodate renewables is about 2x recently accelerated spending levels.
- Planned blackouts in California this August were a function of 1) increased reliance on solar panel power even as fossil fuel plants were retired, and 2) the inability to import power because neighboring states also retired fossil fuel power capacity.
- New transmission line permitting is so difficult it can take years, and major projects have been abandoned.
- Water demand for utility-scale solar projects, to clean dust from panels, can be a limiting factor and can damage aquifers and farming.

Section IV -- Energy Demand & Supply: The Universal Field Theory of Asset Prices

- The price of natural gas is now 40% higher than at year-end, 20% higher than 12 months ago. During the 1st week of August, it rose 25%. That is a preview for oil. Why?
- *Supply*: supply is down, because oil drilling activity is down, while gas storage capacity/inventory is limited.
- *And Demand*: Natural gas consumption set all-time records in the most recent two months and rose 2x faster than GDP in the past 15 years. Consumption is up 3.5% this year.
- Only slight supply/demand imbalances are needed for extreme price changes. Most of oil's 75% drops and 100% rises in recent decades were associated with just 1% or 2% inventory variations.
- Oil supply is dropping sharply and will continue to drop: energy companies' spending and the U.S. rig count are both down 75%. This is a structural issue involving oil-field geology, permitting, financing, and oil pricing, and cannot be changed for many years, perhaps decades.
- Demand, on the other hand, is already recovering. Once oil's always-firm demand intersects with available supply, there will be a momentary equilibrium. Any increases above that level will exceed supply capacity. Worse, supply will continue to decline.

Section V – Banning Fracking

- Not going to happen.
- "Fracking" is a simplified term that covers a half-dozen different drilling technologies. Most U.S. onshore wells involve some form of fracking.
- When regulators have 'banned fracking' they actually haven't:
  - Even in California, 'bans' have not really been bans. They either addressed one specific technique, but not others; applied only to new permits, not to existing activity; been only temporary, etc.
  - California issued more permits in 2019 than in 2018, and more in 2020 than in 2019.
  - Why? Fossil fuels are critical to silicon wafer production, which is critical to California's largest single manufacturing sector, Computers & Electronics, as well as to solar panel manufacturing.
- In Feb. 2020, the U.S. finally became a net energy exporter. That was an enormous shift in geopolitical influence, including the power to influence climate policy. A fracking ban reverses that: Russia & Saudi Arabia will make up the supply deficit and benefit mightily, a retrograde shift requiring decades to overcome.
- If fracking were banned on Federal lands:
  - It could cost up to 1 million direct oil field, midstream and service project jobs.
  - Make catastrophic an already-pending oil price shock by removing almost 4% of global oil supply.
  - It would be a boon to Texas Pacific Land Trust as one of the largest *private* landowners in Texas.

Section VI – Are All Investors Leaving Oil?

- Energy ETFs are down 50%, yet are now receiving enormous money inflows.
- Informed, strategic buyers are now making major acquisitions, and specifically in the Permian Basin where Texas Pacific Land Trust's assets are located.
    - In October 2020, ConocoPhillips paid $13 billion for Concho Resources. All of Concho's reserves are in the Permian.
    - In July 2020, Chevron paid $5 billion for Noble Energy. Noble has 92,000 acres in the Permian adjacent to or contiguous with Chevron acreage.

Two Assessments of Energy: 'The Market' and Fact-Based Investing

One of today's unique investment circumstances is the massive dislocation between energy companies' pricing and their demonstrable asset and business values. That's good for an investor, not bad. It results from two converging elements:

(1) The fossil fuel divestment movement's severe impact on the energy industry itself: **production expenditures, reserves and supply capacity are all in severe decline**; and
(2) Because of investors' mistaken belief that renewable energy can meaningfully replace fossil fuels within any practical investment planning time horizon, **energy stock prices are in severe decline.**

There are now strategic pathways to benefit directly from the massive dislocation in oil and gas pricing and supply capacity, and from the shocks from a shortage. Energy is the single most key commodity in the economy. It poses systemic risks if you lack exposure to it; it is a hedge and 'lifetime opportunity' if you have exposure.

> The numbers we have are not the numbers we need.
> The numbers we need are not the numbers we want.
> *Winston Churchill*

The fear about energy is understandable. Without better information – availability error – investors' default is always price, since price is always available. That leaves only two judgements: something's up (it's good) or it's down (it's bad). If price is all you have to go on, energy stock prices look scary. Judgment error also comes from false choices, such as isolated assertions ("There will be less demand for oil and gas!") that have no quantitative reference points, no specific time frames, no information about the mechanisms by which renewable power sources work, no consideration of the commodities required to manufacture solar or wind power, nothing about oil and gas supply sufficiency.

The balance between supply and demand tells you almost everything you need to know about which way the price of just about anything is headed. Adequate information is the only basis to understand a different outcome than simply a continuation of what's already occurred.
We have plenty of information and facts about energy. We've assessed them carefully, and we integrate new information into our understanding of the circumstances and valuations. This is how we learn about expected returns and we're very confident about it with respect to the energy sector.

We're contrarians. Not as a matter of style choice or posturing, but because we practice fact-based investing, and that looks very much like the opposite of the market when most investors move toward any extreme. We are not contrarian by *intent*; that's only an *outcome* of investing on the basis of information, not crowd-based investing approaches like momentum, arbitrary index weightings, or unqualified growth presumptions.

Section I: The Reference Case Studies

How rapidly will the demand for fossil fuels decline? To answer that question, let's start with three authoritative sources that use original source material and comprehensive methodology. Would you give more or less weight to these studies than other projections you might hear?

The U.S. Energy Information Administration (EIA)'s International Energy Outlook

The EIA published its 2020 *International Energy Outlook* in January, updated this month to include the effects of covid-19. Among the comprehensive list of projection inputs are detailed data on the constituent elements of energy demand growth and supply sources for developed vs. developing economies, population growth patterns, the impact of improved energy efficiency in different building types. It includes the market share of renewables (by source) in net electricity generation (reference case of 50% by 2050). Every projection includes a reference or base case, a low case, and a high case both for future oil and gas prices and for renewable energy cost curves. [*Page 12 in full report.*]

The EIA's main findings show seemingly incongruous trends. By the year 2050, renewables exceed the consumption of all other primary energy[1], yet primary energy oil and natural gas consumption still rise.

Oil remains the dominant energy source in global end-use energy consumption[2]. *[Appendix charts 1 & 2]*

How is this? A modest factor is population growth. More significant is the increase in per-capita GDP in poorer, non-OECD nations. That drives total energy consumption, offsetting the substantial efficiency improvements in energy and $C0_2$ consumption.

Irrespective of the gains in renewable energy production, global energy consumption is modeled to rise nearly 50% between now and 2050, with almost all of the increase occurring in non-OECD countries, and most of that from India and China. That is a very significant factor. *[Page 9 and Appendix chart 3]*

One might question whether political pressure affects EIA's work, since anyone who has ever worked with the annual compounding of multi-decade projections knows that the slightest alterations in one or two factors can totally skew the result.

The International Energy Agency's *World Energy Outlook 2020*

The International Energy Agency (IEA), a joint effort now including 30 nations, with an increased focus in recent years on clean energy technology and efficiency, published its 20-year projection last month.

The report models energy consumption through 2040, and employs three alternative global energy policies: a base-case scenario for carbon emissions targets, an accelerated version that includes the Paris Agreement, and a "net zero emissions by 2050 case." The models also include scenarios with greater or lesser use of carbon capture technologies and differing impacts of the Covid-19 pandemic.

The International Energy Agency's 20-year projections are not very different than the U.S. EIA projections. Oil and natural gas remain the largest sources of energy. *[Page 10 and Appendix charts 4 and 5]*

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[1] Energy at the natural resource end, before conversion or transformation.

[2] Energy that has been transformed from its primary, at-the-source form, and directly consumed by the user, such as gasoline (vs. unrefined petroleum).

British Petroleum's *Energy Outlook*

BP, as an oil company, has obvious vested interests. Still, its annual *Energy Outlook* is an informative and comprehensive data source. To the degree this alters one's assessment, BP has announced it will be a net-zero carbon emissions company by 2050, intends to build scale in renewables, hydrogen power, and carbon capture technologies and spend up to $5 billion annually in these areas.

The BP analysis arrives at much the same results. *[Page 12 and Appendix charts 6 and 7]*

Section II:

Some Facts About: Renewables = Interruptibles, Renewables ≠ Fossil-Free, and Limiting Factors

The three above reports show summary findings, statistical inputs and outputs, but are not truly explanatory. **Why could it take 20-plus years for oil and gas consumption to moderate or decline even as renewable energy production accelerates?** We have no special qualifications to explain that either, but we can provide some additional facts. *[Page 12]*

Interruptibility

Wind and solar power are interruptible, so they cannot operate alone without either on-demand fossil-fuels or effective energy storage. A new solar or wind project can entail *additional* fossil fuel use.

- **Wind turbines**: Onshore wind turbines typically operate only 25% of the time[3] and offshore turbines about 40%. An always-on 'shadow' fossil fuel plant must constantly burn fuel to accompany a new wind farm for uninterrupted in-feed power to the electric grid. The "peaking plants," that utilities can activate for anticipated peak usage and can pre-plan for, cannot meet this need. *[Page 13]*
- **Solar power plants**: Utility-scale solar in the U.S. operates about 25% of rated capacity.[4] Shadow or paired power sources are required to cover periods of power deficit.

Baseload always-on power plants that serve power-on-demand, whether for street lamps or the internet, is accomplished with fossil fuels, even when wind and solar power are operating. **That's why, even though over 75% of *new* U.S. electric generating capacity this year will be from wind and solar power, U.S. natural gas consumption reached all-time monthly highs in June and July, in the depth of a record economic recession. This is an astounding result in the absence of these informing facts.**

Wind and Solar Manufacturing and Fossil Fuel Consumption

Wind and solar power *operations* release very little carbon, but *manufacturing* them requires huge quantities of fossil fuels. They cannot be manufactured without fossil-fuel as 1) a critical part of their physical structure or 2) without using fossil-fuel-based energy in their manufacture. 3) The manufacturing

[3] Due to: periods of no wind, low wind speeds (power generation drops), too high wind speeds (turbine stops to avoid damage)
[4] Due to: day/night cycles, cloudy days, sharp drop-off in generation when the sun is not directly overhead (late afternoon and early evening, just as electricity demand begins to climb).

process also requires pure carbon as a chemical-process input that creates substantial amounts of CO_2. *[Pages 14 & 15]*

Solar:

- Solar panels are basically pure silicon semiconductor wafers. They require mining quartz (for the silicon dioxide) and three extremely intense heating processes, 2,500°F to 4,000°F, which requires fossil fuels.
- It separately requires, for a chemical process reaction, 550 lbs. of coal for every 1000 lbs. of quartz.
- Each panel, typically about 40 pounds, includes petroleum-based plastics for: the laminating layers, mylar for the backplate, and the plexiglass cover.

Wind:

- A 50MW wind power farm[5] uses 6,820 kilograms of steel and iron, and 21,230 kg of reinforced concrete. Concrete is needed to stabilize a 400-foot tower with blades that can be up to 160 ft. long
- The steel manufacture requires iron ore to be heated to 3000° F in a blast furnace fueled by coke (coal previously combusted in a high-temperature kiln).
- The concrete is made with cement, which accounts for about 8% of global CO_2 emission—almost as much as global agriculture and about one-third of all industry.
- The turbine blades are usually made of fiberglass. Glass manufacture is highly energy intensive, coal being used to melt silicon dioxide. The plastic that binds the glass fibers is produced from petroleum.

<u>The Energy Intensity Deficit</u>
Solar radiation is free, but the land for a utility-scale facility is not. A 100MW solar plant for 100,000 homes would occupy an area of about 2.5 sq. miles. Since solar can only operate about 25% of the time, the **100MW of planned output would require a solar farm land area 4x that size, or 10 sq. miles.**

A 147MW natural-gas power plant supports the city of Santa Clara, California and occupies 2.86 acres. That orders-of-magnitude difference in energy intensity between fossil fuels and renewables has limiting-factor implications for land and other resource costs and use.

A Deloitte study suggests that to meet a zero-percent emissions target, total solar and wind, including storage, would need to be at least 3x the *existing* global fossil fuel *baseload* capacity in order to compensate for the intermittency/capacity factor, and up to 8x peak capacity. That is a perhaps impossible scale. *[Page 14 and Appendix chart 8]*

Separately, fossil fuel-based energy intensity is required for manufacturing other key global-scale intermediate materials, from semi-conductor chips to construction cement and steel.

[5] Using Vestas V110 2MW wind turbines.

Section III:

Other Limiting Factors and Technological Advances

Solar Panels and Silver Supply

Solar panels require silver, the most conductive metal. By direct calculation, **replacing *today's* U.S. electric power production with solar panels could require at least 4.25x global annual silver mining production.**

In 2019, solar panel demand used 11.8% of all silver production, up from 6.1% in 2015. **Silver use for solar panels is expected to triple by 2050, to 35% of current global output, which would be almost as large as all other industrial demand for silver today. Meanwhile, silver production in 2020 it is expected to be 10% below the 2015 level. In can require many years, even a decade or longer, to expand supply in metals mining.** [*Page 17]*

Solar Panels, Wind Turbines and Critical Metals Supply

The Netherlands, a leader in the transition to renewables, commissioned a study on future availability of critical raw materials[6]. It found that **by 2050, Dutch demand for 6 critical metals for solar panels and wind turbines will exceed current global production. Dutch silver demand will to be 2.5x today's global silver production, and Dutch demand for neodymium and indium (used for turbine magnets and improving solar panel conductivity) will be 7x to 12x current global production levels.** *[Page 18 and Appendix chart 9]*

Electric Grid Insufficiency: Impact of Interruptible and Distributed Power Growth

The U.S. electric grid infrastructure earned a D+ from the American Society of Civil Engineers; most transmission and distributions lines have reached or exceeded their 50-year life expectancy[7]. The proportion of transmission disruption power outages rose to 46% in 2019, from an average 32% in the 5 years prior. Despite sharply higher spending, **the U.S. still requires about 2x the current level of spending to improve grid reliability and renewables access**. The spending gap is estimated at $208 billion in the next 10 years and $338 billion by 2039. *[Page 20]*

Renewable energy's unexpected complexities and strains are major factors in the grid's low grade. **Among them, renewables' interruptibility causes momentary power fluctuations. These factors create a challenge to maintaining voltage and frequency within acceptable limits and to preventing transformers from overheating during reverse power flow. The more renewables, the greater the strain and instability.**

At the world's largest solar power project in Pavagarda, India, a 2+ MW, 53 sq. km area, the power fluctuations created by clouds passing over the region are an increasing challenge for the electric grid operators, which must counter the variations with coal-fired and hydropower plants. *[Page 18]*

Transmission Grid Strains

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[6] https://www.metabolic.nl/publication/metal-demand-for-renewable-electricity-generation-in-the-netherlands/

[7] https://www.asce.org/uploadedFiles/Issues_and_Advocacy/Infrastructure/Content_Pieces/Failure-to-Act-Energy2020-Final.pdf

California, the policy leader in green energy, provides a window into the near future of integrating renewables. California has been an intensive deployer of new technologies to create a "smart grid" to ameliorate grid instability, including installing smart meters in almost every home and expanding technologies like smart charging electric vehicles. Nevertheless, California accounts for 33% of the national grid spending gap.

Rolling blackouts to swaths of customers were required in California to avoid system collapse in August. The grid system operator had to shut off power partly due to the simultaneous increase, in recent years, in renewables while the state retired 5,000 MW of gas-fired power capacity. Among other issues, electricity from the state-wide fleet of rooftop solar panels dropped to zero on hot evenings when air conditioning demand rose, when there is less gas-fired capacity to make up the deficit. **Importing out-of-state power, an ordinary back-stop, was constrained because neighboring states have also retired base-load fossil-fuel plants.** *[Page 21]*

Permitting Issues: The Electric Grid

New transmissions lines are required to accommodate the geographically dispersed sourcing of renewables power, but interested parties at the state and local level can delay or even prevent federal regulatory permitting.

Last year, for example, the New England utility Eversource abandoned a project to bring Massachusetts 1,092 MW of Canadian hydroelectric power, after spending 7 years and over $300 million. The project required approval from the DOE (importing the power), the Dept. of Interior (crossing a national forest in NH), two states (NH and MA), and private land owners (crossing private land). Local residents and conservation groups filed law suits to protect state park lands, there was state-level political opposition, and eminent domain conflicts arose.

Solar Panels and Water Supply

The world's largest collection of solar power arrays, 2+ MW, occupies 53 sq. km in Pavagada, an arid area of India. One operator in that project has to use 1.6 million liters of water per month to keep 400,000 solar panels -- perhaps as little as 5% of the entire project – dust-free in a region that already overuses its groundwater supplies.

Power Storage

Battery storage is important to the ultimate success of renewables, and it is not yet available on the scale required. Only 500MW of the 1,300 MW of storage required by California by the end of 2024 is now available. The aggregate battery storage capacity necessary to replace the U.S. peaking power plants is immense, and battery production is carbon-intensive, with its own set of complex environmental impacts and production considerations.

CO_2 Capture Technologies: If CO_2 capture, utilization and storage technologies are successful, that could meaningfully alter demand curves for fossil fuel use and net CO_2 emissions.

- Norway is financing a €2.1 billion capture and storage project involving Equinor, Shell, and Total. Carbon from a cement factory will be buried in geological formations in the North Sea. The goal is 1.5 million tonnes/year.
- Scientists recently discovered how to turn CO_2 from power plants into rock for permanent storage. A pilot project of Iceland's Reykjavik Energy mixed power-plant-captured CO_2 with water and hydrogen sulfide and injected it into underground porous basaltic rock. It saw 95% of the CO_2 mineralize in 2 years, vs. an expected 8-10 years. They expect to increase CO_2 injections to 10,000 tonnes/year this year, with increases to follow. **Large** basaltic rock formations are off the coasts of SC, NY, NJ, and MA.

Section IV: Energy Demand and Supply, The Universal Field Theory of Securities Prices

The price of gas is now 40% higher than at year-end 2019, and 20% higher than 12 months ago. It rose 25% in one week in August, which is breathtaking. How is this possible during an oil oversupply crisis and global pandemic? Supply and demand. *[Page 23 and Appendix chart 10]*

Demand for gas set an all-time record in July. The annualized 15-year increase in U.S. demand for natural gas has been 2.6%, and year-to-date through July, it was 3.5%. *[Appendix chart 11]* **Yet, the U.S. 15-year GDP growth was only 1.1%/year.** Why has natural gas demand outpaced population and GDP growth, and why did it accelerate this year?

- Data centers have grown by at least 25% a year[8], supporting the 'cloud', which includes video streaming and AI. Data centers probably accounting for over 4% of all U.S. electric power consumption. At the same growth rate, they will be 8% of U.S. consumption in 3 years.
- The semi-conductor and alternative energy industries' growth rates have far exceeded GDP growth. Manufacturing energy intensity is very high.
- Renewables energy production requires paired fossil fuel generation, typically natural gas.

What explains this year's 40% price surge on a 3.5% demand increase? A large portion of natural gas production is a byproduct of oil drilling activity, which has collapsed, so **natural gas production is lower**. **Storage capacity for gas is lower** than oil as gas occupies much greater volume, so inventory supply is lower. Finally, **utilities secure supply during the summer for the winter heating season. That's firm demand.**

A shortage does not need to be extreme to create extreme price changes in a demand-inelastic commodity. Global oil consumption is remarkably stable, year to year; it is supply that varies. *[Appendix chart 12]* During the 2008 Credit Crisis, inventories exceeded their average level by 2.2% and oil dropped almost 80% to $30. But when global oil inventories went to a deficit of 1.8%-2.8% shortly after that, oil prices rose to around $100 /barrel for 4 ½ years. **Most of the 50% and 100% swings in oil prices in the past 15 years were associated with inventory variations of just 1% to 3%.** *[Appendix charts 13 & 14]*

[8] https://www.forbes.com/sites/forbestechcouncil/2017/12/15/why-energy-is-a-big-and-rapidly-growing-problem-for-data-centers/#2868bace5a30, Dr. Radoslav Danila

Oil Supply: This Year and Thereafter

After oil dropped below $60 in 2014, oil companies reduced exploration and production spending, because the returns at those prices were too low. **ExxonMobil is now spending 60% less on exploration and development than in 2014**. **Chevron is now spending 75% less than in 2014. Chevron replaced just 44% of its output last year, depleting its reserves, and Royal Dutch Shell just 65% of its output.**

The result: reserves are significantly lower than in 2014. Obviously, the U.S. rig count in recent years was too low to sustain reserves, **yet the rig count last week was almost 75% lower than in 2018 and 65% lower than Dec. 2019.** *[Page 26 and Appendix chart 15]*

Demand can recover quickly: April global oil and gas consumption was 21% lower than year-end, and it's now 'only' 7% lower. **But drilling activity, which also had an unprecedented decline, can't recover quickly**.

- The permitting process and the repair and replacement of equipment can be lengthy and expensive processes that sometimes make it uneconomic to reopen a closed well.
- **Even if permitted and repaired, a closed well might never return to earlier production rates, since shutting a well can damage the reservoir. Costs may make it uneconomic to reopen at all.**
- Oil field damage even occurs on sovereign-nation levels. Venezuela, with some of the world's largest reserves, produced about 2.6% of the world's oil in 2016, but due to U.S. sanctions it might now be less than 0.5%. Severe damage to reservoirs and oil field equipment is expected, and there are reports of former employees dismantling facilities for scrap metal. **Much of Venezuela's supply might be permanently or near-permanently lost.**

Oil's always-firm demand will eventually intersect with available supply. With just a slight additional increase in demand above that temporary equilibrium level, the supply will be insufficient. Worse, supply will continue to decline:

1. Because capital expenditures are declining.
2. In the absence of *additional* spending, new well production can decline as much as 50% in year one.

In the U.S. and globally, new supply could take a decade or more to develop. Financing for drilling is unavailable, so companies must rely on their own cash flow.

Recall that a 1% or 2% difference in the supply/demand balance can cause extreme oil price changes. A structural supply shortage is *not* reflected in the EIA and other agencies' forecasts. *[Appendix chart 16]*

Section V: Banning Fracking

'Fracking' – the singular term – way oversimplifies a complex topic, preventing informed decision-making. Again, California provides a case study:

- **In Oct. 2020, Gov. Newsom announced the intended phaseout of hydraulic fracking by 2024, but this is not actually a ban on 'fracking', *only on hydraulic drilling*, not the many other methods of injection drilling** (water flooding, steam flooding, cyclic-steam drilling, gas injection and air injection). **Also, *this applies only to new permits*, not existing activity.** *[Page 27]*

– **A November 2019 moratorium on fracking was terminated by the governor in April 2020, and *24 new permits were approved that day*. Each permit typically covers multiple wells and allows fracking the same well up to 100x or more**. That moratorium was not on 'fracking', only on high-pressure steam extraction, which the governor said was part of "the focus on clean energy sources." The ban only applied to new applications, not existing wells

– **California issued more drilling permits in 2019 than in 2018, and the number of new drill permits was higher in the first half of 2020 than in the first half of 2019.**

Economic and political realities influence these governing decisions.

– California regulators feared that halting ongoing steam injection drilling could damage the reservoir and lead to well failures and catastrophic oil spills.
– **Fossil fuels are critical to California's manufacturers of silicon wafers and semi-conductor computer chips for the Computer & Electronics Products industry, which is 2x larger than the State's next largest manufacturing segment.**

What if the U.S. bans fracking anyway?
1. **That's not going to happen.**
2. **If it does, it would be great for the strongest energy companies, particularly Texas Pacific Land Trust**.

The negative consequences of a fracking ban are too great. The California case study was a field test. **Even California, the U.S. standard-setter of progressive climate change policies, has to make calculated political and economic decisions.** *[Page 28]*

Geopolitically:

In February 2020, the U.S. finally transitioned from net oil importer to being significant oil exporter. *[Appendix chart 17]* **That is a strategic shift in the balance of U.S. geopolitical power, including the power to influence climate change policies. By June 2020, the U.S. reverted to net importer status**, because domestic production declined by more than the rest of the globe**. A supply deficit from near-term fracking restrictions would be made up by Russia and Saudi Arabia, to their great economic advantage, a long-term power shift that could take decades to undo.**

Most U.S. onshore oil and gas wells employ some fracking; banning fracking would be tantamount to ceasing onshore oil drilling. Only OPEC has onshore vertical drilling opportunities.

If fracking were banned on federal lands, then the U.S. would (among other losses):
– **Lose up to 1 million oil field and midstream and service project jobs** across Texas, Louisiana, Mississippi, Alabama, N. Dakota, Montana, Wyoming and Colorado.
– **Make catastrophic an already-pending oil price shock by removing almost 4% of global oil supply**.
– Create benefits for the largest, most profitable oil companies, which have the financial and reserve portfolio flexibility to make best use of any such changes.

Regarding TPL in this context, the federal government can only ban fracking on federal land, not TPL-owned land. TPL is one of the largest private land owners in Texas and about the 10th largest landowner in the U.S. Private land is state controlled, and Texas is a petro-state that needs money.

Section VI: Are All Investors Leaving Oil?

There is no such thing as "all investors." There is the general movement of most investors, and there are investors who have an information advantage (in expertise, access or research). *[Pages 29 & 30]*

Flow-of-funds

Despite the largest energy ETFs being down nearly 50% this year, they had combined investment inflows equal to almost 40% of their collective AUM. We don't know if those who invested that $5.7 billion are better informed or more expert than those who sold shares of those companies down 50%. We only know that they are moving differently than the preponderance of investors. *[Appendix chart 18]*

Informed Investors:

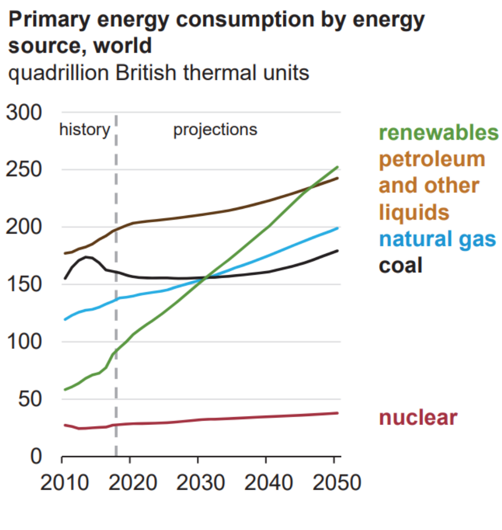
> If you're hunkering down for the long term, you want to hunker down in the Permian.
> *Daniel Yergin*

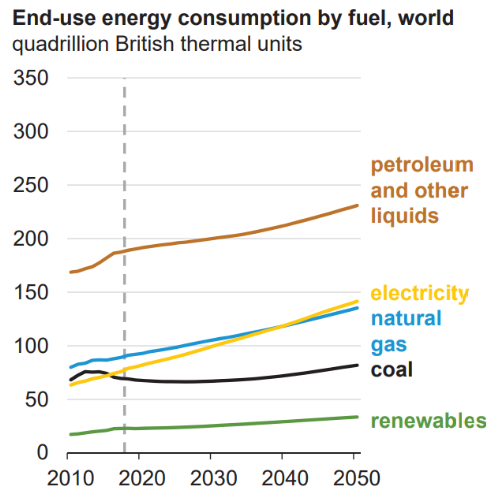
Strategic buyers within the same industry are assumed to have the greatest information advantage. It is common during severe downturns that the best-capitalized and most profitable companies acquire competitors at favorable prices. The energy industry calls it "buying reserves on the stock exchange." **Reserves and production ultimately concentrate in the strongest companies that can focus development in the lowest-cost, most productive reservoirs.**

- In October 2020, **ConocoPhillips announced it would acquire Concho Resources for $13.3 billion**, resulting in the largest "independent" oil and gas producer in the world, with access to 23 billion barrels of oil that can be supplied at less than $30/barrel. **All of Concho's reserves are in the Permian Basin, as are TPL's.** Conoco Phillips and Concho have complementary, value-enhancing acreage positions in the basin.
- **In July 2020, Chevron announced that it would acquire Noble Energy for $5 billion. Noble's assets are varied, but it has 92,000 acres in the Permian Basin** adjacent to or contiguous with Chevron's.

APPENDIX

Charts 1 & 2: Energy Consumption by Source and Fuel





U.S. Energy Information Administration

Chart 3: Global Energy Consumption Forecast Inputs

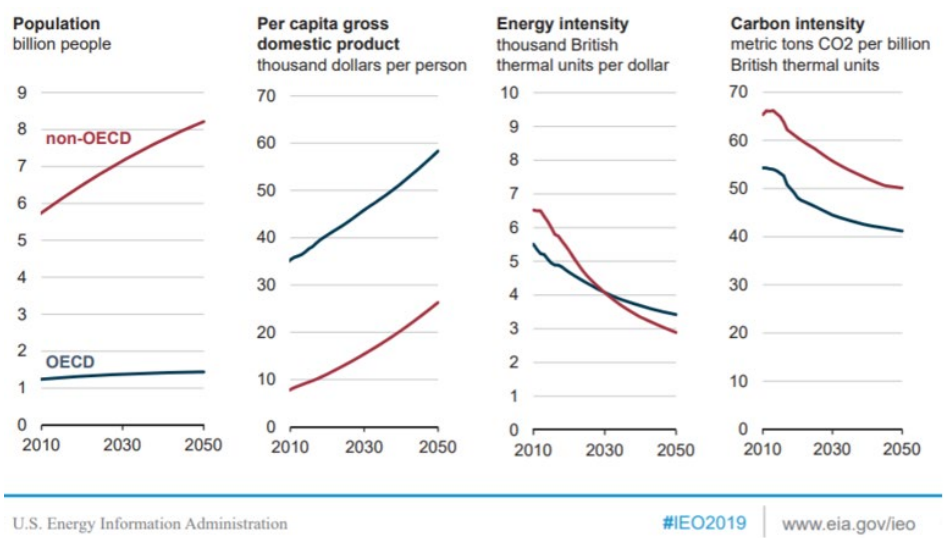


Chart 4: Projections for Renewables-sourced Primary Energy

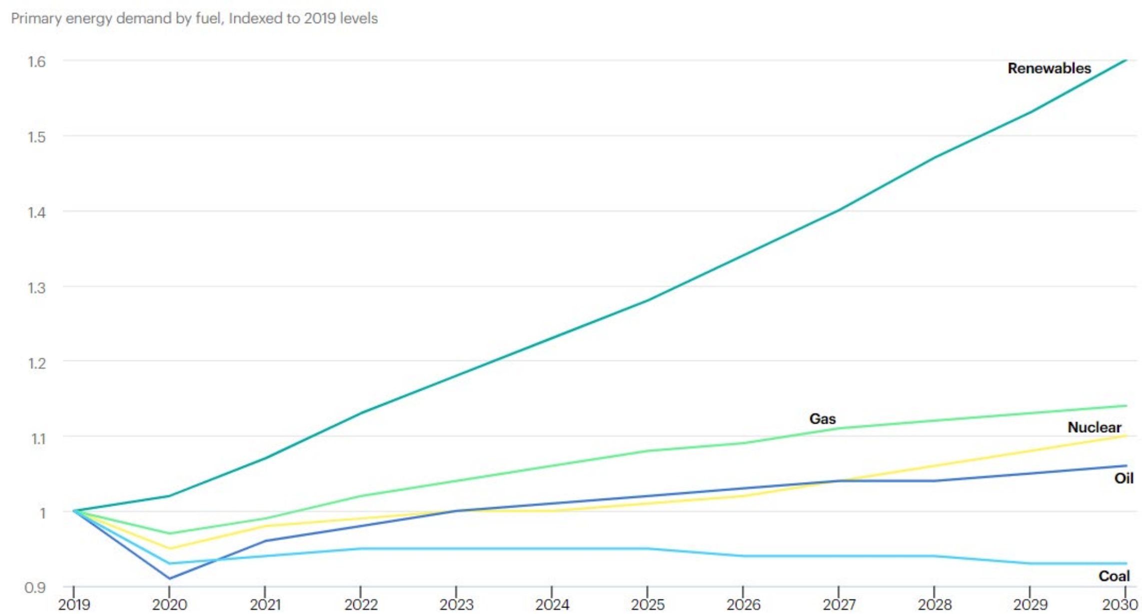
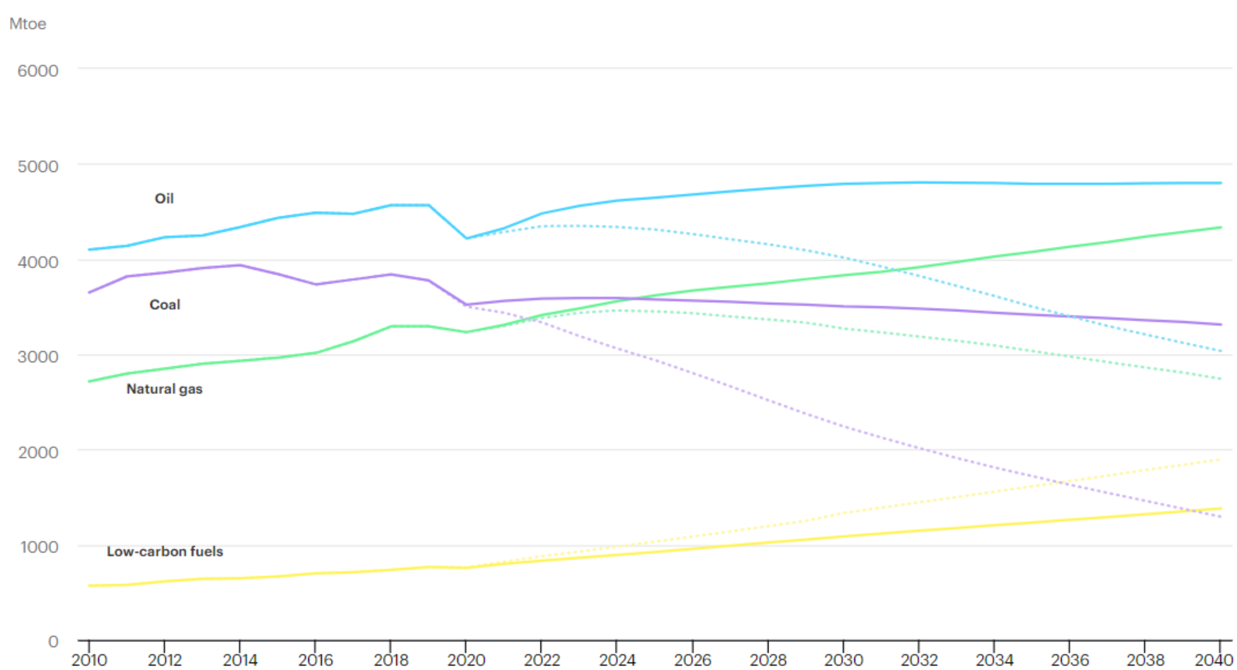


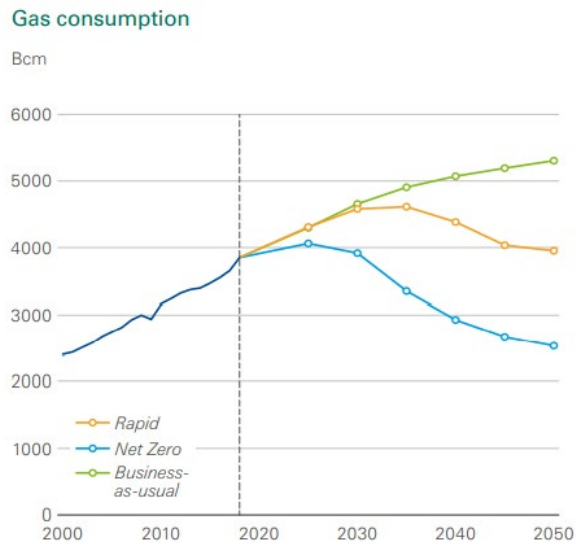
Chart 5: Future profile of the global fuel supply

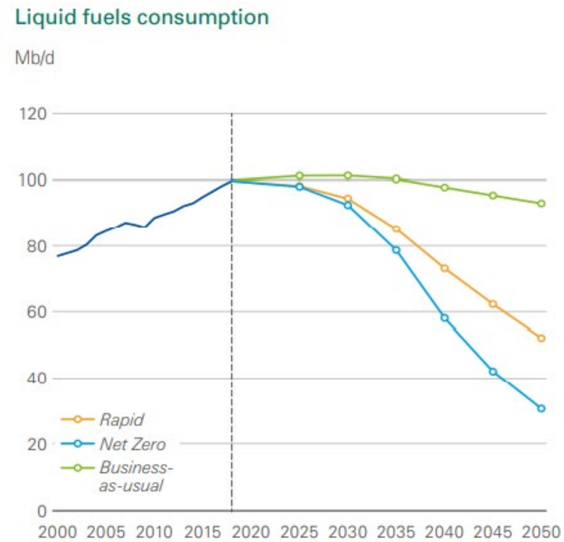


IEA, Global fuel supply by scenario, 2010-2040, IEA, Paris https://www.iea.org/data-and-statistics/charts/global-fuel-supply-by-scenario-2010-2040

Mtoe: Megatoe, or one million tonne of oil equivalent (toe)

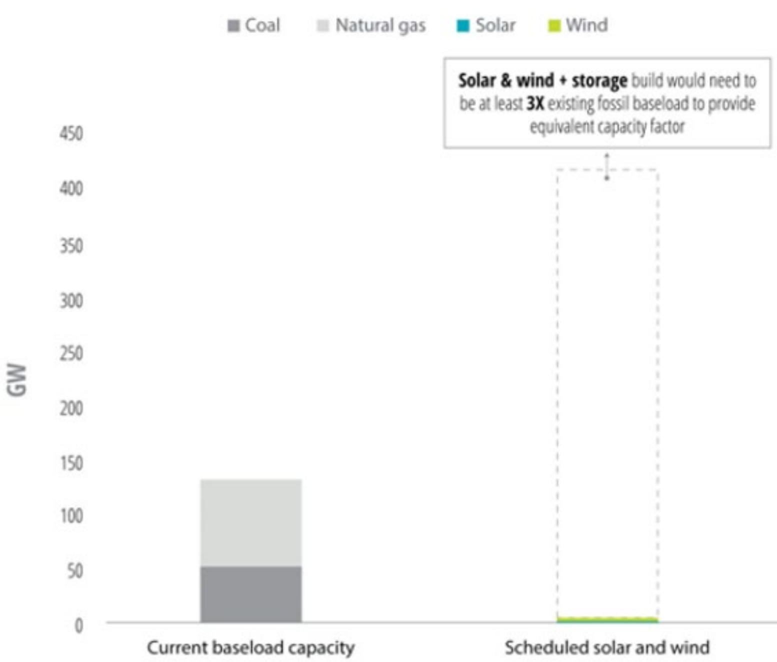
Charts 6 & 7: Gas and Liquid Fuels Consumption Projections





Source: https://www.bp.com/en/global/corporate/energy-economics/energy-outlook.html

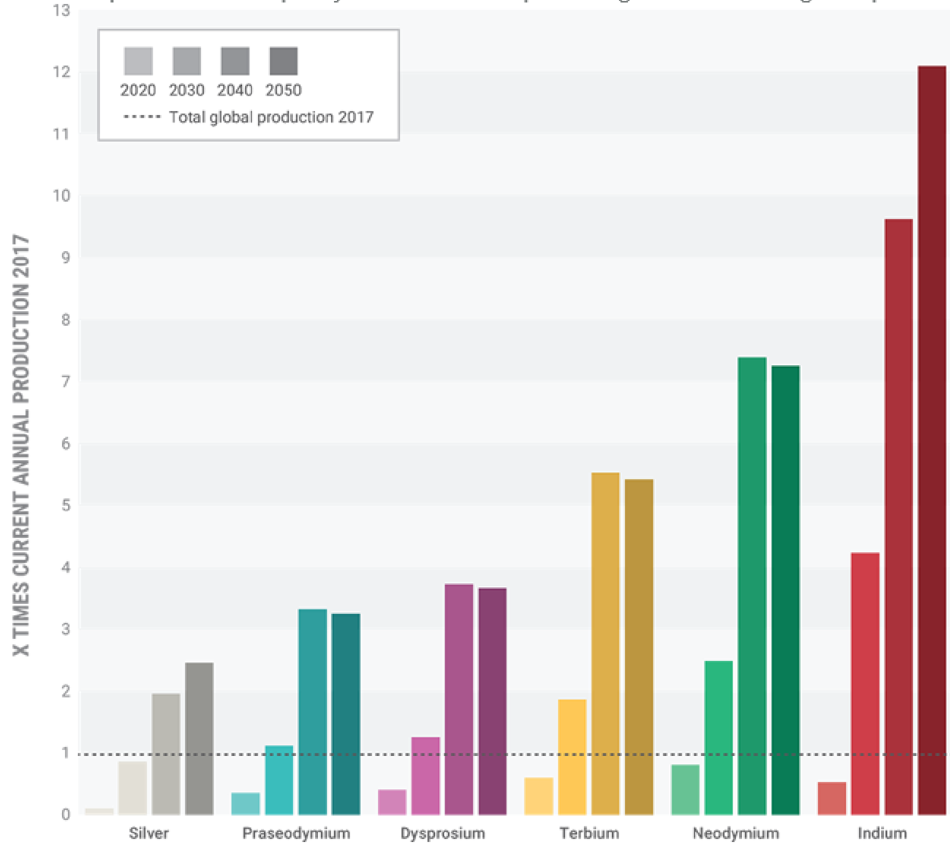
Chart 8: Solar & Wind Installation Needs to Meet Zero-Emissions Targets



Sources: S&P Global Market Intelligence; Deloitte analysis.

Chart 9: Renewable electricity targets

The renewable electricity targets [for the Netherlands] for 2030 serve as the starting point for the calculations. Based on these targets, the annual installed capacity is calculated. The metals required for this capacity are shown as a percentage of the annual global production.



Annual global critical metal demand for wind and PV, between 2020 and 2050, compared with the annual metal production index (2017 = 1).

Source: https://www.metabolic.nl/publications/metal-demand-for-renewable-electricity-generation-in-the-netherlands-pdf/

Chart 10: Natural Gas Prices

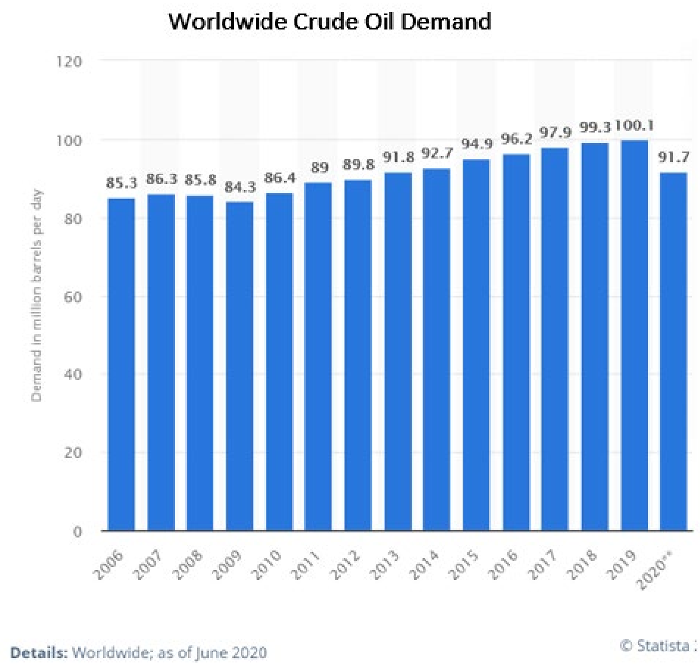
Source: EIA.gov

Chart 11: U.S. Natural Gas Consumption

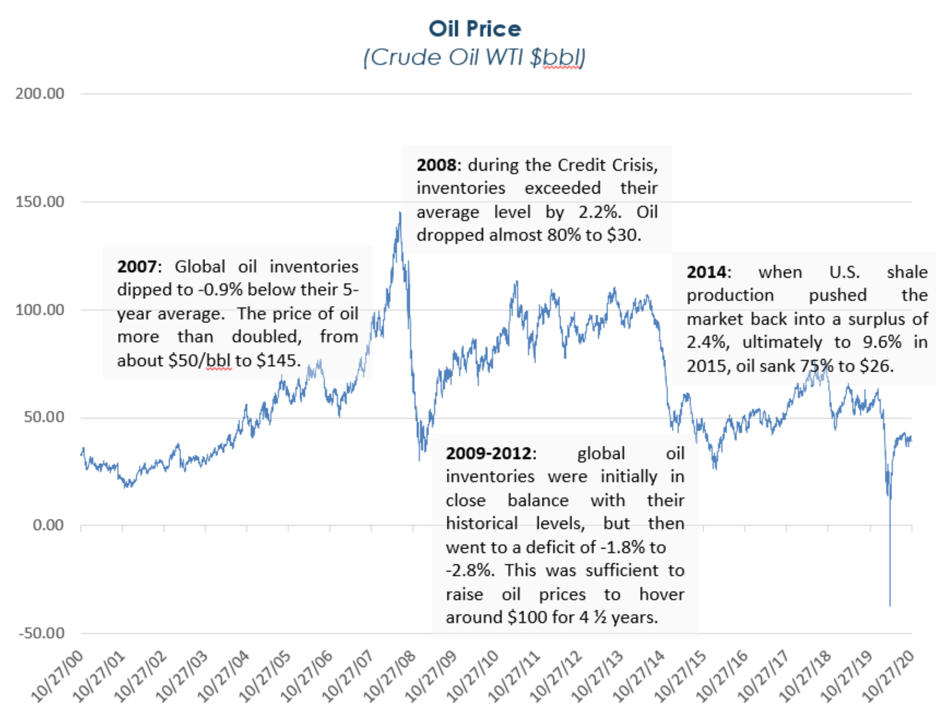
U.S. Natural Gas Consumption (mill. cubic feet)	
July 2005	1,686,609
July 2010	1,825,828
July 2015	2,067,714
July 2019	2,409,508
July 2020	2,494,702

https://www.eia.gov/dnav/ng/hist/n9140us2m.htm

Chart 12: Worldwide Crude Oil Demand



Charts 13 & 14: Oil Price and Inventory



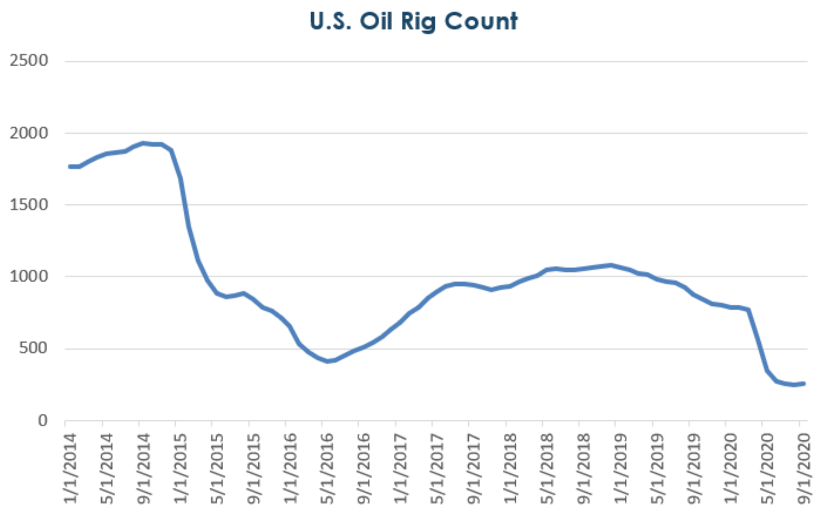
Crude Oil WTI /Global Spot NYMEX ($/bbl) Source: Factset

OECD Crude Oil Inventory
Surplus/Deficit Vs. 5-Yr Avg

2007	-0.93%
2008	2.25%
2009	0.29%
2010	0.41%
2011	-1.87%
2012	-0.21%
2013	-2.83%
2014	2.41%
2015	9.62%
2016	7.56%
2017	1.33%
2018	-0.45%
2019	-1.06%
2020	1.94%

Source: U.S. Energy Info Admin

Chart 15: U.S. Oil Rig Count



Source: https://rigcount.bakerhughes.com/

Chart 16: World Fuel Production and Consumption

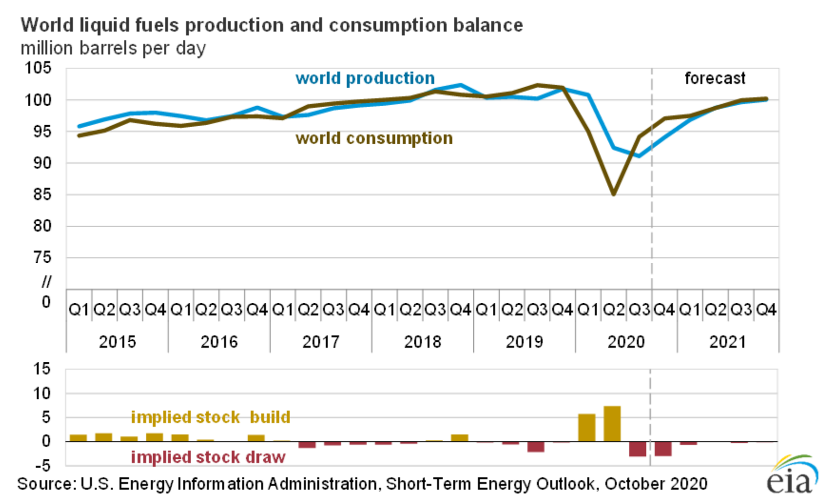


Chart 17: U.S. Net Imports/Exports of Oil

(000 bbl/day)	U.S. Net Imports	From OPEC	From Non-OPEC
Jun 2020	675	1,574	(899)
Feb 2020	(1,526)	902	(2,428)
2019	670	1,434	(765)
2018	2,341	2,580	(239)
2017	3,768	3,174	594
2016	4,795	3,221	1,574
2015	4,711	2,654	2,057
2014	5,065	2,996	2,070

Feb '20 to June '20 swing	2,201
Annual value @ $40/bbl, $ bill	$ 32.1

Source: EIA, Horizon Kinetics Research

Chart 18: Are Investors Leaving Oil?

($ mill.)	AUM at 10/9/20	YTD Return to 9/30/20	Net Inflows	Inflows % AUM	Price/ B.V.
Energy Select SPDR Fund (XLE)	$ 8,907	-47.6%	$ 3,396	38%	1.02
Vanguard Energy ETF (VDE)	3,100	-48.5%	878	28%	1.10
SPDR Oil & Gas Exploration (XOP)	1,813	-54.5%	734	40%	0.69
iShares Global Energy ETF (IXC)	852	-45.8%	648	76%	0.77
VanEck Vectors Oil Svcs ETF (OIH)	401	-63.1%	40	10%	0.56
	$ 15,072		$ 5,696	38%	

Source: Company reports, Horizon Kinetics Research

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