Pickering Energy Partners Investments

SAILINGSTONE CAPITAL PARTNERS LLC

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Inconvenient Truths

An analysis of the real-world implications of the Energy Transition with a focus on the opportunities and challenges facing capital allocators and policy makers.

October 19, 2021

The world is committed to achieving net zero by the second half of the current century. Hundreds of billions, soon to be tens of trillions, of dollars will be spent on carbon abatement solutions ranging from green ammonia to utility-scale storage to high-speed EV charging applications. In many ways, this level of commitment from capital allocators, consumers, corporations, lenders and governments is cause for optimism – the Energy Transition will be one the most capital intensive and complex of any undertaking in human history. However, it seems that policy and capital allocation decisions are occurring in an echo chamber, focused on what we wish to be true rather than what is possible based on a rational examination of economics and technology. In this paper, we examine the realities of the current situation as well as the unintended consequences of policy decisions. Our intention is to help create a more objective, fulsome discussion which is a necessary precursor to achieving the ultimate goal: a net-zero global energy system which supports the needs and aspirations of the world's population.

See important disclosures at the end of this report.

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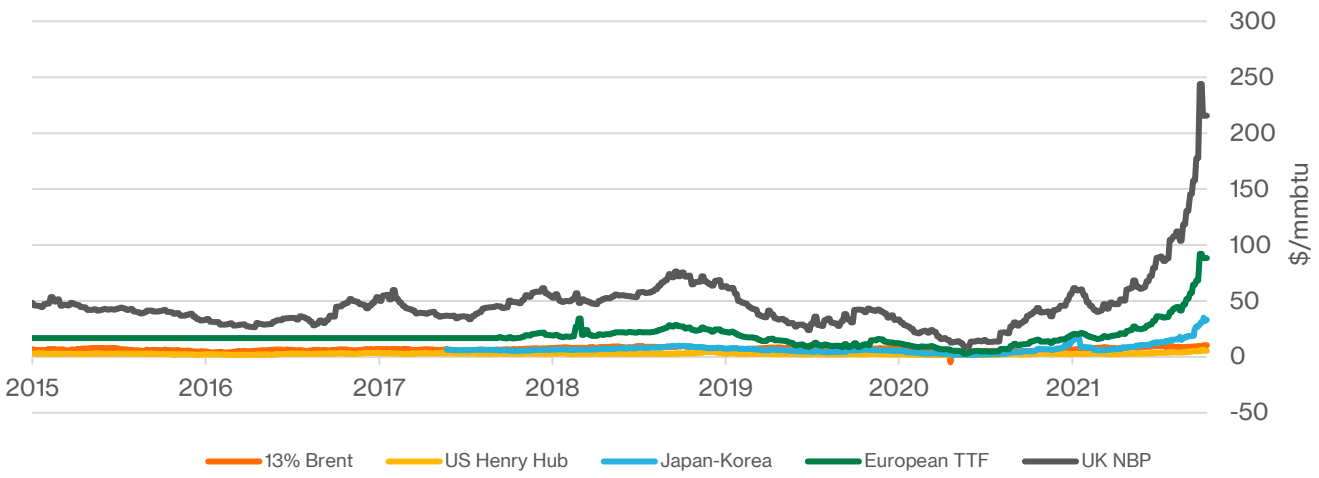
Inconvenient Truths

> ***If you don't know where you are going, you will probably end up somewhere else.***
>
> *-Laurence J Peter*
>
> ***For a successful technology, reality must take precedence over public relations, for Nature cannot be fooled.***
>
> *-Richard P Feynman*

INTRODUCTION

Natural gas prices are surging around the world, part of an emerging global energy crisis that is shaping up to be the worst in the last 50 years.

Figure 1 - Global Natural Gas Pricing

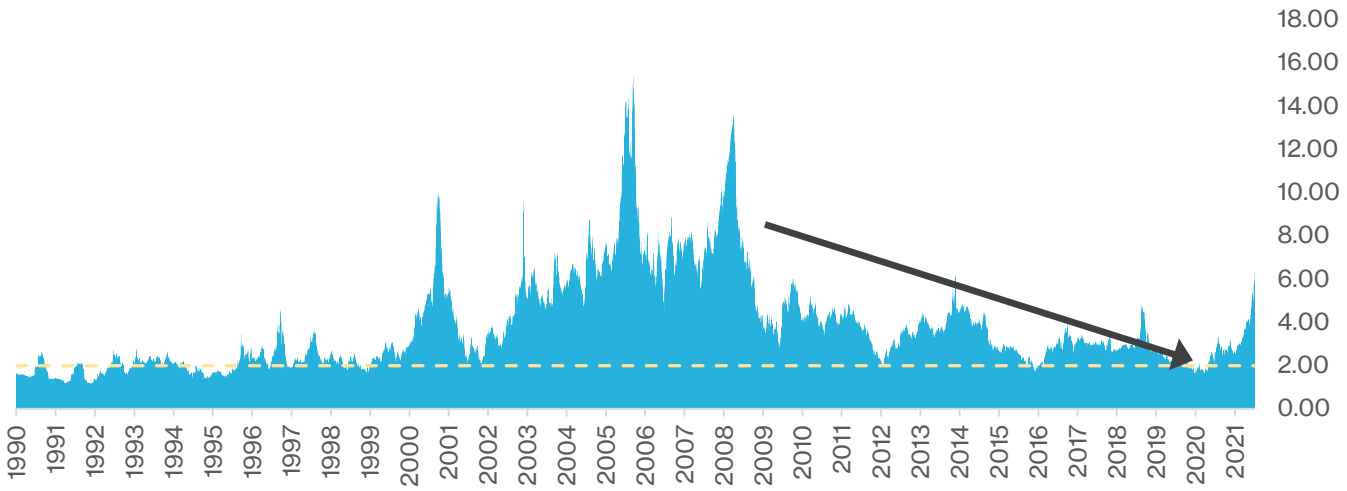


Source: Bloomberg; Bernstein Research, European Integrated Energy, October 6, 2021

The run-up in natural gas is spilling into coal and carbon markets, causing power prices to spike. This, in turn, is creating a series of knock-on effects, ranging from a sudden lack of carbon dioxide for food processing in the U.K. to government intervention in Europe to an emergency mandate for Chinese banks to prioritize lending to coal mines and power plants.

This is quite a turn of events. In 2020, U.S. natural gas prices hit the lowest levels since the mid-1990's, driven by the emergence of advantaged shale gas basins, the overcapitalization of the shale oil industry, and a short period of disequilibrium while incremental demand from LNG and chemical plants came online.

Figure 2 - US Natural Gas Pricing ($/mcf)



Source: Bloomberg

Fifteen months later, prices are at their highest seasonal level since 2008 as associated gas from shale oil has declined and as global demand for gas causes U.S. LNG facilities to run at full capacity. So much for "perpetual sub-$2.50 gas."

While prices and availability will normalize over time, the current environment exposes a number of realities which run counter to conventional wisdom and highlight the risks of allowing politics and ideology to interfere with scientific debate and economics. Specifically, there are three interrelated topics that deserve special consideration:

1. **Raw materials are integral to the Energy Transition**. Creating the energy complex of the future will require raw materials. In this piece, we'll focus on natural gas which is a key enabler to reducing carbon emissions today ***and*** keeping energy prices in check while we invest in the technology and infrastructure necessary to attain net zero in the future.
2. **The Energy Transition will be inflationary**. The inherent limitations of renewables, rising input costs driven by geology and capital scarcity (see point 3 below) and the introduction of carbon pricing will result in structurally higher energy prices going forward.
3. **The Hypocrisy of Divestment and ESG Investing.** Refusing to invest in responsibly sourced enabler commodities increases global emissions while exacerbating income inequality on a global basis, thus resulting in outcomes that run directly counter to the stated objectives of these policies.

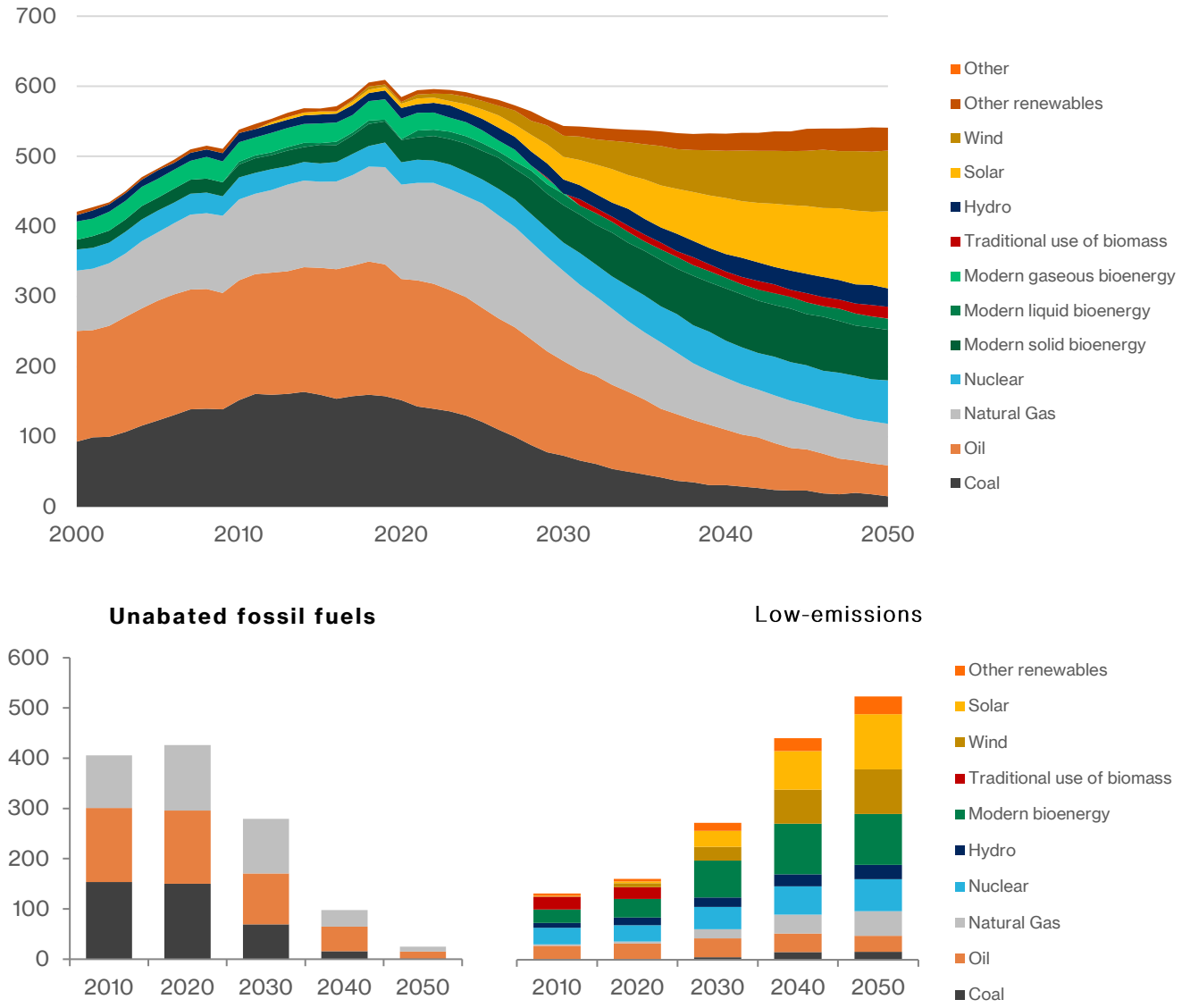
These issues are co-dependent and create a self-perpetuating cycle. There is no question that the Energy Transition will be material intensive, which tends to put upward pressure on prices. Beyond rising input costs, we believe that there are structural reasons that the Energy Transition will be inflationary as well. Finally, policy-driven capital constraints, no matter how well intentioned, only serve to amplify these inflationary pressures while simultaneously increasing global emissions and safety risks.

As is so often the case, those who can least afford it will end up being disproportionately impacted by these dynamics. We hope that this analysis serves as the basis for a sober discussion about the future of the Energy Transition, one based on data and cost/benefit assessments, not storytelling and hyperbolic arm waving.

RAW MATERIALS AND THE ENERGY TRANSITION – NATURAL GAS

Because natural gas is a hydrocarbon, generally it is assumed that the fuel must be either largely or completely removed from the global energy system in order to achieve long-term net-zero targets. For example, the chart below shows the IEA Net Zero Estimate scenario in which natural gas falls immediately from about 25% of total energy supply in 2020 to 15% in 2030 to less than 10% by 2050. This is rather remarkable, since today renewable power penetration is in its infancy and there is no technology that exists at scale to backstop the intermittent, non-dispatchable nature of solar and wind energy.

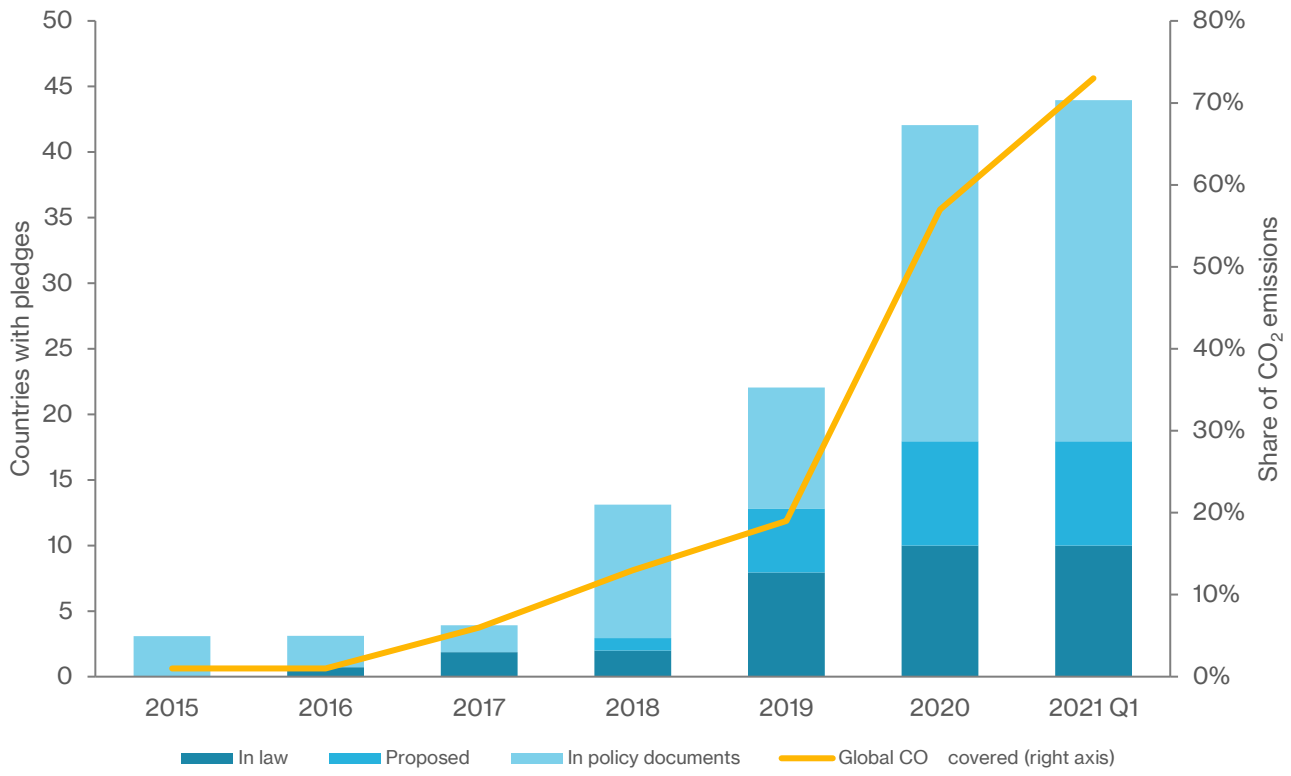
Figure 3 - Total Energy Supply - IEA Net Zero Estimate



Source: I.E.A
https://iea.blob.core.windows.net/assets/beceb956-0dcf-4d73-89fe-1310e3046d68/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf

Since the majority of the global economy has already committed to net zero, it is critical that we understand the ramifications of such a pivotal set of assumptions.

Figure 4 - Number of Countries and Share of Global CO_2 Emissions Committed to Net Zero



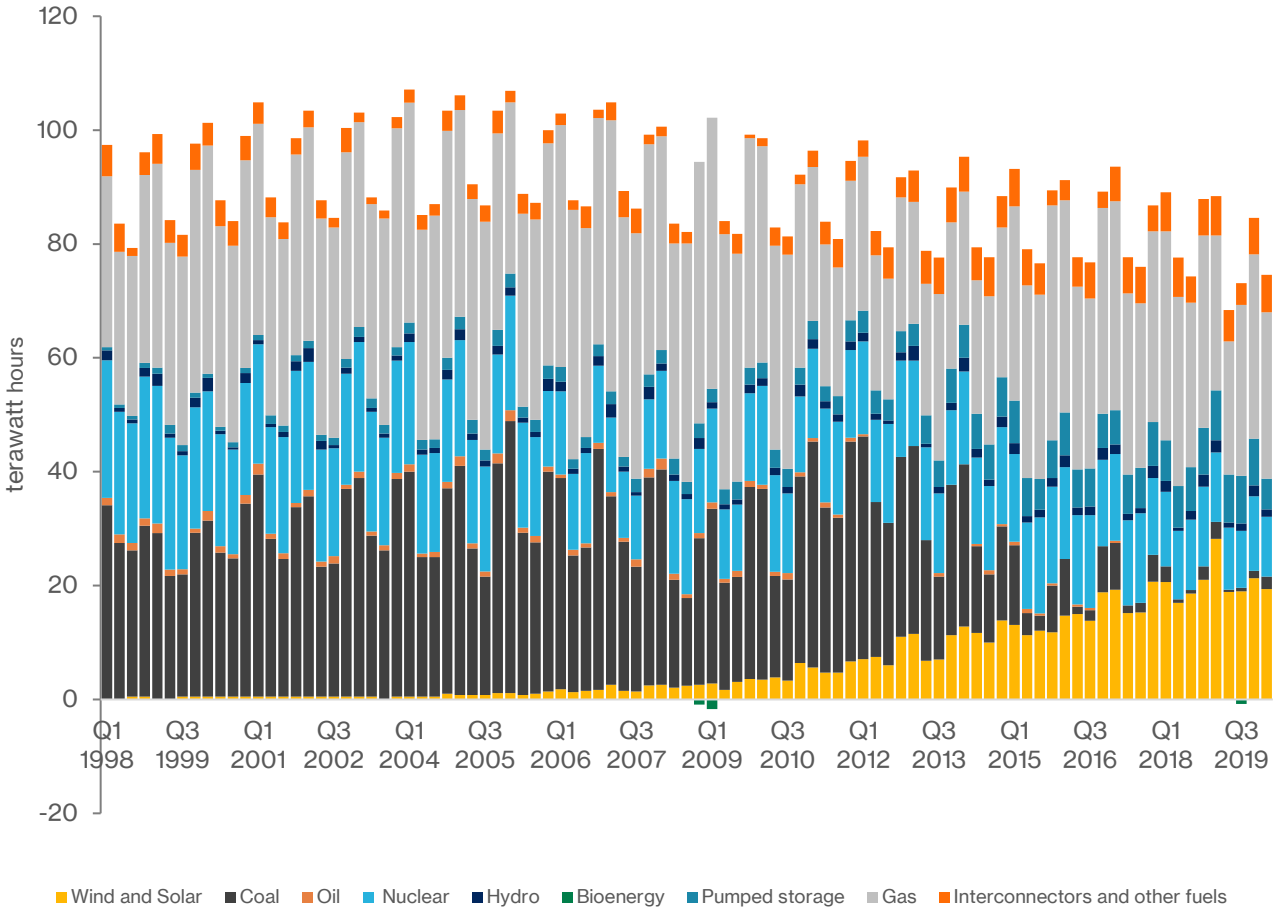
Source: Ibid

Just how feasible is it to remove, or at least drastically reduce natural gas from our energy systems? It seems that spreadsheet math is running well ahead of both technical feasibility and economic realities. The current U.K. energy crisis is an interesting case study.

U.K. Case Study

Renewables (largely wind) have displaced coal from the power stack over the last decade, increasing the reliance on natural gas-fired plants to provide base-load electricity since utility-scale battery storage solutions are in their infancy and nuclear power is only 20% of supply.

Figure 5 - UK Power Stack by Energy Source

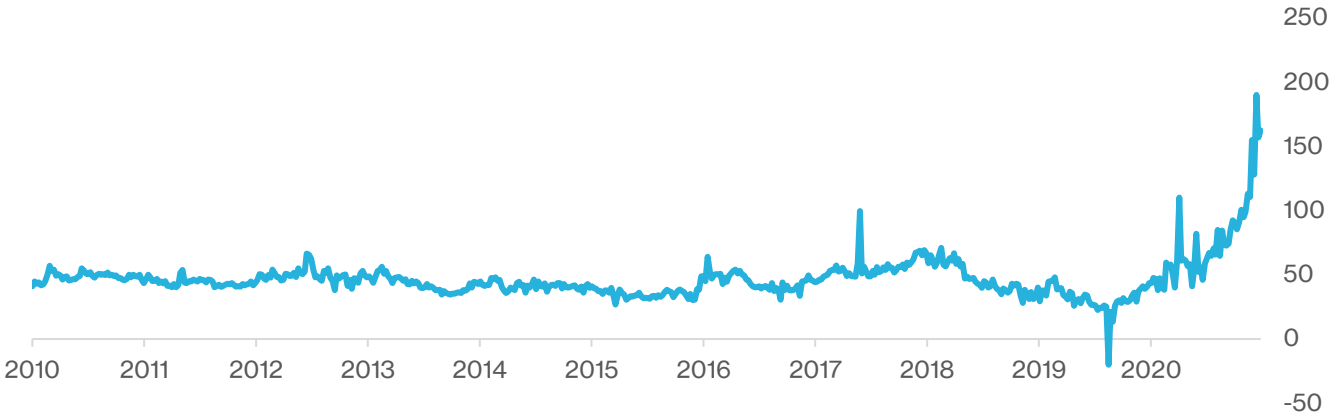


Source: Bloomberg

70% of the U.K.'s natural gas storage capacity was shuttered in 2017, with regulators expecting a combination of natural gas imports and new-build renewables to meet demand. Unfortunately, policy makers don't get to determine when the wind blows or what other countries' energy requirements may be at any particular point in time.

With limited storage capacity and domestic production falling more than 65% since 2000, the U.K. is reliant on LNG imports at a time when both Asian and European consumers also are actively bidding for volumes. U.K. retail customers are paying the price, with day ahead power prices 4-10x higher than historical norms.

Figure 6 - UK Day-Ahead Power Prices (GBP/MWh)

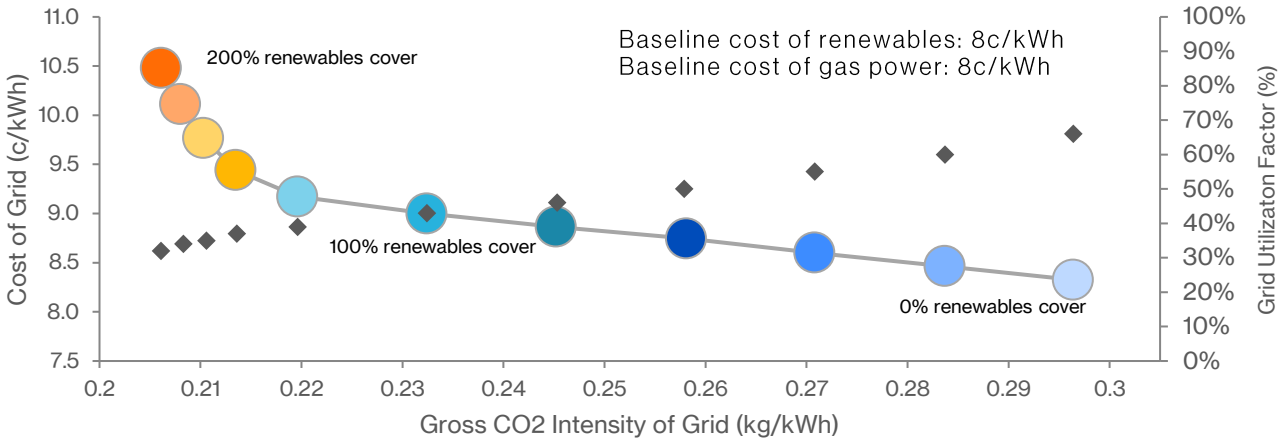


Source: Bloomberg

Renewables were supposed to fill the void, but the U.K. has endured a period of colder than normal weather and lower than average wind speeds. In the absence of dispatchable baseload power supply (natural gas, nuclear power, battery storage), renewables simply cannot be relied upon as a primary source of energy.

In fact, based on the most complete, objective analysis that we have seen, renewable energy likely is capped at about 25-30% of generation, after which intermittency and other real-world constraints cause power prices to increase with limited improvement in the emission profile and considerably more exposure to exogenous events...like calm, windless days.

Figure 7 - Energy Cost and Grid CO_2 Intensity Based on Renewable Penetration



Source: Thundersaid Energy, Power Grids: Tenet?, September 20, 2021

The reality is that absent widespread deployment and integration of utility-scale energy storage, or the sudden proliferation of nuclear power plants, the world cannot afford to simply wish away natural gas from our energy systems.

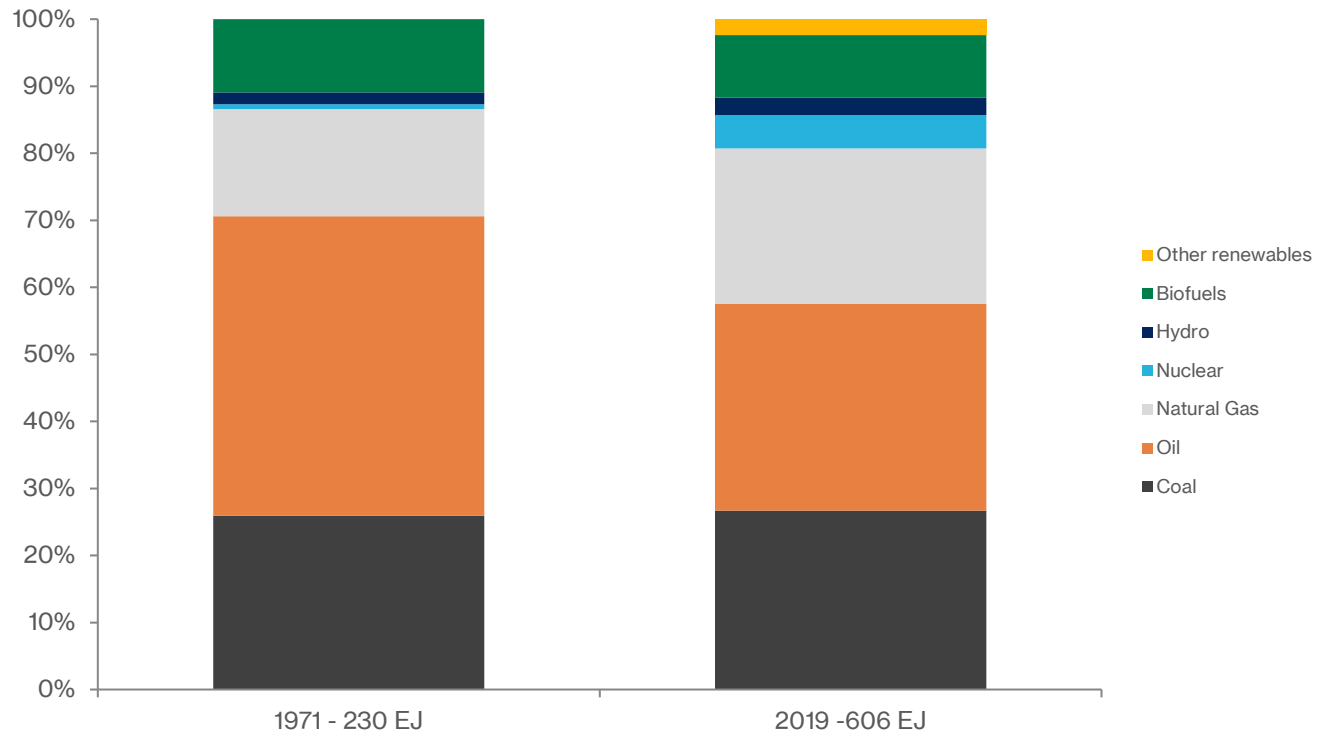
Natural Gas Key to Decarbonization Efforts

Whether it was Voltaire or Montesquieu, for the Energy Transition, the phrase "*le mieux est le mortel ennemi du bien*" is right on point.[1] There is a path to net zero, but as the U.K. example illustrates, a refusal to optimize what is possible today while simultaneously investing in the solutions of the future is increasing costs and accelerating permanent harm to our environment.

Fortunately, there are currently available solutions that can reduce carbon emissions immediately without handicapping economic growth in developing economies. One of the most impactful steps is to replace coal with natural gas in the global power stack.

Remarkably, coal has maintained its share of primary energy consumption over the last 50 years, while gas and nuclear power have usurped oil.

Figure 8 - Global Primary Energy Supply by Fuel

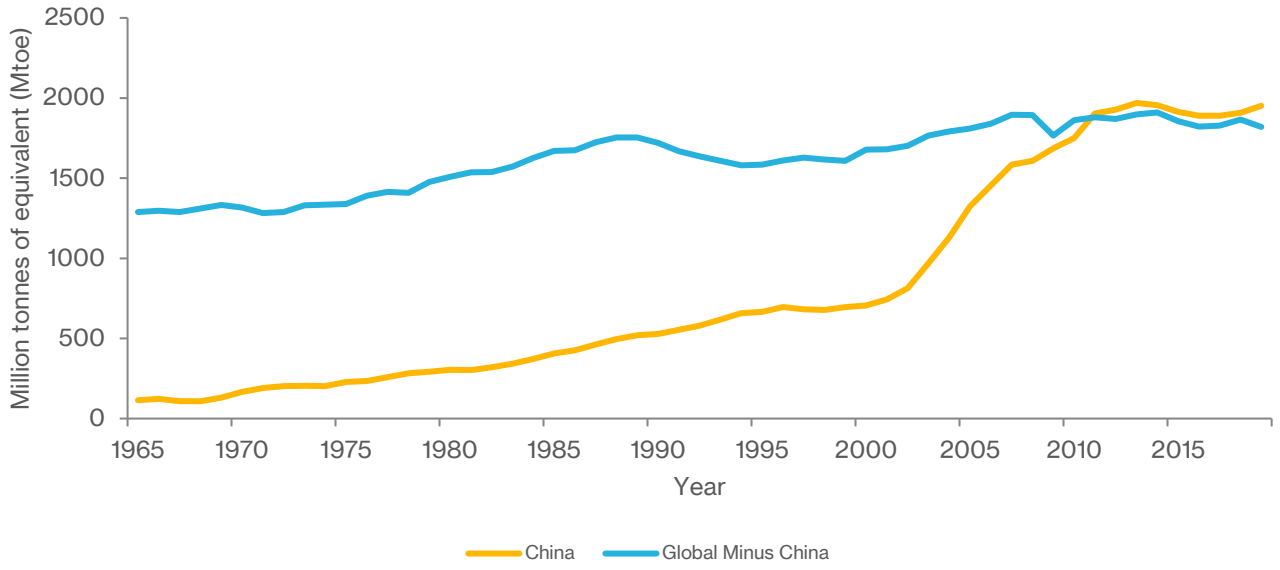


Source: IEA, Total primary energy supply by fuel, 1971 and 2019, IEA, Paris
https://www.iea.org/data-and-statistics/charts/total-primary-energy-supply-by-fuel-1971-and-2019

However, total primary energy supply has increased by 250% over the last 50 years, meaning that coal consumption has increased by a similar amount. China represents the bulk of that increase, as coal still constitutes approximately 60% of China's total energy consumption while natural gas is less than 10%.

[1] "The best is the enemy of the good."

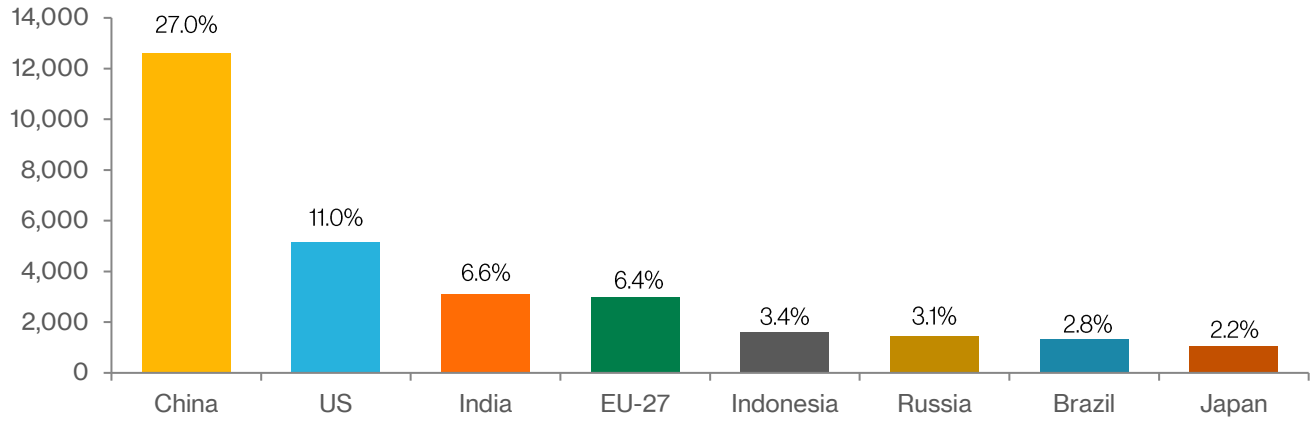
Figure 9 - China vs Global Coal Consumption



Source: https://chinapower.csis.org/energy-footprint/

Unsurprisingly, given the carbon intensity of coal-fired power and heat, China is also the world's largest emitter of CO_2, surpassing the OECD for the first time in 2019.

Figure 10 - 2019 Net GHG Emissions as Percent of Global Total (million metric tons CO_2 equivalent)

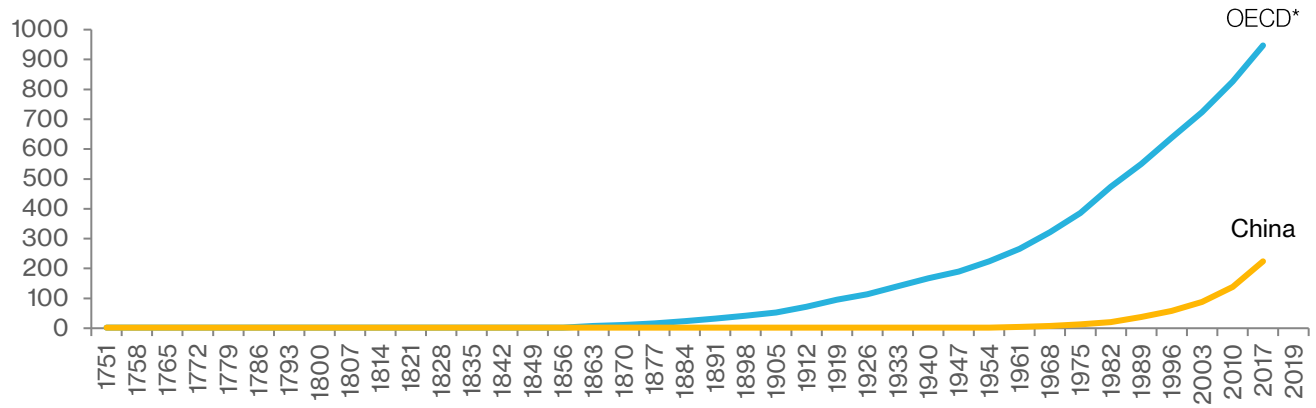


Source: https://rhg.com/research/chinas-emissions-surpass-developed-countries/

Why does this all matter? First, carbon dioxide is a permanent pollutant – it doesn't degrade over time. Per the EPA, "carbon dioxide's lifetime cannot be represented by a single value because the gas is not destroyed over

time, but instead moves among different parts of the ocean-atmosphere-land system."[2] While getting to net zero in 30 years is a wonderful aspiration, the reality is that we have a growing problem today.

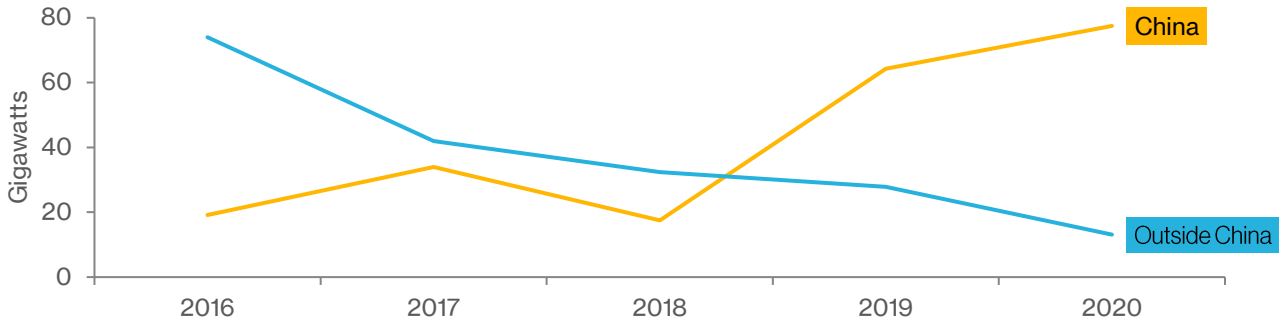
Figure 11 - Cumulative CO_2 Emissions from Fossil Fuel and Cement, 1750-2019 (gigatons)



Source: https://rhg.com/research/chinas-emissions-surpass-developed-countries/

That problem is being exacerbated by the fact that China built three times more new coal-fired capacity than the rest of the world combined in 2020, equivalent to more than one new coal fired plant per week, and initiated another 73GW of new coal projects, more than five times the rest of the world.[3]

Figure 12 - New Coal Plant Proposals



Source: https://globalenergymonitor.org/wp-content/uploads/2021/02/China-Dominates-2020-Coal-Development.pdf

China burned more than 50% of the world's coal in 2020. If coal is key to mitigating $C0_2$ emissions, China is at the heart of the issue.

The most expedient – and realistic – way to drastically lower China and other developing countries' emission profile is by displacing coal with natural gas. China's coal consumption generated about 20% of total global

[2] https://www.epa.gov/climate-indicators/greenhouse-gases
[3] https://globalenergymonitor.org/wp-content/uploads/2021/02/China-Dominates-2020-Coal-Development.pdf

emissions in 2020. Assuming that natural gas has about 50% of the carbon intensity of coal (a gross simplification given how inefficient the bulk of China's coal fleet is) simply switching from coal to gas would create an immediate 10% reduction in global emissions *every year*. For context, the COVID pandemic caused total global emissions to fall by 5.6% in 2020, but they are on the rise in 2021 as the global economy recovers.[4]

China prudently is creating a balanced power portfolio, expanding its nuclear and renewable fleet (in addition to building new coal plants) as a way to reduce its emission intensity while still supporting economic growth. Its reliance on coal is more a function of limited global LNG export capacity and the primacy of energy security than a statement about the climate.

Both in terms of economics and emissions, natural gas-fired power should be a preferred source of incremental supply since it can be built quickly with the lowest capital intensity and fixed O&M costs of any major power source, including renewables.

Figure 13 - Levelized Cost of Electricity - $/MW

Plant Type	Capacity factor (%)	Levelized capital cost	Levelized fixed O&M[2]
Dispatchable technologies			
Ultra-supercritical coal	*NB*	*NB*	*NB*
Combined cycle	87%	$ 7.00	$ 1.61
Combustion turbine	10%	$ 45.65	$ 8.03
Advanced nuclear	*NB*	*NB*	*NB*
Geothermal	90%	$ 18.60	$ 14.97
Biomass	*NB*	*NB*	*NB*
Battery storage	10%	$ 57.51	$ 28.48
Non-dispatchable technologies			
Wind, onshore	41%	$ 21.42	$ 7.43
Wind, offshore	45%	$ 84.00	$ 27.89
Solar, standalone[4]	30%	$ 22.60	$ 5.92
Solar, hybrid[4'5]	30%	$ 29.55	$ 12.35
Hydroelectric[5]	*NB*	*NB*	*NB*

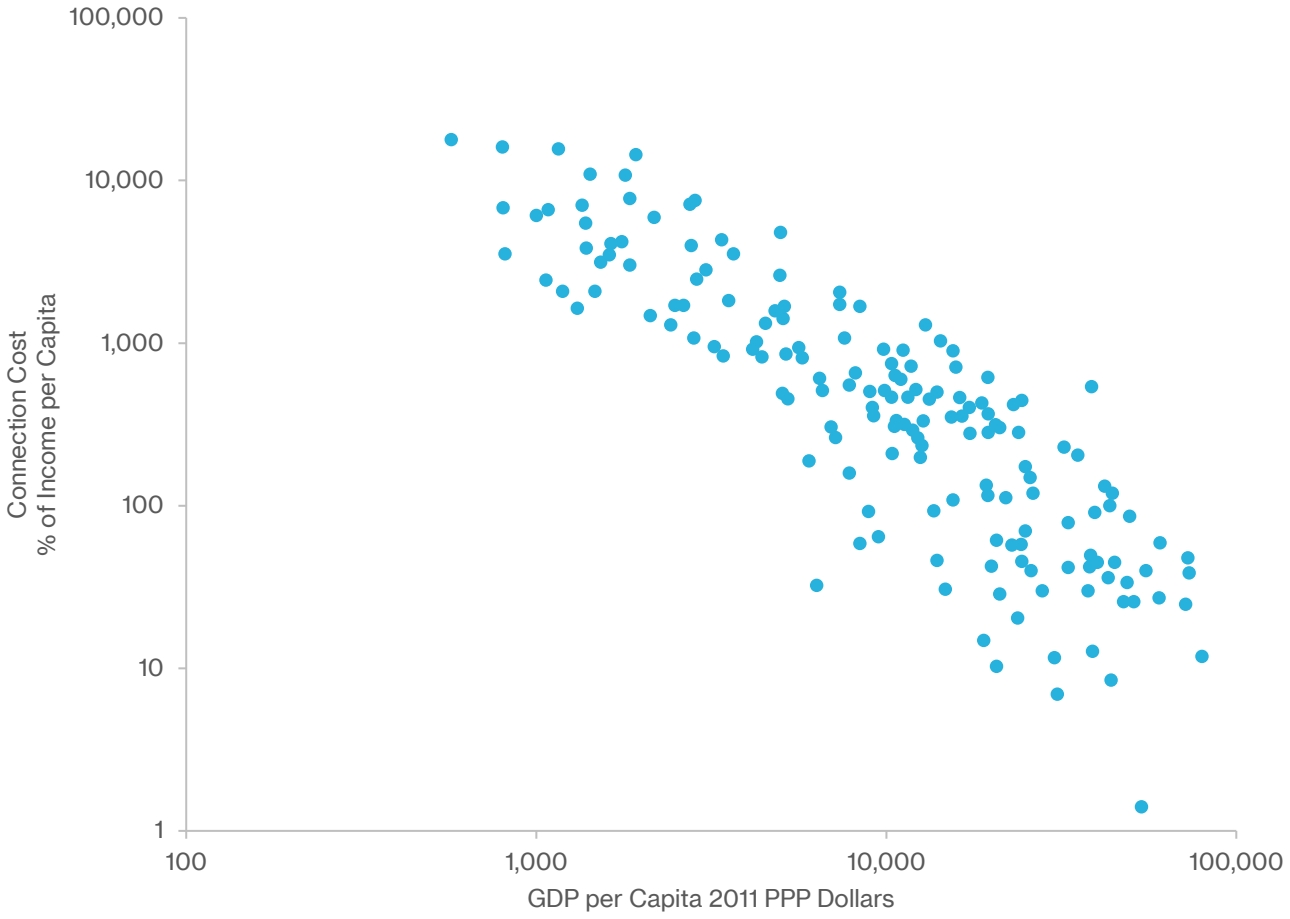
Source: U.S. Energy Information Agency, Annual Energy Outlook 2021

Furthermore, gas-fired generation is modular (think jet engine on skids) making it ideal for addressing more distributed energy requirements that exist in the many regions of the world with antiquated, localized grids.

There will be a day when the world runs on renewables with an appropriate mix of storage to ensure grid stability and access to cheap, readily available electricity. In the interim, neither sustainable economic development nor the emergence from economic poverty can occur without access to clean, stable, ***cheap*** energy.

[4] https://www.unep.org/news-and-stories/press-release/covid-19-caused-only-temporary-reduction-carbon-emissions-un-report

Figure 14 - Relationship Between Energy Cost and Per Capita GDP

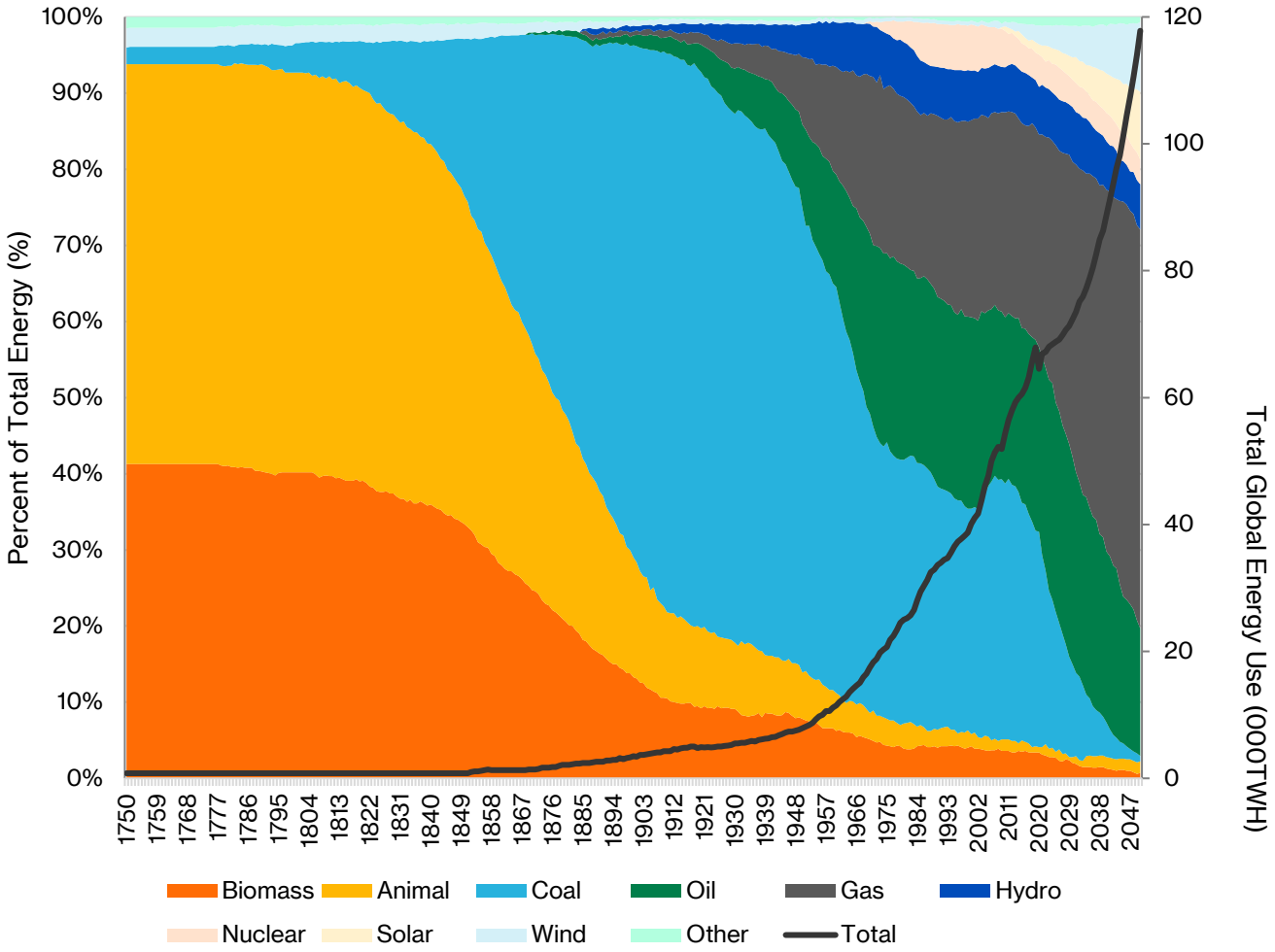


Source: Stern, D. I, Burke, P. J, & Bruns, S. B. (2019). The Impact of Electricity on Economic Development: A Macroeconomic Perspective. UC Berkeley: Center for Effective Global Action. Retrieved from https://escholarship.org/uc/item/7jb0015q

The regions of the world with the most pronounced energy poverty are largely reliant on dirty fuels, have the fastest growing populations and will not tolerate being asked to bear the burden of "net zero" in advance of economic development. We need to find solutions which allow these economies to grow while ***reducing*** emissions, not strangle them with expectations of ***zero*** emissions.

Natural gas is one such solution, which is why, contrary to most forecasts, we remain confident that demand will continue to increase on the path to net zero.

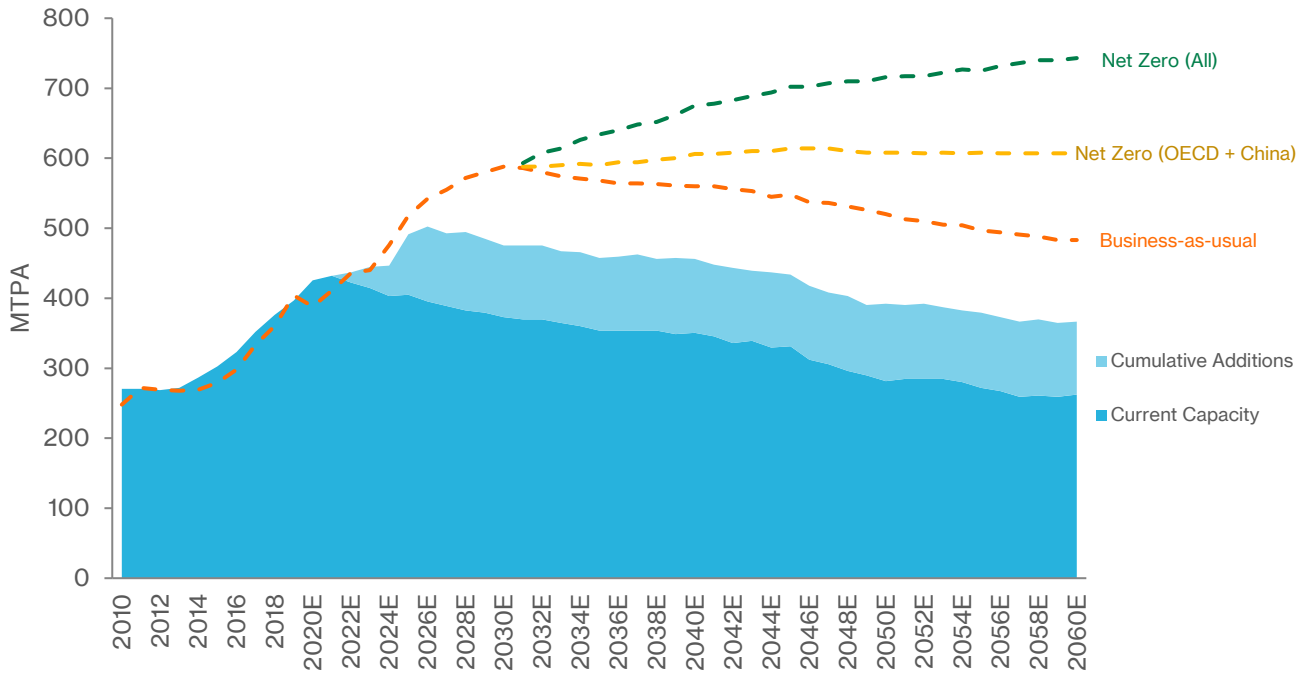
Figure 15 - Total Net Energy by Fuel Source: 1750-2050



Source: Thundersaid Energy, Power Grids: Tenet?, September 20, 2021

In our view, this energy mix is much more realistic than those presented by agencies like the IEA and IRENA which are often viewed as the default experts by policy makers. This conclusion is important because even in the most optimistic (i.e. lowest) demand scenario, current capacity and known future additions will not be able to meet the global call on supply.

Figure 16 - Natural Gas Supply and Demand



Source: Bernstein Research, European Integrated Energy, October 6, 2021

Serious practitioners of the Energy Transition recognize that we need to reduce $C0_2$ emissions today without undermining the economic growth that is key to addressing famine, disease and poverty in the developing regions of the world. Attempts to hinder or eliminate supplies of a large and growing fuel source such as natural gas with no feasible alternative is more than just bad policy. It's inhumane.

THE ENERGY TRANSITION WILL BE INFLATIONARY

We continue to believe that most investors expect that technological innovations and the zero-variable cost nature of renewables will perpetuate the deflationary world that we have been living in for most of the last decade.[5]

The global natural gas cost curve is quite steep, and North America sits at the very bottom. This is an outstanding position for any industry as it represents a durable competitive advantage which translates into attractive free cash flow and cash-on-cash return profiles. As a result, investors find themselves with an incredibly compelling opportunity to own long duration, low-cost, mission-critical assets at very depressed valuations.

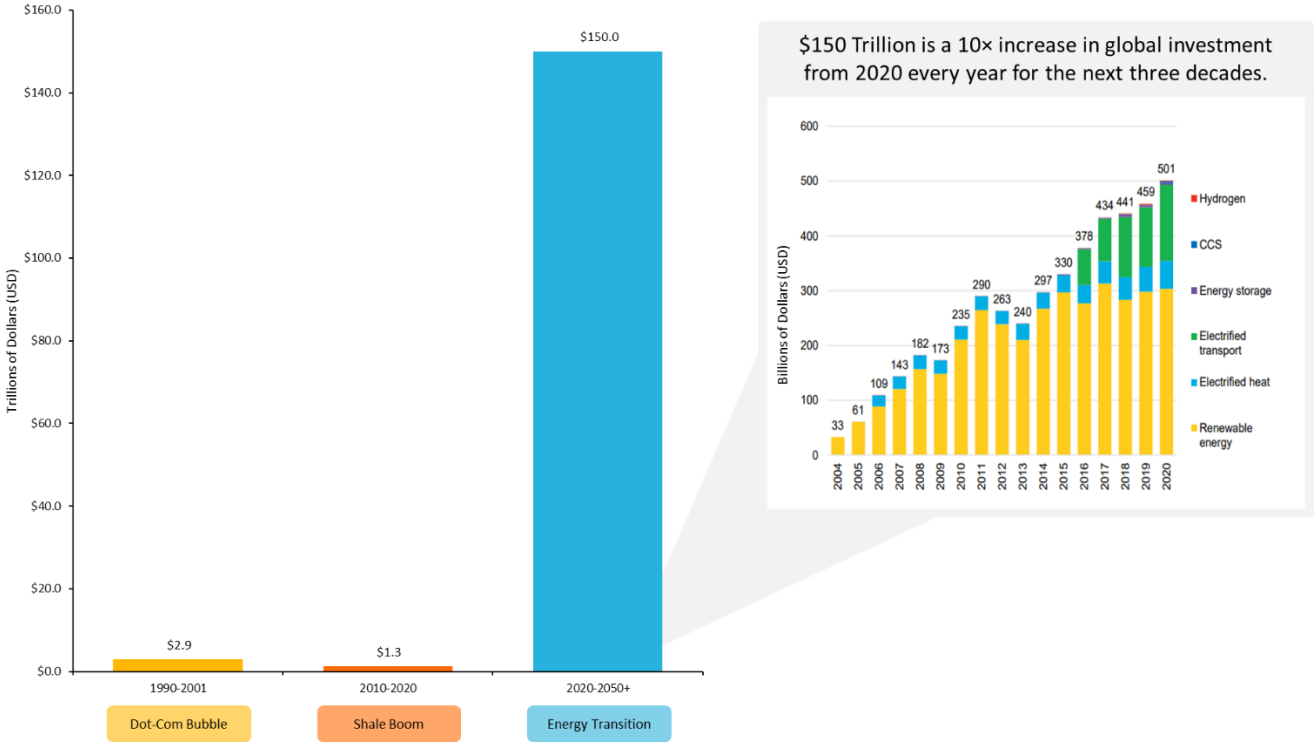
[5] Inflation and the Energy Transition

We contend that the opposite is true. The Energy Transition will be one of the most capital- and resource-intensive undertakings in the history of mankind, which will put pressure on raw material prices as a means to incent incremental supply.

More broadly, the introduction of carbon prices and a lack of capital being invested into key enabler commodities will result in higher energy prices until we are saturated with renewables, grid-level storage and nuclear power, which seems like a multi-decade prospect.

The capital intensity of the Energy Transition is unlike anything that we have seen. Relative to 2020 investment rates, spending needs to increase about 10x and hold steady for the next three decades.

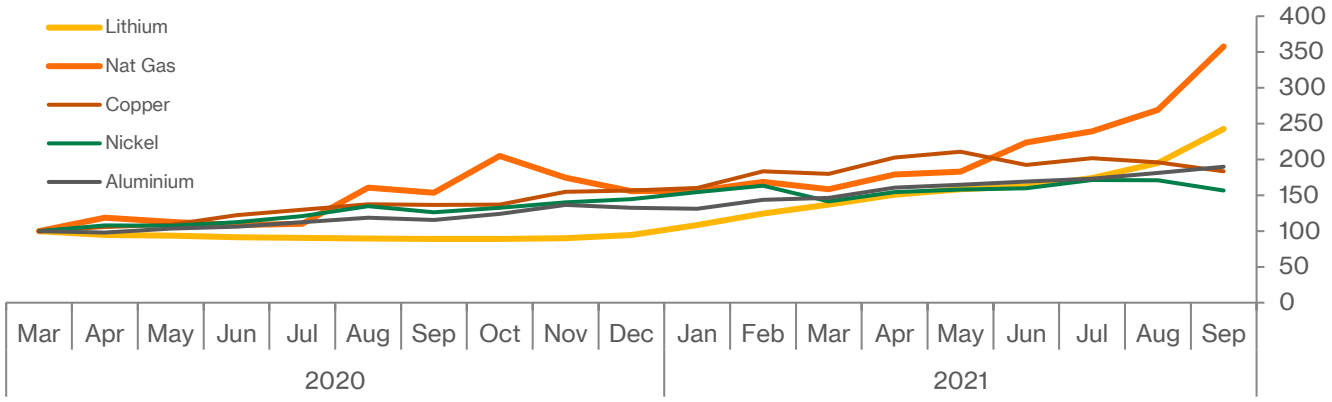
Figure 17 - The Energy Transition in Context



Source: CNNfn and Birinyi Associates, Rystad Energy, BloombergNEF, and the International Renewable Energy Agency (IRENA)

While this analysis largely ignores raw material requirements, the move to "electrify everything" will place serious pressure on commodities like copper, nickel and lithium. Even though the Energy Transition is in its infancy, prices have already started to react.

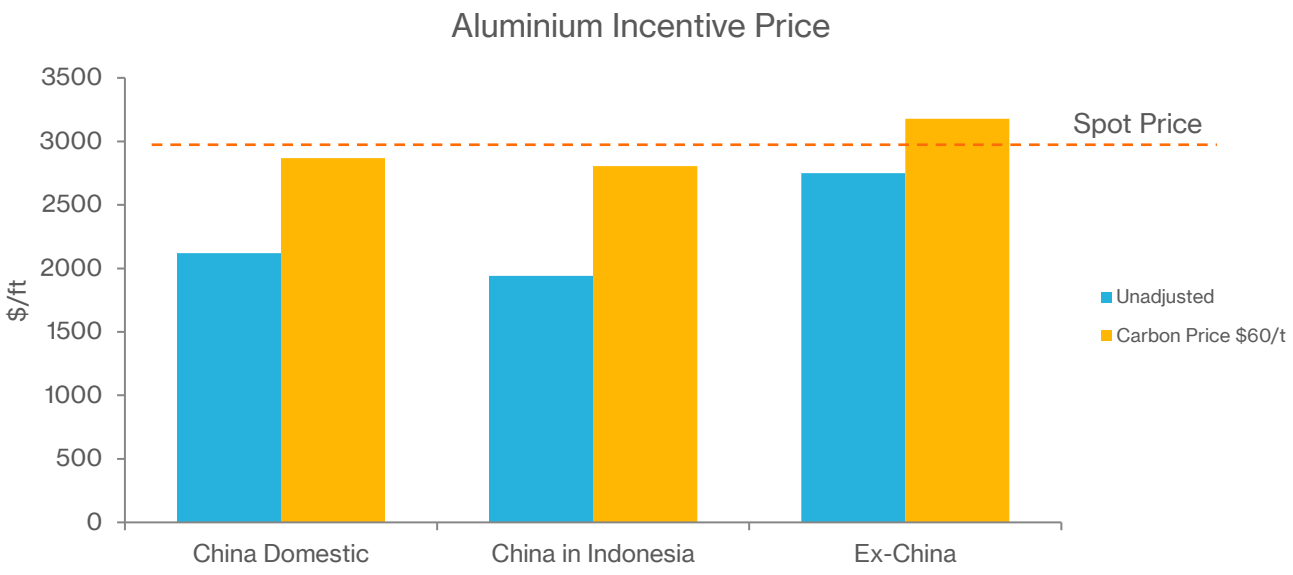
Figure 18 - Recent Commodity Price Changes



Source: Bloomberg

Since the Energy Transition is just getting started, rising raw material prices reflect maturing geology and insufficient reinvestment, not sudden demand spikes. However, the implementation of carbon prices already is impacting the cost of production in power-intensive industries like aluminum, which ironically is considered a foundational building block of a decarbonized future due to its strength and light weight.

Figure 19 - Aluminum Incentive Price by Region With and Without Carbon Price



Source: BMO Research, 4Q21

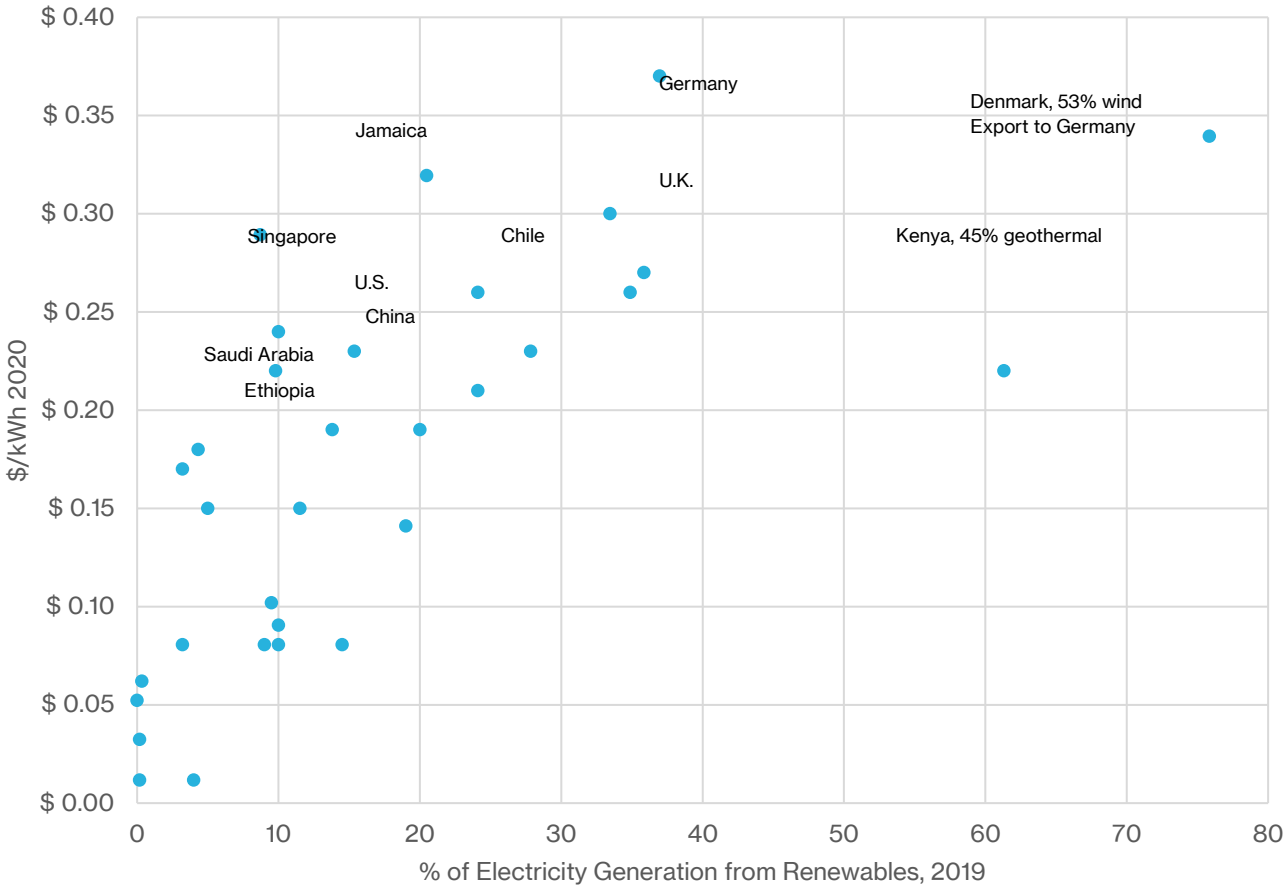
There are less direct but equally important inflationary pressures emerging as well. Based on our analysis, the copper intensity of renewables under the EU Green Deal represents more than 110% of current annual mine

supply. Just for renewables, just in Europe. Nowhere in the €10 trillion plan is there acknowledgement that incremental production will require incremental capital, and that the owners of mining companies need a clear price signal to green-light the billions of dollars required to build new mines.

More immediately, if spot North American natural gas prices were to prevail for an entire year, it would represent a 50bp direct drag on GDP. At current European or Asian prices, the impact would be closer to 3.5%. ***The current environment isn't solely a function of decisions related to the Energy Transition, but it does serve as a reminder of what happens when policy makers and capital allocators tamper with an extraordinarily complex, interconnected ecosystem on the basis of less-than-fully formed, or perhaps more accurately, pre-determined conclusions.***

Finally, ***adding renewables to the grid increases the cost of electricity***, despite the fact that there are no input costs to pass along to consumer. This relationship is clearly evident when looking at retail power rates vs renewable penetration around the globe and is a function of the non-dispatchable and highly intermittent nature of renewable energy production.

Figure 20 - Electricity Prices Correlated with Renewable Penetration



Source: SailingStone Capital Partners, https://ourworldindata.org/grapher/share-elec-by-source?time=latest, https://www.statista.com/statistics/263492/electricity-prices-in-selected-countries

In our opinion, questions about future inflationary pressures are a matter of degree, not direction. As we wrote back in June:

> Why does this matter? Hundreds of billions of dollars have been invested in the Energy Transition already, and a hundred plus trillion will need to be deployed over the next three decades to achieve the mission's two primary objectives: carbon abatement and addressing global energy poverty. Despite the massive material requirements of this undertaking, and the incredible valuations that exist today for many mission-critical projects, ***the majority of investors appear to be anchored in a deflationary world view, bound by overly simplistic ESG considerations.***
>
> Capital allocators who are serious about achieving net zero status while assisting the billions of people facing energy poverty on a daily basis must actively find opportunities to expand the supply of raw materials necessary to increase the supply of clean, abundant energy. Capital allocators who have a mandate to identify and exploit uncorrelated return streams must look beyond the convenient, well-trodden path of renewables and EV's where much of the blue-sky scenario is already reflected in asset values and find ways to gain exposure to the same structural trends but with a free option on the unknowable future. And, lastly, capital allocators charged with preserving the long-term purchasing power of their portfolio must find assets classes which both benefit from inflation and where the premium on that insurance policy isn't so onerous that it defeats the purpose of insurance to begin with. We believe that we are in the very early stages of a cyclical recovery which is coinciding with one of the most important and material-intensive undertakings in the history of mankind.

THE HYPOCRISY OF DIVESTMENT AND ESG INVESTING

The responsibilities of capital allocators and fiduciaries are enormous. From apartheid to tobacco, the markets repeatedly have shown the ability to catalyze socially beneficial outcomes by curbing investment flows. While we have always argued that assessing ESG risks is an integral component of due diligence, since poor performance often creates existential risks to a company's social license to operate, market participants increasingly seem willing to outsource this analysis to third parties or to adopt binding policy statements which preclude any further discourse.

The emergence of "ESG as an asset class" has certainly created some wonderful marketing opportunities for financial service firms and consultants alike. ***It appeals to what we refer to as the new institutional mandate: to do well and to do good*** and as such has enormous influence over which industries receive capital and which do not. However, much like various aspects of the Energy Transition, the lack of rigorous analysis and the comfort of narratives as opposed to debate has ***created unintended consequences which run directly counter to the stated objectives of ESG-driven investment decisions.***

We are focused on carbon abatement as one of two key tenets of the Energy Transition. Carbon accounting, which involves the measurement and classification of greenhouse gas emissions into Scope 1, 2 or 3 categories, has been around for more than a decade. Simplistically, Scope 1 measures direct emissions from an organization's activity, Scope 2 measures electricity indirect emissions (i.e. from the consumption of purchased electricity, heat, cooling or steam) and Scope 3 measures "value chain" emissions, or the emissions released either upstream or downstream by the use or processing of a product.

The problem with this categorization lies in determining who is responsible for "the use or processing of a product." Should energy companies be penalized for industrial and commercial demand for their products, or is it the market's job to incentivize the consumer to switch to lower carbon alternatives? Prosaically, is the farmer responsible for obesity? Is the fertilizer company responsible for alcoholism since they helped grow

the corn that made the mash that went into the bourbon? Clearly, it's easier to vilify "big oil", but the framework seems custom suited to achieve a singular output – reduce fossil fuel production – without considering the global implications of the objective.

To make matters worse, the reporting mechanisms in place are highly subjective, designed to fit a story as opposed to creating an analytical framework. For instance, in 2020, Amazon reported that it emitted 51.1 million tons of CO_2, about 48 million tons of which is directly related to their business (i.e. excluding lifecycle emissions related to customer trips to Amazon stores but including corporate purchases, capital goods, business travel, etc). On a similar basis, Chevron emitted 58 million tons of CO_2. How is it possible that Amazon is included in virtually every Clean Energy/ESG vehicle and most assuredly Chevron is not?

Part of the answer lies in the weightings used by ESG data providers which vary considerably by industry.

Figure 21 - MSCI ESG Weightings by Sector

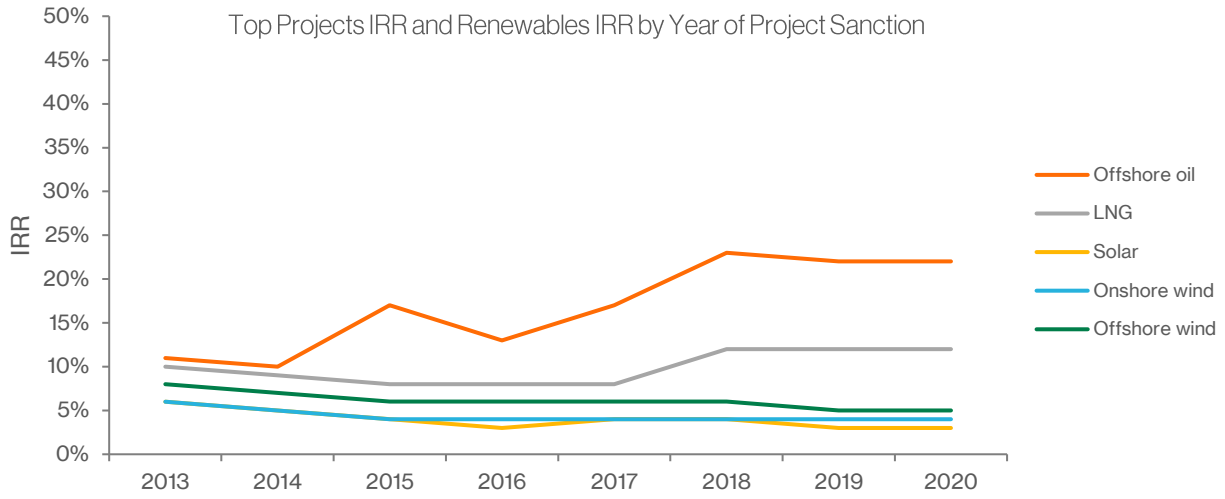
	Energy	Utilities	Industries	Materials	Tech
Top 5 "E" Topics for Energy					
Carbon Emissions	18%	12%	5%	12%	2%
Biodiversity	13%	5%	1%	4%	0%
Toxic Emissions & Waste	10%	9%	6%	13%	0%
Opportunities in Clean Tech	2%	0%	10%	4%	12%
Water Stress	1%	10%	0%	11%	2%
Top 5 "S" Topics for Energy					
Health & Safety	13%	3%	10%	7%	0%
Community Relations	9%	1%	1%	3%	0%
Labor Management	1%	0%	15%	7%	5%
Human Capital Development	0%	12%	1%	0%	20%
Privacy & Data Security	0%	1%	2%	0%	10%

Source: Pickering Energy Partners, 3Q21

The carbon directly emitted from Amazon's activities is no different than the carbon directly emitted from Chevron's. The inherent bias in the ESG analytical framework used by most market participants today is exacerbated and in many cases reinforced by divestment decisions made by many institutional investors in the name of "protecting the environment" or "combatting climate change." While these are noble causes, it is worth considering whether the objectives are helped or hindered by these relatively simplistic policy stances.

The impact of either explicit or implicit divestment decisions, particularly for capital intensive industries, is obvious. The cost of capital rises. In fact, Goldman estimates that investor ESG pressures have created a 10-15% WACC premium for carbon intensive investments relative to renewable projects.

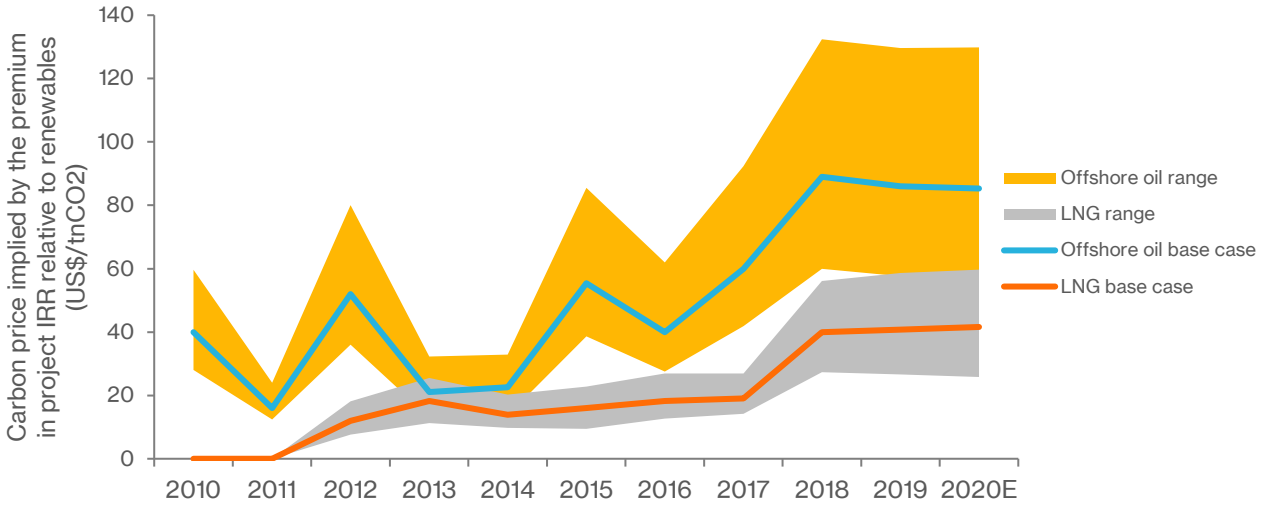
Figure 22 - Cost of Capital by Energy Source



Source: Goldman Sachs, Carbonomics: Five Themes of Progress for COP26, September 24, 2021

Most would argue that this is precisely the point of divestment – to starve a "bad" industry of capital. The problem, of course, is that the world still runs on hydrocarbons, and by constraining access to capital, the cost of production increases. In fact, Goldman estimates that these ESG pressures translate into a $40/ton implied carbon price for LNG and an $80/ton for new offshore oil and gas developments.

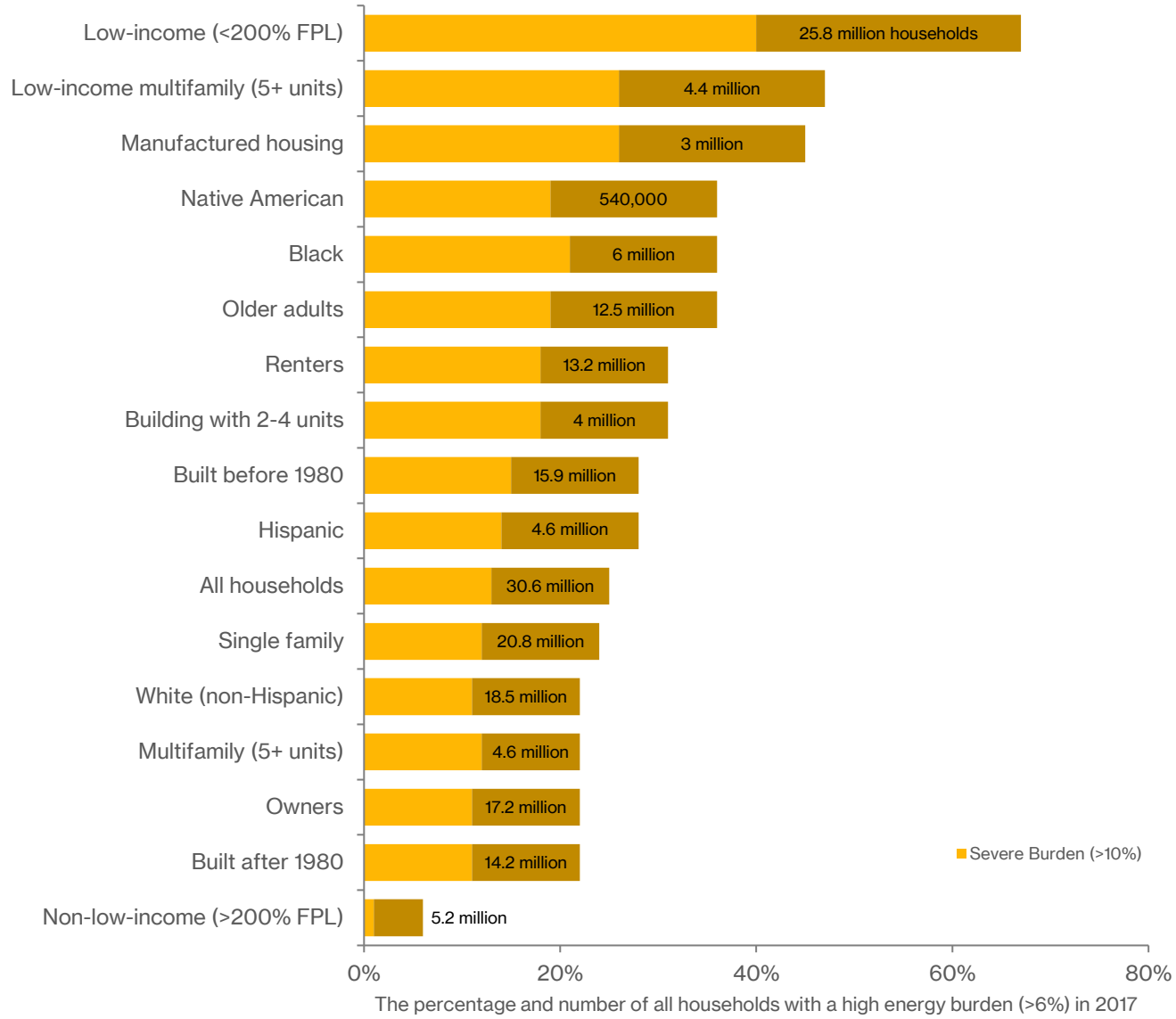
Figure 23 - Implied Carbon Price of New Hydrocarbon and LNG Projects



Source: Ibid

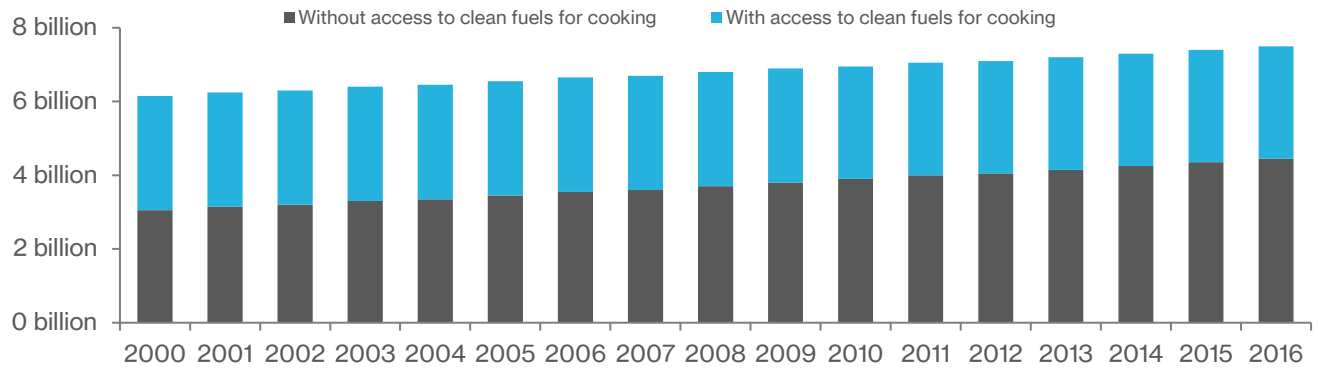
Herein lies the first directly counter-productive impact of divestment and biased ESG analysis. ***It results in higher costs for the production of materials that are still needed today and will be needed for the foreseeable future. For any commodity, higher costs equals higher prices.*** In other words, ***decisions to blindly exclude companies or industries from investment consideration might be comfortable and convenient, but in reality they represent a direct and regressive tax on those who can least afford it***.

Figure 24 - Percentage of US Households with High Energy Burden



Source: https://www.aceee.org/sites/default/files/pdfs/u2006.pdf

Figure 25 - Global Access to Clean Cooking Fuels

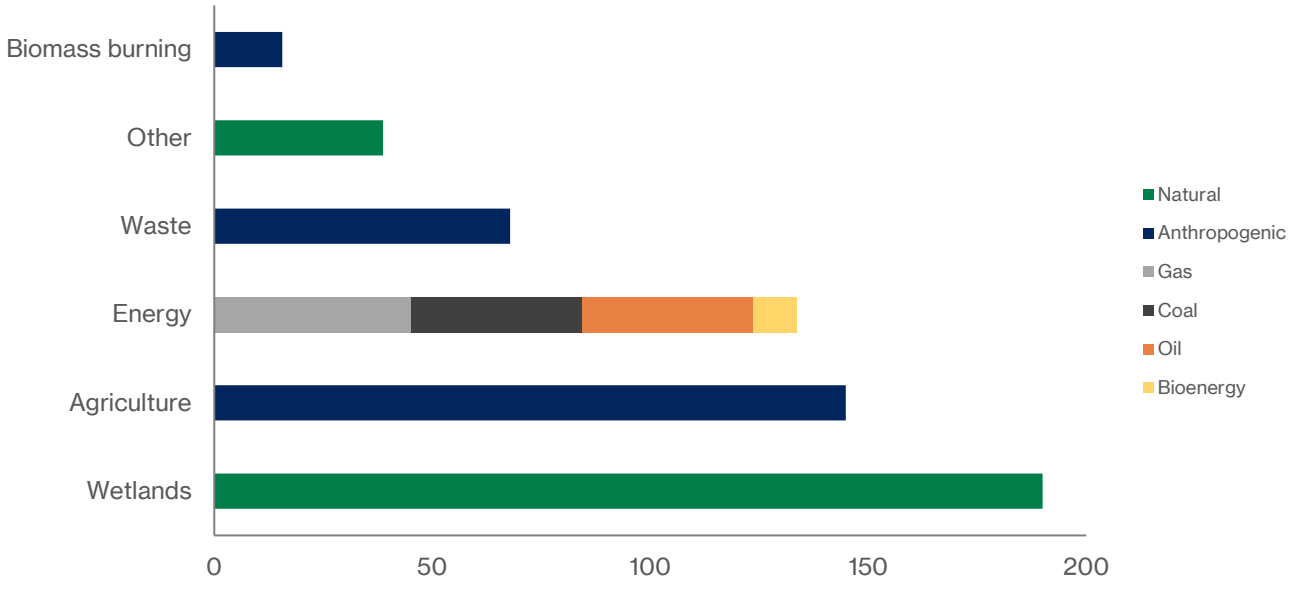


Source: http://data.worldbank.org/data-catalog/world-development-indicators

The second direct and counter-productive result of divestment is that by focusing on supply and not demand, which continues to grow, it simply forces production of the "undesirables" into regions of the world with less stringent health, safety and environmental regulations.

For instance, methane is a potent greenhouse gas, with the Intergovernmental Panel on Climate Change estimating that it has a global warming potential 28 – 87 times that of CO_2 on a per ton basis. About 40% of emissions are from natural sources, followed by agriculture which is the largest anthropogenic contributor. The energy sector is next, approximately evenly split between oil, natural gas and coal.

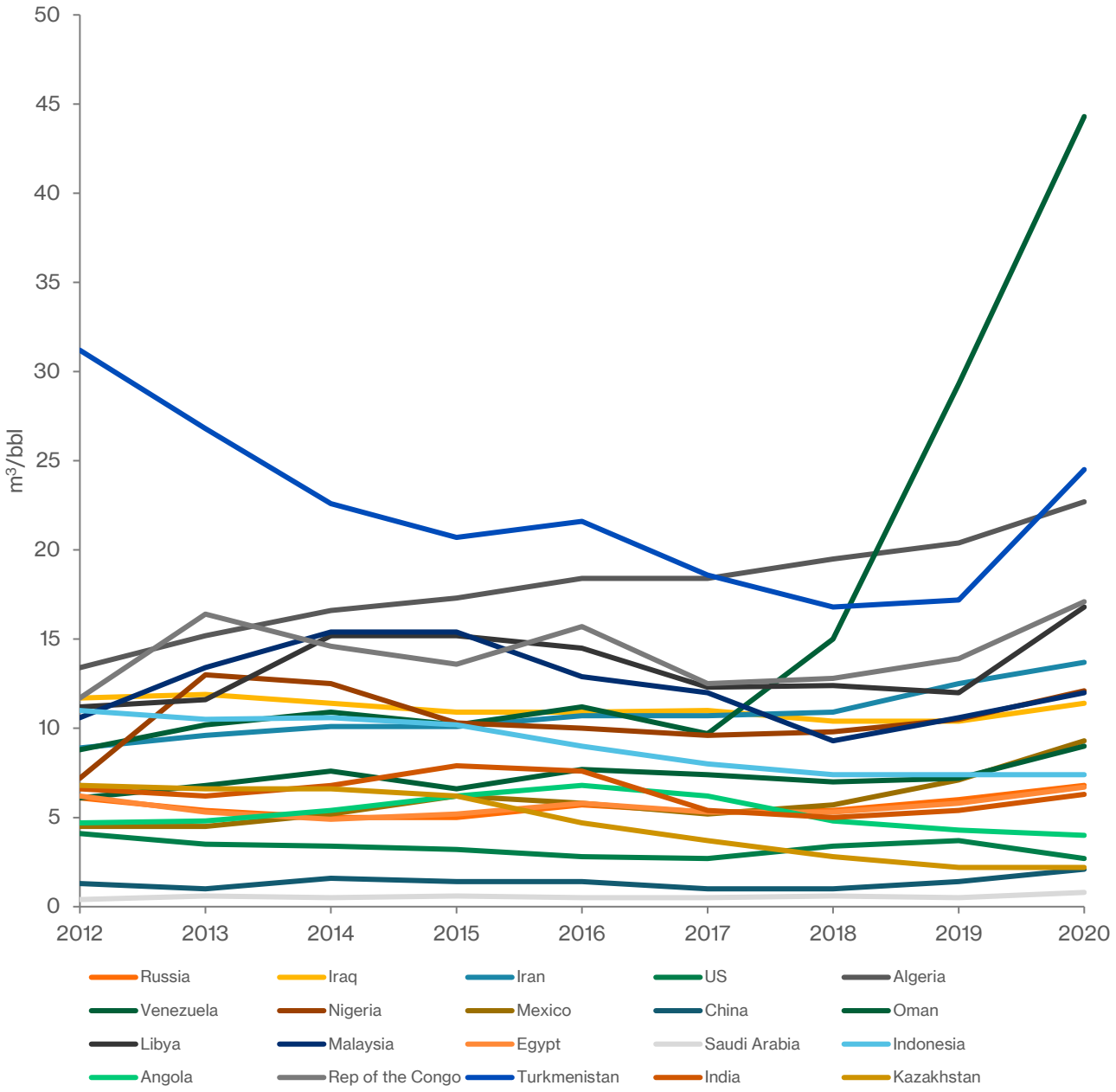
Figure 26 - Methane Emissions by Source (million tons of methane)



Source: IEA, https://www.iea.org/data-and-statistics/charts/sources-of-methane-emissions-2

It is estimated that about 2.5-3.0% of methane is leaked each year on a global basis, although percentages vary significantly by country and even within each country. The U.S. and Europe have leak rates of about 0.6% according to Equinor and the EPA, while developing countries may have rates as high as 10%. Using flaring as a reasonable proxy for methane emissions (if you are willing to burn gas instead of capturing it, you probably aren't that focused on leaks) the disparate approaches to methane capture across the globe are quite clear.

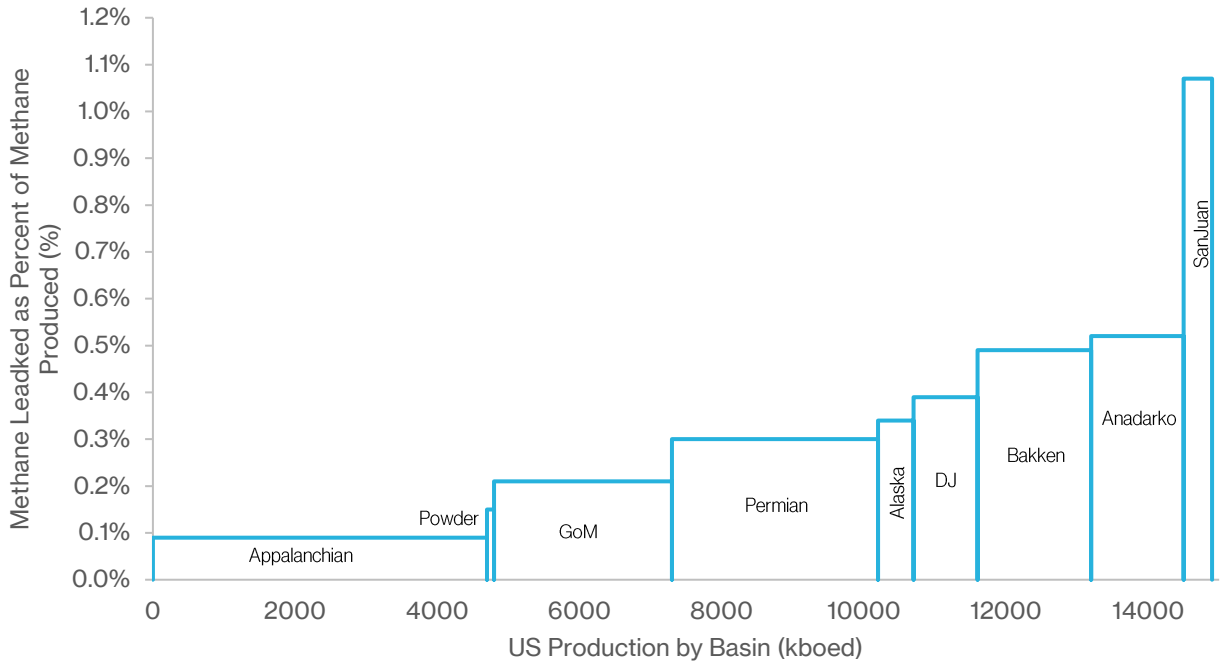
Figure 27 - Flaring Intensity by Country - Top 20 Flarers by Volume



Source: Global Gas Flaring Reduction Partnership, https://www.ggfrdata.org/

And, similar to the global comparison, different regions of a low-methane-leak country like the U.S. have very different emission profiles as well.

Figure 28 - Methane Leak Rate by Basin



Source: Thundersaid Energy, Global Gas: Catch methane if you can?, March 2021

So, if gas is a key input to providing cleaner, inexpensive energy as means to mitigate carbon emissions **today**, then investors should be focused on the safest, cleanest supply available. Remarkably, one of the lowest cost, cleanest sources of natural gas in the world sits in the U.S., yet many institutions have decided to divest from hydrocarbons while retail and institutional investors alike are piling capital into all things "ESG" or "clean energy."

Since demand for natural gas is rising, not falling, these investors are relegating production to less safe, higher cost regions of the world with far weaker regulatory oversight than exists in the U.S., Canada and Europe. In effect, ***divestment decisions increase the cost of energy, increase income inequality, increase the probability of injury or death for the labor force and increase greenhouse gas emissions.*** Claiming otherwise is evidence of either willful ignorance or a lack of due diligence that is requisite for these entities to fulfill their dual mandates as capital and societal fiduciaries.

In other words, ***taking a "wish-based" approach to ESG results in outcomes which are in direct contradiction to the stated mission of ESG investing. It is the most obvious, and least discussed, hypocritical stance in the market today, and it is having a profound impact on our collective ability to decarbonize the planet while meeting the pressing, real-world issues associated with energy poverty.***

CONCLUSION – INVESTMENT AND POLICY IMPLICATIONS

There are three primary implications from these Inconvenient Truths.

1. We cannot wait until the world's economy is powered by renewables – we need to mitigate greenhouse emissions right now. Combatting climate change means taking a pragmatic approach to what is feasible today and identifying and capitalizing the innovators who will deliver a solution for tomorrow. By encouraging the responsible production of key enabler commodities like natural gas, copper, aluminum…we could go on for a while…investors and policy makers can both accelerate and lower the price tag of the Energy Transition.
2. The future is likely to be far more volatile and inflationary than the last decade. Valuations will matter again, as will the ability of portfolios to weather periods of rising prices. Long-term investors would be wise to consider ways to insulate their capital from the rising probability of these shocks while insurance is cheap.
3. It is incumbent upon investors to engage in objective ESG discussions so that we can address responsibly the risks and challenges facing us all as global citizens. This is particularly true for those charged with allocating capital – the most important ingredient on the path to net zero.

There are enormous opportunities, and enormous risks, as we collectively undertake the herculean task of decarbonizing our energy systems while addressing global energy poverty. This will be a multi-decade, hundred plus trillion-dollar effort. We will all be better served if we can put aside pre-formed conclusions and engage in a serious, rational discussion about the future of our planet, and the best way to protect it.

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