



Re-Defining the Energy Sector

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Introduction

The world is facing an energy paradox: countries need enormous amounts of energy to support economic growth, even as this growth threatens the health of their people and planet. Addressing this energy paradox, and averting an environmental catastrophe, will require producing more energy while releasing less carbon dioxide into the atmosphere. As such, the energy problem facing the world today is no longer where to find energy sources, but how to power society as cleanly and efficiently as possible. Although global energy consumption is already transitioning toward less carbon-intensive sources like natural gas and renewables, truly solving this energy challenge calls for a complete transformation of how we produce, distribute and consume energy. In this white paper, we re-define the energy sector as those companies facilitating the development of this clean, efficient, flexible energy system. We believe that investing in clean technologies that are accelerating this energy transformation offers an enormous investment opportunity, while failing to do so adds risk by reducing portfolio diversification. The Essex Global Environmental Opportunities Strategy (GEOS) captures the energy transformation by identifying these clean technologies, and GEOS deepens energy exposure more than fossil fuel investments alone.

Clean Technology: Doing More With Less

Clean Technology and the GEOS Solution

Resource scarcity is one of the greatest obstacles to human well-being. Future economic growth, human health, and social prosperity depend on resources that are in high demand and increasingly short supply. The statistics are alarming. Consider that the global population will exceed 9 billion by 2050, and that the percentage of people living in urban areas will rise from 54% in 2014 to 66% in 2050, approximately 2.5 billion additional people.^{1,2} In the next 20 years alone, the number of middle-class consumers will increase by 3 billion, up from 1.8 billion today.³ Given that the average middle-class American consumes four times as much energy, three times as much meat, and three times as much cotton per capita as the average world citizen, a new middle class that even approaches American levels of consumption will put enormous stress on the world's resources.^{4,5,6}

Meanwhile, as demand soars, natural resource supply grows ever more constrained. The UN estimates that 700 million people suffer from water scarcity today, and that nearly half of the global population will live in regions of high water stress in 2030.⁷ Growing food demand around the world will put additional stress on energy, land, and water. Climate change, along with the associated extreme weather events, further exacerbates these issues and limits our ability to address them. As the global population continues to grow, urbanization intensifies, and middle-class consumption spreads to emerging markets, we are running out of the natural resources necessary to feed and power the world.

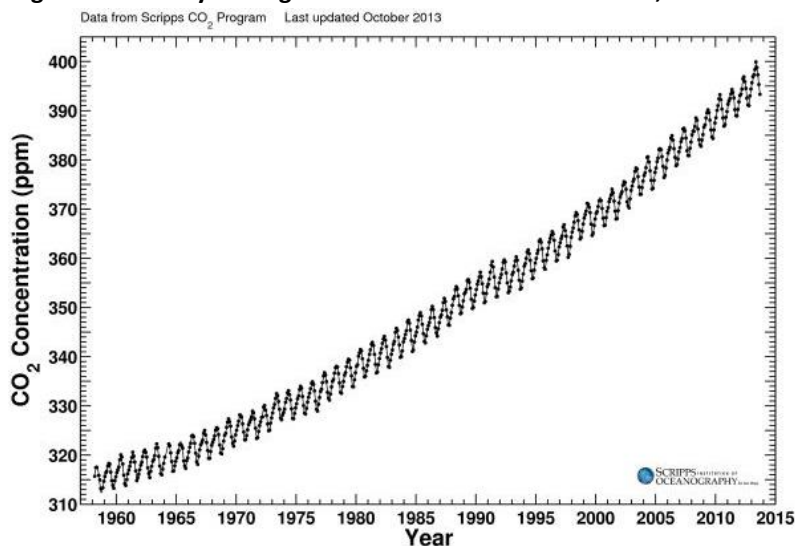
Ultimately, people must learn to *do more with less*, providing for a larger population without exhausting our stock of natural resources. With the Essex Global Environmental Opportunities Strategy (GEOS), we are investing in companies that are helping people do just that. Our investment philosophy is simple but clear: we believe that companies with technologies that increase the efficient use of scarce resources will deliver strong shareholder returns over time. In line with this belief, we invest thematically across nine clean technology sectors in energy, food, and water that are solving the world’s greatest social and environmental problems. Operating at the *nexus of environment and finance*, GEOS offers a listed-equity, social impact investment solution with significant growth potential.

The Energy Paradox

One area where GEOS has identified an enormous opportunity is the global energy challenge. While energy demand grows every year, burning fossil fuels to meet this demand threatens the environmental health of our planet by emitting carbon dioxide (CO₂), a greenhouse gas responsible for climate change. Our investment thesis holds that the growing threat of climate change will compel society to reduce the carbon intensity of energy consumption, and companies that facilitate the transition to a cleaner, more efficient energy system will find demand for their services around the world.

Society’s license to release carbon into the atmosphere has decreased dramatically, as scientists almost unanimously agree that rising levels of atmospheric CO₂ are causing our climate to change in dangerous ways. The scientific consensus holds that the planet can warm no more than 2°C (3.6°F) above pre-industrial levels if people are to avoid severe environmental repercussions, and they have calculated that 3.67 trillion tons of human CO₂ emissions will cause this level of warming.⁸ The world is currently projected to surpass this CO₂ threshold in 25 years.⁹ Figure 1 below demonstrates the steady increase of atmospheric CO₂ over the past half-century, a rate which has accelerated since the 1990s. Activists, politicians, and business leaders alike have expressed concern over this growing environmental risk.

Figure 1: Monthly Average Carbon Dioxide Concentrations, 1958-2013



Source: Scripps Institution of Oceanography, UC San Diego, Oct 2013

A popular response to the threat of climate change has been advocating to reduce consumption of fossil fuels, a highly carbon-intensive energy source. The fossil fuel divestment movement, for instance, has convinced hundreds of institutions to join its campaign in selling off coal, oil, and gas investments to

weaken the political power of the fossil fuel industry (see Figure 2). As of September 2014, the campaign had achieved over \$50 billion in divestment commitments, and in June 2015, Norway alone divested \$9 billion of coal and tar sand investments from its \$900 billion sovereign wealth fund.^{10,11} Operating under the tenet that “if it’s wrong to wreck the planet, then it’s wrong to profit from that wreckage,” the divestment movement has made addressing climate change a moral imperative.¹² Likewise, the Pope’s encyclical in June 2015 called on the world to come together in the fight against climate change, urging people of all faith to “care for our common home.” Greater cultural awareness of the environmental, social, and health consequences of fossil fuels has strengthened moral support for environmental action. As such, momentum behind a cleaner energy system is growing.

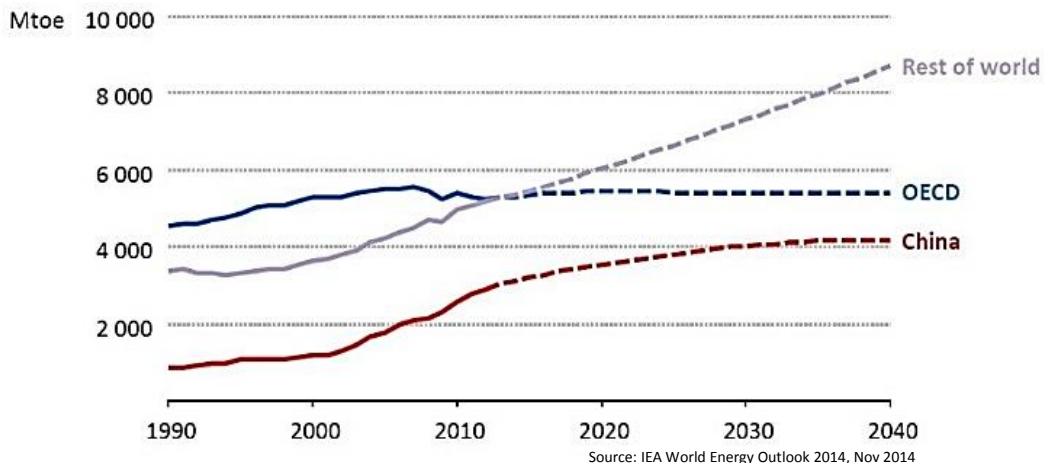
Figure 2: Fossil Fuel Divestment by the Numbers

Asset Owner	# of Commitments	Example	Size of Endowment
College/University	33	Syracuse University	\$1.8 billion
Foundation	100	Rockefeller Foundation	\$900 million
Religious Institution	81	Episcopal Church	\$380 million
Municipality	46	San Francisco, CA	\$16 billion
Other	26	Guardian Media Group	\$1.2 billion

Sources: Go Fossil Free, Nonprofit Quarterly; Data as of July 2015

While many people support “going green,” doing so is an exceedingly difficult endeavor. Mitigating the effects of climate change necessitates reducing our CO₂ emissions. Yet global energy demand is projected to rise by 37% through 2040, driven almost entirely by non-OECD countries as illustrated by Figure 3 below.¹³ The world is facing the challenge of an *energy paradox*, where both developed and developing countries need enormous amounts of energy to support economic growth, even as this growth threatens the health of their people, land, air, and water. Since data suggest that countries will continue to use whatever energy they have access to in order to keep growing, averting an environmental catastrophe will ultimately require producing more energy while emitting less CO₂.

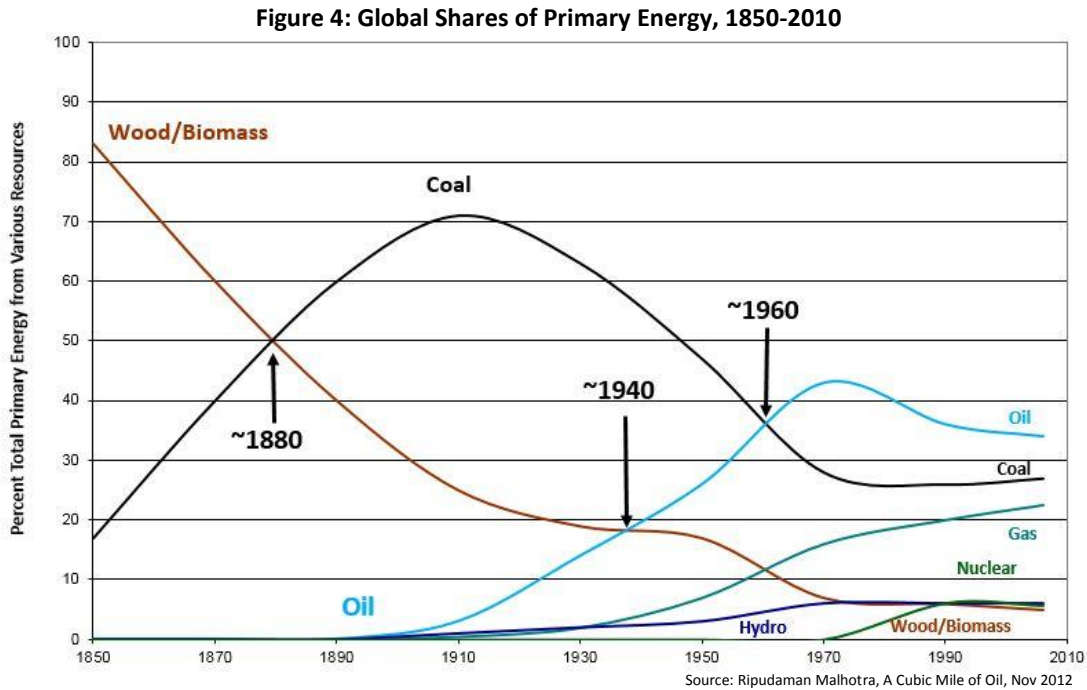
Figure 3: Energy Demand by Region, 1990-2040



An Energy Transformation

Energy is Evolving

People use energy every day, to cook their food, heat their homes, and generate light after the sun has gone down. As Figure 4 illustrates below, the primary source of this energy has undergone a series of transitions since the 1800s.



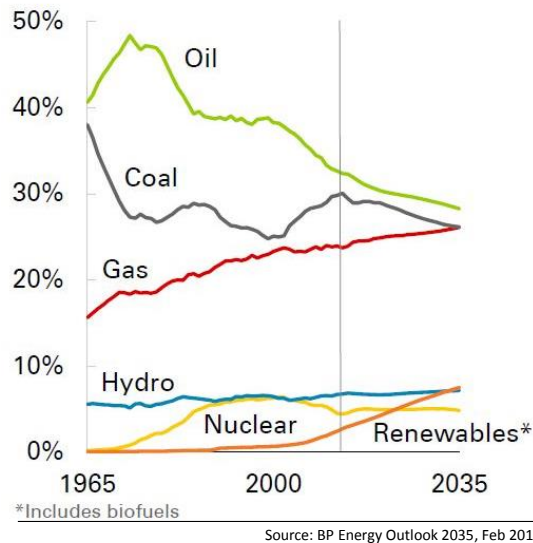
This comprehensive graph demonstrates how energy is fluid and evolving. The global energy mix has experienced two major transitions involving coal and oil, both driven by the demand for more flexible, concentrated energy. The shift from wood to coal occurred when dense urban areas required a fuel with greater energy concentration that could be more efficiently transported and stored.¹⁴ When the internal combustion engine gained prominence in the early 1900s for its vast array of applications, the world turned to oil as an even more condensed and flexible fuel than coal.¹⁵ Though not out of any regard for the environment, both energy transitions actually represented shifts toward less carbon-intensive energy sources (see Figure 5). Now the needs for greater flexibility, energy density, and carbon efficiency have paved the current transition to natural gas and renewables, as shown by Figure 6 on the next page.

Figure 5: Carbon Intensity of Energy Sources

Energy Source	Carbon-to-hydrogen ratio
Wood	10:1
Coal	2:1
Oil	1:2
Natural gas	1:4

Source: Jesse Ausubel, BofA Merrill Lynch Global Research, 2011

Figure 6: Global Shares of Primary Energy, 1965-2035



While the newfound abundance of natural gas has contributed to its rising consumption, natural gas also offers operational advantages over previous forms of energy. For one, it has a lower carbon intensity than both coal and oil, making it the “lesser evil” of fossil fuels regarding environmental impact. Natural gas also produces electricity more efficiently than coal, reducing energy losses in power plants.¹⁶ And while coal and oil are focused exclusively on electricity and transportation respectively, natural gas has applications in both electricity and heat, with growing viability as a transportation fuel as well.

Renewable energy is thriving for similar reasons. Perhaps most importantly, renewables provide zero-emission energy, a significant environmental advantage over fossil fuels. Second, residential renewables like solar and geothermal offer distributed energy at point-of-source, giving consumers more control over energy supplies and making the energy grid more flexible and adaptable. Finally, several forms of renewable energy are becoming competitive with traditional energy sources purely on a financial basis; wind is already the cheapest form of new power generation in Europe, Australia, and Brazil, while residential solar is cost-competitive in areas like Germany and the southwestern U.S.¹⁷ Power generation from wind and solar is projected to increase annually by 13% and 22%, respectively, from 2012 to 2020.¹⁸

Coal and oil hold their lowest collective share of global energy consumption in over 100 years, and they will only continue declining. As these legacy energy sources keep losing share to natural gas and renewables, the global energy mix will grow more diversified and less dependent on a single energy source, in addition to becoming much less carbon intensive. Although the world has never had such a mixed *energy palette* before, this diversification can be highly beneficial. For one, utilizing multiple energy sources reduces the potential economic impact of a price shock affecting one of these sources. Providing distributed energy in the form of electricity from renewables or heat from natural gas also provides an alternative to the inflexibility of centralized energy production. Third, the availability of different energy sources for heat, power, and fuel means that people will be able to develop more cost-effective options for each form of energy consumption. The growth of natural gas and renewables will yield a more balanced global energy mix, making the energy system more resilient, flexible, and cost-effective.



When viewing energy from a long-term perspective, it becomes clear that energy transitions occur gradually. It took several decades for coal and oil to claim energy dominance, and the declines of these energy sources from their peak shares of consumption have been just as subdued. Gradual movement, however, should not be confused with no movement at all. Natural gas and renewables are swallowing more of the energy mix every year, directly replacing shares of coal and oil. As the world begins to consider the social and environmental impacts of energy consumption in addition to financial costs, countries will increasingly search for cost-effective energy sources that meet their economic needs without compromising the health of their people and planet. Although an energy transition is a steady process, the growth of gas and renewables indicates that energy is evolving yet again.

Building a Cleaner Energy System

Before people recognized the threat of climate change, the energy problem facing society was how to provide all the necessary heat, fuel, and power to support economic growth. Now the energy problem has changed. Countries are concerned not only with what energy sources are available, but how to power society as cleanly and efficiently as possible.

While the new energy transition has succeeded in lowering the carbon intensity of energy, truly addressing the global energy challenge requires a transformation of the entire energy system. The technologies involved in energy production, distribution, and consumption have as large an impact on climate-changing CO₂ emissions as the energy sources themselves. In 2012, for instance, just 33% of the energy used in U.S. power production was effectively consumed as electricity, with the remaining two thirds lost in the processes of generation, transmission, and distribution.¹⁹ This staggering inefficiency belies that notion that adjusting our energy sources alone will solve the energy paradox. Producing more energy while emitting less CO₂ will necessitate both cleaner sources and more efficient production, distribution, and consumption of this energy.

GEOS invests in the solutions to this new energy problem, identifying the technologies, products, and services in every stage of the energy process that are facilitating the energy transformation. In fact, every GEOS theme includes companies involved in building this clean energy system:

- **Agricultural productivity and clean fuels**—Agriculture makes a direct contribution to energy production, offering biological energy sources such as ethanol, biodiesel, and biogas that provide alternatives to fossil fuels. Agricultural processes also consume enormous amounts of energy, and as food insecurity threatens ever more regions, determining how to produce more food while using less energy will be a global concern. Products like precision agriculture technology, data management solutions, and biological fertilizers all improve the productivity and energy efficiency of agricultural processes.
- **Clean technology and efficiency**—Energy efficiency technologies have a very simple value proposition: they save customers money by saving energy. LED lights, for instance, use 75% less energy than traditional incandescent bulbs and remain operational 25 times longer, reducing energy costs, maintenance time, and CO₂ emissions.²⁰ Other products like efficient building materials and “smart” energy systems for buildings and homes lower utility bills while conserving natural resources. Energy efficiency technologies do not generate heat or power, but they significantly reduce energy demand and decrease the amount of energy consumed.
- **Efficient transport**—Transportation is the largest energy demand sector in the United States; it also wastes nearly 80% of the energy it consumes.²¹ Fuel efficiency technology and fleet optimization analytics lower energy demand and reduce waste. Meanwhile, vehicles powered by

electricity or natural gas decrease the carbon intensity of the transportation sector, and electric charging stations and natural gas fueling locations distribute this clean energy to consumers.

- **Environmental finance**—The availability of financing has a significant impact on the capacity for clean technologies to develop and scale. Venture capital, private equity, and public equity offer financing for companies in various stages of growth, and investments in any of these nine themes advance the development of technologies make the energy system cleaner. Companies that finance energy efficiency upgrades and green building initiatives also reduce the economy’s energy consumption, making a profit and saving customers money in the process.
- **Low carbon commerce**—Companies in all economic sectors are aiding the development of a cleaner energy system by reducing the carbon intensity of their sourcing, products, and operations. Grocers that sell local foods, manufacturers that design clean technology components, and corporate sustainability consultants all support low carbon commerce.
- **Power merchants and generation**—Power generation offers significant opportunities for the transition to a cleaner energy system. Coal-powered plants, for instance, operate at a 33% efficiency, meaning that just a third of the energy consumed by these plants is converted to electricity.²² Natural gas-powered plants are 31% more efficient than coal-powered ones, and new technologies can further improve the efficiency of power generation.
- **Power technology**—Power plants generate huge amounts of electricity, but the distribution of this energy is highly inefficient; the U.S. loses approximately 6% of its electricity every year due to transmission and distribution.²³ Power technologies ensure that energy is efficiently transferred between producers and consumers. High-capacity batteries, smart meters, and electricity grid analytics increase the amount of electricity available for consumption and reduce energy demand.
- **Renewable energy**—There’s more than one way to generate electricity. Burning hydrocarbons releases a lot of energy, but at the environmental cost of extracting those fuels, transporting them, and emitting dangerous toxins. Solar, wind, and hydropower, on the other hand, harness energy from renewable resources that create electricity without emitting greenhouse gases. Renewable energy is growing rapidly as a distributed, cost-effective, clean source of power that is projected to steadily diminish the share of fossil fuels in the global energy mix.
- **Water**—It takes water to create energy, just as it takes energy to pump, treat, and heat water. In 2005, for instance, U.S. electricity production required 143 billion gallons of water every day, or 140 times the amount that New York City consumes in a given day, while California used 19% of its electricity and 32% of its natural gas on water treatment and distribution alone.²⁴ Companies that improve water efficiency in power plants can maximize energy yields given existing water availability near such plants. Likewise, water technologies for industrial processes, buildings, and infrastructure can also improve the economy’s energy efficiency.

Clean energy technologies span across industries and end-uses, but they are all involved in facilitating the transition to a low carbon energy system. The incompatible collision between growing energy demand and the environmental impact of atmospheric CO₂ has initiated an energy transformation, changing how society produces, distributes, and consumes energy to make economic growth cleaner and more efficient. GEOS is investing in companies across the energy spectrum that are accelerating this transformation.



Re-Defining the Energy Sector

The old energy sector does not meet our needs

GEOS is not only investing in energy solutions, however, it is re-defining what the energy sector means. As the demand for “energy” increasingly moves from finding fuel sources to building a clean, efficient, flexible energy system, the companies that we choose to include in our energy sector must change as well. These companies are the very ones GEOS has identified as propelling the energy transformation, solving the fundamental problem of consuming more energy while emitting less CO₂. Put simply, companies in the energy sector are those developing solutions to the global energy challenge.

Traditional energy funds, however, demonstrate a stubborn resistance to change. The Vanguard Energy ETF, with net assets of \$5 billion, is defined as including “stocks of companies involved in the exploration and production of energy products such as oil, natural gas, and coal.” Similarly, the iShares Global Energy ETF allocates 89% of its assets toward oil, gas, and consumable fuels, with the remaining 11% invested in energy equipment and services. According to Vanguard, iShares, and other index fund providers, the energy sector can be tracked by a portfolio of fossil fuel stocks alone (and a miniscule investment in biofuels). Meanwhile, wind and solar stocks are separated into “clean energy” index funds, and other technologies involved in the production, distribution, and consumption of energy are excluded altogether.

The inaccurate conflation of the energy sector with the fossil fuel industry has important and costly ramifications for investors. First, this narrow definition of energy ignores the complexity of an ever-changing global energy mix. In 2014, 14% of primary energy derived from non-fossil fuel sources like nuclear power, hydroelectric, and renewables.²⁵ And in the next 25 years, renewables are positioned to comprise 60% of new global power generation and attract over \$8 trillion in investment.²⁶ This enormous amount of capital will result in renewables doubling their share of global electricity production to 46% by 2040, with wind and solar alone increasing their share to 30%, up from 5% in 2014.²⁷ As renewables continue to displace fossil fuels in the global energy mix, traditional energy indices will offer increasingly flawed representations of the energy sector. Investors, furthermore, have the opportunity to capitalize on a tremendous growth industry while mainstream financial thought remains rooted in the past.

Limiting the energy sector to fossil fuels not only omits major sources of power, it also excludes industries with significant exposure to the energy system, such as those identified in the nine GEOS themes. While many investors disregard clean technology companies as offering niche products, these technologies continue to solve one of the greatest environmental challenges facing the world today. When governments establish energy agendas, their concern is no longer limited to the source of their energy, but rather how they can power themselves as cleanly and efficiently as possible. This rising demand for flexibility and carbon efficiency requires that we define the energy sector holistically as an integration of companies involved in transforming every aspect of the energy system.

Implications for Investors

Re-defining the energy sector means that investors must evaluate exactly which of their holdings constitutes an “energy” investment. Given that today’s global energy challenge is how to power society as cleanly, efficiently, and flexibly as possible, an investment in energy is an investment in a solution to this challenge. These solutions are the clean technologies involved in the production, distribution, and consumption of energy that are driving the energy transformation.

Investors thus far have hesitated to replace fossil fuel investments with clean technology for a variety of reasons. Those who point to high costs and unproven technologies are overlooking the successful implementation of products like LED lighting, solar panels, and wind power, along with other technologies nearing the tipping point of commercial viability. Other investors worry about short-term volatility, disregarding the long-term growth potential that clean technology offers. Investors concerned that selling fossil fuel investments will reduce diversification, moreover, already risk portfolio imbalance by shunning an enormous sector in clean technology. Since the initial clean technology bubble burst after the financial crisis of 2008, the surviving companies have emerged as proven, profitable, scalable businesses with strong long-term potential. Investors who fail to allocate assets toward clean technologies diminish portfolio diversification and ignore a high-growth industry in favor of investments in declining fossil fuels.

Conclusion

By every measure, it's clear that fossil fuels will not be phased out of the global energy mix any time soon. But fossil fuels are just one component of an integrated energy system that must become cleaner, more flexible, and more efficient. Defining energy holistically as those companies involved in solving the energy paradox allows us to better understand the state of fossil fuels and the future of clean technologies that are reducing our carbon intensity. While common belief holds that divesting from fossil fuels is the same as divesting from energy, partially divesting from fossil fuels and reinvesting in clean technologies actually deepens energy exposure and corrects portfolio imbalance.

The solutions to the global energy challenge are here in the form of clean technologies, and GEOS is harnessing these trends. The transformation of energy will drive significant demand for clean technology services and bolster tremendous long-term growth, offering an enormous financial opportunity as traditional investors cling to misperceptions and misinformation around clean technology. And while conventional financial thought regards clean technology as an unnecessary risk, continuing to avoid clean technology only increases risk by ignoring a large and growing sector of the economy. Reliance on an antiquated definition of energy has created market inefficiencies, as most investors remain on the sidelines while new technologies transform the global energy system. The longer investors wait to adapt their portfolios, the longer they're ignoring the reality and opportunities of the new energy sector.

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