Electrifying Portfolios

Fossil fuel free investing gets supercharged with electric vehicles, renewables and battery storage

Investment industry practitioners and academics are increasingly analyzing the financial and economic reasons investment advisors should offer clients investment strategies that are void of fossil fuel extractors, fossil-burning utilities, pipelines and oil and gas industry service providers. As advisors evaluate the economic and financial risks presented by fossil fuels, it's also necessary to consider the parallel investment opportunities presented by companies innovating around the growing renewable energy and electrification industries.

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About Green Alpha

*We have been redefining asset management since 2007 by **Investing in the Next Economy**™ — one in which creating solutions to systemic risks drives economic growth and enables populations to thrive. We believe that investing in companies creating innovative, economically competitive solutions to climate change, resource degradation and widening inequality is the greatest wealth creation driver of the 21st century.*

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Key Highlights

- **Transportation Sector is Shifting Energy Demand:** Innovation, growing consumer demand and international policy changes are driving explosive growth in electric vehicle (EV) production, which is leading to decreasing fossil fuel demand. As overall electricity demand continues to increase and technology rapidly develops, renewables are gaining market share.

- **Efficient Energy Generation and Storage:** Unlike commodity-based fossil fuels that become more expensive as demand increases, renewable energies and battery storage are tech-driven. Following Moore's Law and Wright's Law, the technologies become more efficient and cheaper as production increases, so cost competitiveness will only continue to improve.

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Former U.S. Securities and Exchange Commission (SEC) Commissioner Bevis Longstreth is one observer who shares this thesis, and he has been working hard to educate investors and investment professionals about why it's entirely within one's fiduciary duty to rethink the current and near-future investing paradigm of fossil fuels.

In his article, "The Financial Case for Divestment of Fossil Fuel Companies by Endowment Fiduciaries," Longstreth writes, "At some point down the road towards the red light of 2 Degrees Centigrade . . . it is entirely plausible, even predictable, that continuing to hold equities in fossil fuel companies will be ruled negligence."[1] One can scarcely imagine a more qualified subject matter expert on potential negligence and what falls within one's fiduciary duty than a former SEC commissioner. Let's explore a few of the factors leading him and many others to recommend that investment portfolios be divested from fossil fuel companies.

"At some point down the road towards the red light of 2 Degrees Centigrade… It is entirely plausible, even predictable, that continuing to hold equities in fossil fuel companies ***will be ruled negligence****."*

— Bevis Longstreth,
Former SEC Commissioner

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Transportation Sector is Shifting Energy Demand

Some of the clearest economic signals come from transportation and energy generation, both of which trend toward decreasing fossil fuel demand and increasing renewable energy demand. Because it's an advisor's responsibility to invest client assets in investments that are expected to grow within a given time horizon, it would not be prudent to invest in a sector or specific company experiencing shrinking demand.

Mainstream analysis is now firmly in the camp of declining oil demand. Bank of America Merrill Lynch analysts declared in January 2018 the global oil demand will cease to increase between 2020 and 2025 and will be shrinking by 2030. [2] Their stated cause is simple: electric vehicles.

In 2016, there were already more than two million electric vehicles (EVs) on the road globally,[3] and the research and development (R&D) that carmakers are pouring into new EV production is growing rapidly. In July 2017, Volvo made the bold announcement that it will no longer build any cars that are exclusively gas-powered starting in 2019.[4] Volvo has clearly been quietly investing and innovating in the space for a while. Between 2019 and 2021, it plans to launch five new EVs in addition to ensuring that all existing models will either be pure EVs or plug-in hybrids.[5]

As companies such as Volvo now pile into the EV market, BMW is already benefiting from early R&D investments. BMW has steadily increased sales of EVs from 18,000 in 2014[6] to 20,000 in just the first quarter of 2017.[7] As BMW's close attention to consumer demand and efficiency gains continues to pay off, it's ramping up its EV development. The automotive company plans to release several new EVs in the next few years as it phases out internal combustion engine (ICE) production altogether by 2024.[8]

And it's not just a few carmakers creating a niche product segment.

Back in November of 2016, Daimler announced that it would invest approximately $11 billion in electric vehicle development over the next five years.[9] Daimler is certainly putting its money where its mouth is. Several important investments have already been initiated, including:

- $1 billion to convert a factory in Tuscaloosa, Alabama to produce EV SUVs and build batteries, generating 600 new jobs,[10]
- $740 million to build a new battery factory in China for Mercedes-Benz's EVs,[11]
- $543 million to build a plan to assemble lithium-ion batteries in Germany for use in Daimler automobiles.[12]

"An expanding EV market clearly indicates that ***gasoline demand is set to decline.***

Because it's an advisor's responsibility to invest client assets in investments that are expected to grow within a given time horizon, it ***wouldn't be prudent to invest in a sector with shrinking demand.****"*

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Porsche reported in September 2017 that its first all-electric vehicle will be released a year ahead of schedule – originally in 2020, now in 2019.[13] It comes as no surprise that the firm sped up development, likely in fear of being last to market and left behind as demand swells.

In October 2017, General Motors announced that it will not make any internal combustion engines "at some point in the future," declining to comment on a target date due to the size and complexity of the organization.[14] Despite GM's lack of transparency on this front, the fact that such a conservative carmaker has made this commitment points to the inevitable demise of internal combustion engines.

These growth and development opportunities extend beyond vehicle production. BMW has joined forces with Volkswagen and ChargePoint to grow ChargePoint's electric car charger network throughout the United States,[15] a move that will support and further increase EV sales. The United States alone already has more than 44,000 public charging outlets,[16] plus many more private, free charging stations found in store parking lots, and more than 5,000 charging stations in Tesla's proprietary charging network.[17] The day is long gone when consumers feared being too far from a charging station.

And why shouldn't consumer demand for EVs be snowballing? Once purchased, EVs are dramatically cheaper to fuel than their ICE counterparts. The U.S. Department of Energy offers an excellent, simple tool called eGallon that compares costs to fuel an EV via today's energy grid versus purchasing a gallon of gasoline at the pump.[18] As of February 20, 2018, the U.S. average was $1.18 for an EV compared to $2.60 for regular gas. In states with a greater mix of renewable energy available to consumers, the cost

3 Myths: Fossil Free Investing

1. *"Fossil free investing means giving up performance"*

Just as one would likely never say "all mid-cap growth funds are created equal," nor should one say, "all fossil free investment strategies are the same." As with all portfolios, one also needs to consider numerous portfolio construction qualities, like research process, sector- or risk-factor allocation, market cap allocation and vehicle type. Given all the variables involved in portfolio construction, a broad statement like "all fossil free investments underperform" does not hold true.

Research doesn't support the idea of a "performance penalty," either. For example, S&P Capital IQ found that, over a ten year period, a $1 billion endowment would have grown more if it had divested from fossil fuels.

2. *"Fossil free investing is riskier"*

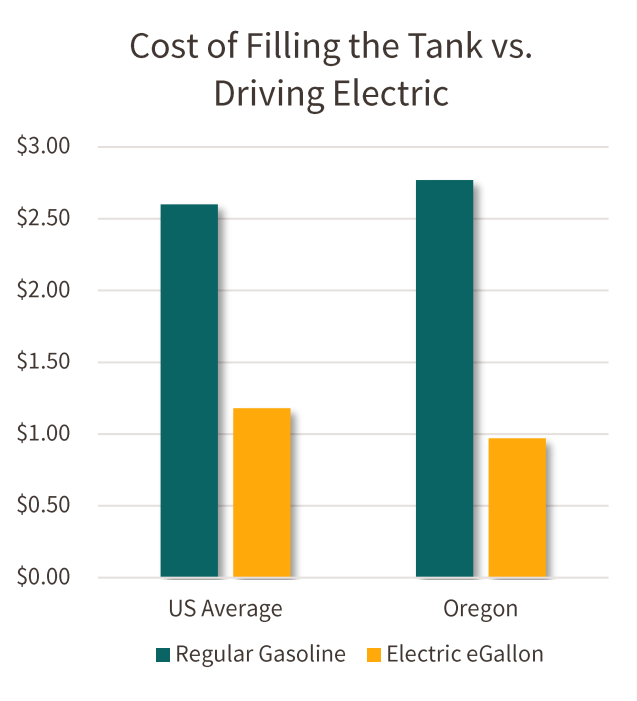
Demand, supply and regulatory signals all point toward a declining fossil fuel sector and growth in renewable energy, battery technology and zero-emission transportation solutions. These signals indicate that fossil fuel-*based* investing, rather than fossil fuel-*free* investing, is the riskier long-term strategy.

3. *"Fossil free investing is against my fiduciary duty"*

As former SEC Commissioner Longstreth points out, it is likely to be the opposite; it may be against one's fiduciary duty *not* to consider fossil fuel risk. He wrote that "it is entirely plausible, even predictable that continuing to hold equities in fossil fuel companies will be ruled negligence."

Furthermore, the DOL has said that Environmental, Social and Governance investment criteria "may have a direct relationship to the economic value of [a] plan's investment," and are therefore "proper components of the fiduciary's primary analysis."

can be even lower. Fueling an electric vehicle in Oregon, for example, came out to $0.97 for an EV versus $2.77 for regular gas. These figures do not account for free charging that is often readily available and reduces prices for consumers even further. A 17,000-kilometer (about 10,500-mile) demo of a Tesla Model S by journalists at Clean Technica found that the total charging cost for the entire distance was $70, including electric bills for at-home charging.[19]



Source: eGallon

EVs also are cheaper to maintain than ICE vehicles,[20] which is made evident when comparing the differences in engineering; the average ICE has 2,000 moving parts, whereas an EV has about 20. As the initial purchase price of EVs declines and more options come online, it is evident that EVs will continue to be the fastest-growing portion of the personal transportation segment.[21]

In addition to these benefits, EVs can also be more adaptable and flexible than traditional internal combustion vehicles. As mandatory and voluntary evacuations were underway in Florida in September 2017, Simon Usborne of *The Guardian* reported, "Tesla drivers who fled Hurricane Irma . . . received an unexpected lesson in modern consumer economics along the way. As they sat on choked highways, some of the electric-car giant's more keenly priced models suddenly gained an extra 30 or so miles in range thanks to a silent free upgrade."[22]

Some negative press resulted from Tesla's proactive measures, but other press explained the facts. For a time, Tesla produced Model S and Model X's with 75 kilowatt-hour battery packs in order to offer more affordable versions at scale. Tesla then used software to limit the energy to 60 or 70 kwh, thereby limiting the battery range.[23] Owners of these models have the choice to upgrade the range at any time. When one customer fleeing the hurricane called and asked for a temporary range expansion at no cost, Tesla took it a step further and enabled all cars in that area to extend their range. Power of choice, with possibilities to execute in real time, is a huge benefit of EVs that cannot be discounted. As more consumers experience these benefits, demand will likely increase.

An expanding EV market clearly indicates that gasoline demand is set to decline. This trend is not only driven by consumers; global regulations are playing their part as well. Norway will ban the sale of all fossil fuel-based cars by 2025.[24] Germany, the country that invented the ICE and produces more cars than any other country in Europe, voted to ban ICEs by 2030.[25] France is following Germany's lead

and has committed to ban the sale of all fossil fuel-based cars by 2040.[26] In fact, ING Bank expects to see "battery-powered vehicles accounting for 100% of registrations in 2035 across the [European] continent."[27]

India, one of the world's fastest-growing economies, has set goals to transition away from ICEs to EVs, proposing a ban on ICE sales by 2030 and a total, nation-wide fleet turnover to electric by 2030. India's target is a "goal few see possible,"[28] but any meaningful progress will materially dent oil demand.

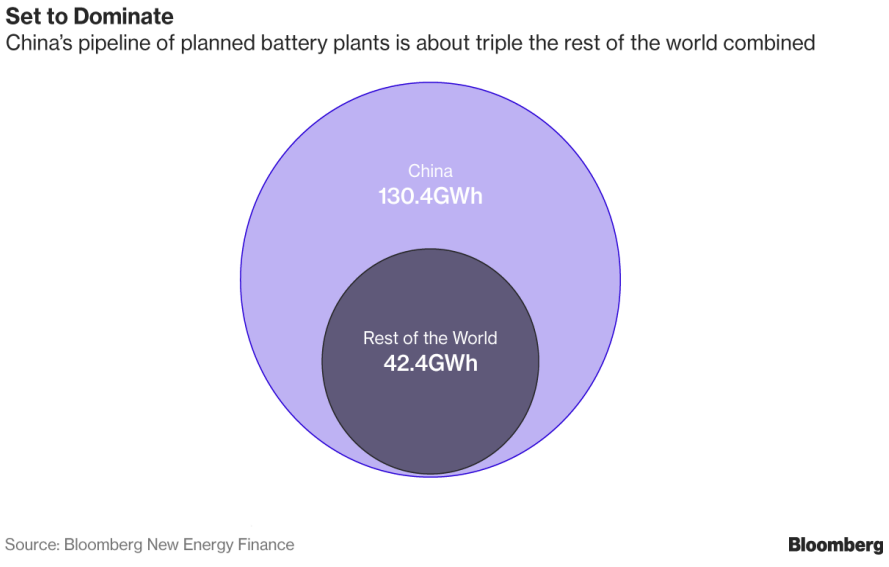
China's government is loudly developing a plan to phase-out vehicles powered by fossil fuels. This is no small matter considering that China is the world's largest and fastest-growing auto market. One response called this development a "defining moment for the auto industry," and another declared "if China says no more fossil-fuel powered cars, global carmakers must follow."[29] If carmakers focus on developing EVs, a rapid increase in scale and options will lower consumers' perceived barriers to adoption.

China's phase-out plan has not been fully divulged, but in the meantime the Chinese government has placed restrictions on the number of new ICE vehicle registrations in major cities such as Beijing and Shanghai. Qualified EVs remain exempt from these restrictions, further encouraging consumers to shift toward EVs.[30]

Keeping up the momentum, Chinese authorities announced plans to increase subsidies to encourage development of longer-range electric cars[31] and maintain provincial-level incentives to sustain rising demand.[32]

Meanwhile, China's plan to unilaterally triple the world's lithium-ion battery production means prices for storage are likely to fall dramatically, thereby improving the economics of EVs even further.

Overall, it's hard to see the transportation sector providing demand growth for oil and gas. On the contrary, demand is about to decline, and precipitously.



Source: Bloomberg

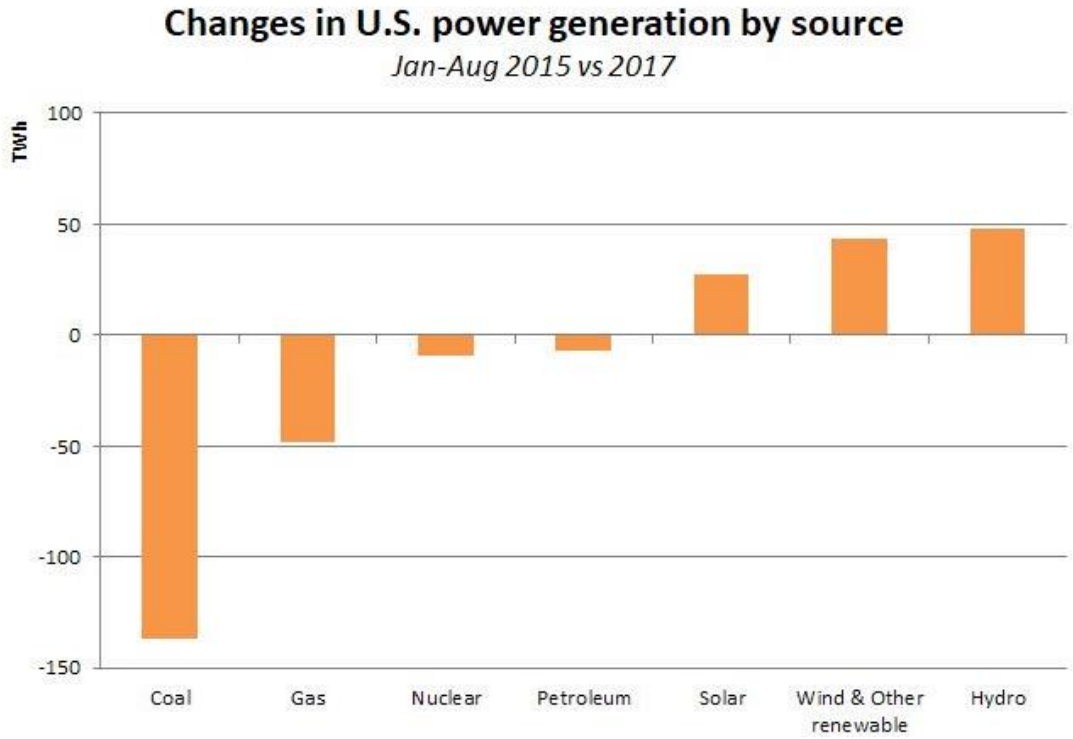
Efficient Energy Generation and Storage

Alongside transportation, the other major driver of fossil fuel consumption is, of course, the electrical energy grid. Fortunately for the health of the entire population,[33] energy consumption is down in the United States[34] due to efficiency efforts that have been in place for decades, and the percentage that is generated through renewable means is up.[35]

There's an exciting race on in the world of renewable energy generation, with wind and solar jockeying for the leading position. In 2015, wind energy was the fastest-growing source of electricity in the United States.[36] In 2016, solar took the lead, growing 95 percent in the United States and contributing 39 percent of the grid's capacity additions.[37] Renewables will capture most of the estimated $10.2 trillion that will be invested in new power generation globally by 2040, according to projections by Bloomberg New Energy Finance.[38]

Solar and wind are both already less expensive on a price per kilowatt-hour (kWh) basis, without subsidies, than new natural gas, coal, or nuclear power plants.[39] Solar is declining in price so rapidly that the lowest price for solar power in 2016 was the highest price in 2017.[40] The price of renewably-generated energy will continue to plummet because wind, solar and battery storage technologies are racing each other down the cost curve.

According to a press release accompanying a 2017 NREL report, "solar photovoltaic (PV) capital costs have declined recently and are projected to continue to decline. Similarly, land-based wind capital costs have fallen while capacity factors have increased. These are trends that are both projected to continue and make wind increasingly competitive with new generation from natural gas combined cycle plants in the near term."[41]



Source: EIA via Lauri Myllyvirta

Unlike commodity-based fossil fuels that become more expensive as demand increases, renewables are tech-driven and follow both Moore's Law and Wright's Law.[42] They become more efficient and cheaper as more are produced, so cost competitiveness will only continue to improve. As new reports forecast the acceleration of these trends, we're seeing headlines such as, "Wind power costs could drop 50%. Solar PV could provide up to 50% of global power. Damn."[43]

With respect to storing this energy, Bloomberg reports that lithium-ion battery packs are now the cheapest they have ever been due to escalating global production. How cheap? The average price of a lithium-ion battery pack has come down to $209 per kilowatt-hour,[44] a steep and swift price decline from $1,000 per kilowatt-hour in 2010.[45]

The declining price of this essential technology is set to continue, benefiting both electric vehicles and stationary storage. Bloomberg estimates that the global energy storage market will experience an astounding expansion similar to that of the solar industry. Between 2000 and 2015, photovoltaics as a percentage of total generation doubled seven times. Likewise, energy storage is projected to double six times between 2016 and 2030, rising to a total of 125 gigawatts per 305 gigawatt-hours.[46] This growth is expected to result in about a 65% cost decline in the next decade, meaning storage is expected to cost approximately $100 per kilowatt-hour by 2025 and less than $73 per kilowatt-hour by 2030.[47]

Let's examine this expected cost decline in terms of an electric vehicle that is currently available. In June 2017, Chevy spokesman Fred Ligouri said that "the current list price of a Bolt EV HV battery pack is $15,734.29."[48] Reducing that price by two-thirds means Chevy could reduce the cost of a Bolt by about $10,000 over the next few years without pressuring their profit margins. Presently, a Bolt with an EPA-estimated 238 miles of range starts at $37,495.

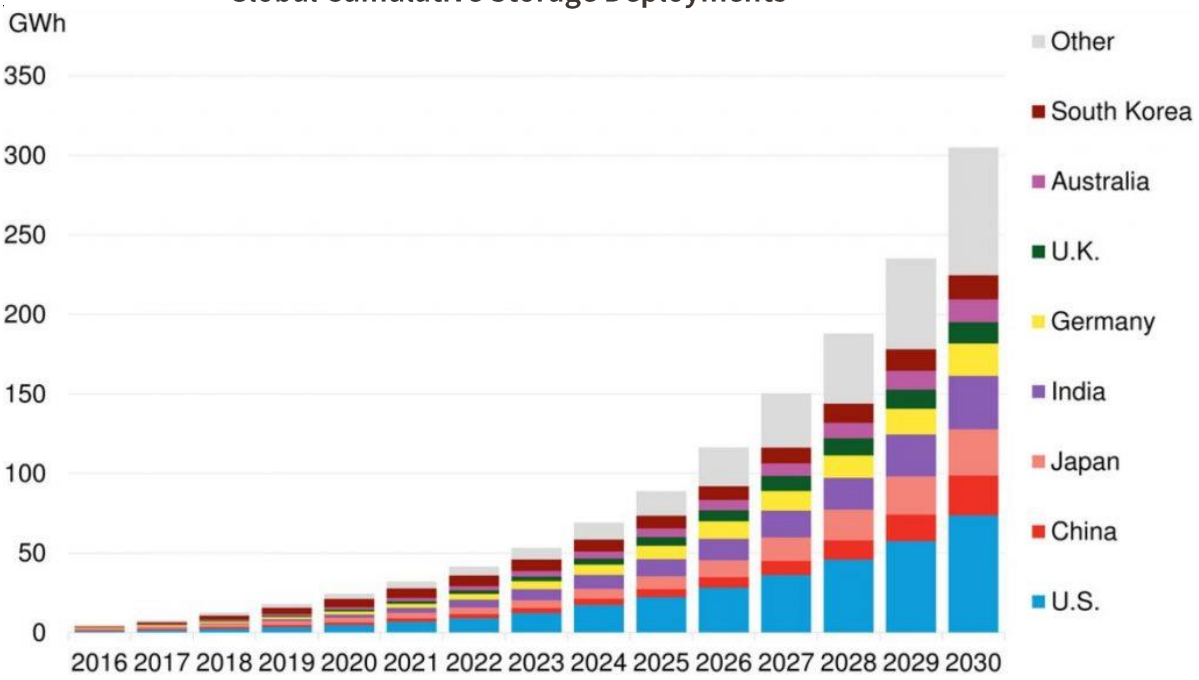
Source: Bloomberg

In electricity grid management, early larger-scale stationary battery installations are already having a big impact. For example, the world's largest battery – installed by Tesla in South Australia in November 2017[49] – already proved its worth by December 2017. According to RenewEconomy, the Tesla battery responded immediately when it recognized that one of the biggest coal units in Australia, Loy Yang A 3, tripped without warning and caused a slump in frequency on the network. The Tesla battery injected 7.3MW into the network to arrest the slump, a nimble move that impressed electricity industry insiders.[50] As battery storage proves both less costly and more adaptable to dynamic conditions, long-term trends are likely to favor stationary grid storage over traditional fossil-fired plants and associated peaking power plants.

Upstream and downstream from the solar panels, wind turbines and battery packs themselves, opportunities to harness greater electric efficiency abound. For example, IBM's analytics group is now offering an Internet of Things leveraged service that will enable "predictive insights for wind turbines and wind farms, and optionally incorporate weather data to assess turbine health and risk and optimize wind farm performance."[51] Interconnectivity and big data have the power to make these renewable energies even smarter and more efficient.

As demand for fossil fuels shrinks due to the shift toward EVs, renewables and battery storage, it's important for an investor to understand how incredibly sensitive oil and gas prices are to marginal changes in the balance between supply and demand.[52] In the transportation sector, two million barrels per day of demand will be displaced by 2023 by electric passenger cars alone.[53] Recall that it was a two million barrels per day imbalance that led to steep oil price declines between 2014 and 2017. Given the rapid rise of EVs, the two million barrels per day displacement by 2023 will be only the beginning of much larger demand reductions. Consequently, investments in companies that primarily derive revenues from fossil fuel extraction, transportation, or refining will soon be in peril.

Global Cumulative Storage Deployments



Source: Bloomberg New Energy Finance

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Conclusion

A portfolio of stocks is simply an illustration of a portfolio manager's vision of the future. Investments held reflect the industries and companies that the manager believes are most likely to grow during the investing time horizon. A prudent investor should carefully consider current and evolving economics when determining whether fossil fuel companies are a reasonably likely source of competitive risk-adjusted returns, given his or her timeframe and goals. Companies innovating around renewable energy are gaining market share and becoming more competitive. Therefore, they are investments that will help clients preserve and create wealth, rather than risky investments in fossil fuel companies that have now begun their decline.

*"A portfolio of stocks is simply an illustration of a portfolio manager's vision of the future. In a world where **fossil fuels are losing market share to efficient, technology-leveraged renewable energies**, a prudent investor should consider carefully whether fossil fuel companies are a reasonably likely source of risk-adjusted returns."*

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