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The Path to Fossil Fuel Divestment for Universities: Climate Responsible Investment

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Executive Summary

Should university endowments divest from fossil fuels? A public discussion of this question has included some university presidents issuing statements that they would not, that investments should not be used for "political action." Many universities hold large endowments that have significant positions in fossil fuel companies and/or funds that hold fossil fuel assets. Universities consume fossil fuels in most aspects of campus operations. But universities also support most of the research that has identified the existence, nature, and consequences of climate change, and the principal purpose of the university is to educate, particularly the young adults who will live and work in the climate of the future.

Arguments for divestment by universities from fossil fuels are frequently based on moral grounds. Ignoring the moral issue at the core of the climate challenge presents real peril to the reputation of universities and their standing in society. The costs of climate change stretch across generations due to the long atmospheric lifetimes of greenhouse gases (GHGs) and the inertia in the Earth's climate system, posing the question of what the impacts of today's societies are on the well being of their children and grandchildren. The poor bear the brunt of the economic and health impacts of climate, a relationship that holds within every nation, and between rich and poor nations. Climate change requires development of the capacity to manage our collective impact on our environment, and universities have a duty to help foster this development. Universities cannot pretend they have no such responsibility without forsaking the role they have historically engendered as trustees of humanity's capacities, values, and understanding.

But the case for divestment is not limited to moral imperatives. Holding assets in fossil fuel companies, and in companies that are fossil fuel-intensive, poses a significant array of risks for universities that appear on multiple, simultaneous fronts. Fossil fuel companies will eventually experience a dramatic decline in demand for their products, producing so-called "stranded carbon." Price volatility of fossil fuel assets is the norm, and it will be exacerbated by rising concerns about extractive practices and the forced internalization of external costs, shareholder advocacy, the elimination of generous subsidies, and intense competition from energy efficiency and fast-developing, low-carbon sources of energy. Taken as a whole, the financial, moral, and reputational risks associated with holding assets in fossil fuel companies create a compelling case for divestment, even without considering the rising opportunity costs of not transferring investments to cleaner alternatives. Careful examination of the stated reasons for not divesting shows that they do not hold water.

Instead of viewing the choice as "business as usual" or "disinvest," universities should engage with other universal owners and learn how to invest responsibly. Aligning their financial interests with their commitments to sustainability will not be accomplished overnight, but that does not justify turning a blind eye to the fact that a healthy portfolio requires a healthy economy. Universities can first disinvest in the highest polluting and irresponsible operations, and launch a process of learning where

to reinvest in the cleaner opportunities of the future. Developing the capacity to identify good investments that make sense from both a moral and a financial standpoint, and doing that work will help inform the rest of us. Doing this work visibly fulfills the university's role in society, and will attract high quality students, faculty, and donors. Once this work is commenced, the question concerning where the line is to be drawn recedes in importance.

These actions would provide the world with a lesson worthy of educational institutions that really are concerned with the future. These actions would demonstrate that universities understand that money management is not separate from its moral and environmental consequences, and that they will not participate in the fiction that holds that they are separate. That alone would have incalculable value because it would help convince others. Even the most cold-blooded investor will eventually have to acknowledge that these risks are growing, as is the value of industries that are not vulnerable to regulation, resistance, and devaluation. University leaders should recognize how intelligently going down the road of divestment fulfills their role in society, and that failing to fulfill the university's basic mission will eventually degrade its reputation and capacities.

Introduction

The divestment from holdings in fossil fuel companies, and the funds they comprise, burst into the public consciousness with Bill McKibben's (2012) piece in Rolling Stone titled "*Global Warming's Terrifying New Math*." This corresponded with an increasing number of independent signals that concern about climate change is growing across every segment of society. Norway recently divested from 49 companies in its $850 billion sovereign wealth fund due to "high levels of uncertainty about the sustainability of their business model;" many of the companies were involved with the extraction of coal and unconventional oil. The United States military views climate change as an immediate "threat multiplier" to national security (DOD, 2014). Lloyd's of London has urged the insurance industry to factor climate change into their probabilistic risk models to better manage their catastrophe risk exposures associated with the increased frequency of catastrophic damage due to high winds, storm surges, and flooding (Lloyds of London, 2014). Standard and Poors identifies climate change as one of two "megatrends" affecting economic risks to sovereign nations (the other megatrend is aging) (Standard and Poors, 2014). The insurance industry—not known for left-wing politics—increasingly is concerned with the risks associated with climate change. Global weather-related losses from natural catastrophes increased from $5 to $25 billion in the 1970s and 1980s to $50 to $150 billion in the 2000s (SwissRe, 2014). In 2010, the Securities and Exchange Commission issued guidance instructing publicly held companies to disclose information about both direct and indirect impacts, including pending legislation and treaties, competition from lower emission products, and potential environmental impacts. In 2014, students at Harvard University filed a lawsuit against the president and fellows of Harvard College for what they call "mismanagement of charitable funds" due to the institution's refusal to divest its endowment from fossil fuels.[1]

New institutions, knowledge, and analytical tools are forming in response to these concerns. Activist NGOs such as 350.org and gofossilfree.org clamor for individual and institutional investors to immediately begin to divest. The Carbon Tracker Initiative[2] provides data on "unburnable carbon" and the associated risk for companies holding that carbon. The Carbon Disclosure Project[3] has built a global system for companies to measure, disclose, manage, and share key environmental data. The Investor Network on Climate Risk[4] is a community of investors that share best practices associated with mitigating the risk associated with climate change. New funds are sprouting on Wall Street that provide investors with "fossil free" indexes and funds.

Governments are responding to the mounting scientific evidence and to growing public pressure to respond to the climate challenge. Auctions of tradable permits to emit greenhouse gases beginning in 2008 under Regional Greenhouse Gas Initiative of

[1] http://www.divestproject.org/wp-content/uploads/2014/10/Read-the-Complaint.pdf
[2] http://www.carbontracker.org/
[3] https://www.cdp.net
[4] http://www.ceres.org/investor-network/incr

Northeast and Mid-Atlantic states have reduced emissions by more than 40 percent and provided funding for energy efficiency investments projected to save billions.[5] In 2014 the United States and China agreed on a modest but nevertheless historic plan to reduce GHG emissions.[6] The United States Environmental Protection Agency's (EPA) Clean Power Plan will dramatically alter the electric power industry with its new limits on carbon emissions (EPA, 2014a). United Nations Secretary-General Ban Ki-Moon told attendees of the launching of the International Year of Small Islands and Developing States that "Planet Earth is our shared island, let us join forces to protect it." And in the past year European leaders negotiated a climate change policy that commits the EU as a whole to cut GHGs by at least 40 percent by 2030 (European Commission, 2014).

Universities are uniquely positioned in the divestment space. Many universities hold large endowments that have significant positions in fossil fuel companies and/or funds that hold fossil fuel assets. Universities consume fossil fuels in many aspects of campus operations. Universities support most of the research that has identified the existence, nature, and consequences of climate change. Finally, and perhaps most importantly, the purpose of the university is to educate, particularly the young adults who will live and work in the climate of the future.

Arguments for divestment by universities from fossil fuels are frequently based on moral grounds. In their letter urging divestment, students from Smith College argued:

> Our campaign is centered around the belief that Smith College has a moral responsibility to divest…We are financially supporting an industry that strips communities of the ability to thrive. In Holyoke, where there is a coal-fired power plant, one in four children has asthma… Climate change refugees, fleeing their homes due to flooding and extreme weather events, continue to grow in number. Those who are the least to blame for this crisis will suffer from it the most.[7]

Ignoring the moral issue at the core of the climate challenge presents real peril to the reputation of universities and their standing in society. The costs of climate change stretch across generations due to the long atmospheric lifetimes of greenhouse gases (GHGs) and to the inertia in the Earth's climate system, posing the question of what today's societies are doing to their children. And, as observed by the students at Smith College, the poor bear the brunt of the economic and health impacts of climate, a relationship that holds within every nation, and between rich and poor nations. The fact of climate change requires development of the capacity to manage our collective impact on our own environment, and universities have a duty to help foster this development. Universities cannot pretend they have no such responsibility without forsaking the role they have historically engendered as trustees of humanity's capacities, values, and understanding.

[5] The reduction compares 2012 to 2005. https://www.rggi.org/docs/Documents/2012-Investment-Report.pdf
[6] http://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change
[7] http://divestsmithcollege.com/2014/10/27/response-to-fossil-fuels-update/

But the case for divestment is not limited to moral imperatives. Holding assets in fossil fuel companies, and in companies that are fossil fuel-intensive, pose a significant array of risks for universities that appear on multiple, simultaneous fronts. Fossil fuel companies will eventually experience a dramatic decline in demand for their products, producing so-called "stranded carbon." Price volatility is the norm with fossil fuel assets, and it is exacerbated by rising concerns about extractive practices and forced internalization of external costs, shareholder advocacy, the elimination of generous subsidies, and intense competition from energy efficiency and fast-developing low-carbon sources of energy. Taken as a whole, the financial, moral, and reputational risks associated with holding assets in fossil fuel companies create a compelling case for divestment, even without considering the rising opportunity costs of not transferring investments to cleaner alternatives.

We begin with a brief overview of the current state of knowledge regarding climate change and its impacts. We argue that universities should view themselves as "universal owners" that should be aware of the negative and positive externalities generated by their investment decisions. We then make the case for divestment based on the benefits it can generate, followed by the debunking of conventional wisdom about divestment. We close with some recommendations on how universities can develop and implement an investment plan that reduces the costs and risks associated with climate change.

Climate Change and its Impacts

Although some prominent politicians and significant segments of the electorate remain skeptical about the need to reduce greenhouse gas emissions, the effects of anthropogenic climate change are clear and indisputable across every biophysical realm of the planet, from the top of the atmosphere to the depths of the ocean. Temperatures at Earth's surface, in the troposphere (the active weather layer extending up to about 5 to 10 miles above the ground) are rising; snow and ice cover have decreased in most areas; sea ice in the Arctic has decreased dramatically; atmospheric water vapor is increasing; sea level is rising; growing season length has increased in some regions; the ocean is becoming more acidic; many terrestrial, freshwater, and marine species have shifted their geographic ranges, seasonal activities, migration patterns, and abundances; and there are increasing trends in extremes of heat and heavy precipitation events, and decreases in extreme cold. (IPCC, 2014a; Walsh, et al., 2014).

These changes in the Earth's biophysical systems will have wide-ranging impacts on society. Some impacts will be positive, such as longer growing seasons in temperate regions, and more efficient shipping routes and easier access to oil and gas resources in an increasingly ice-free Arctic.

But the preponderance of evidence indicates that the costs of climate change will outweigh the benefits. Continued abundance of greenhouse gases in the atmosphere will increase the risk of severe, pervasive, and in some cases irreversible detrimental impacts (IPCC, 2014b). Climate change is projected to undermine food security; reduce renewable surface water and groundwater resources in most dry subtropical regions, intensifying competition for water among sectors; impair human health especially in poor developing countries; retard economic growth, making poverty reduction more difficult; and increase the displacement of peoples. In urban areas climate change is expected to increase risks for people, assets, economies and ecosystems, including risks from heat stress, storms and extreme precipitation, inland and coastal flooding, landslides, drought, water scarcity, sea-level rise, and storm surges.

This puts universities that are reluctant to alter their current investment structures in a tough spot. Denial that climate change is upon us and already wreaking significant harm is not an option. It would be viewed – ever more widely – as an abdication of their treasured position as representing the intelligence of society. They are left with the argument that investment is an essentially one-dimensional affair and that it is not their concern, but that of the money managers they trust, who are only supposed to look at the numbers. They can buttress this argument by citing their responsibility to preserve and expand the assets of the university, and point out that this defends and supports the mission of education. Instead of denying the consequences of climate change, this is an argument for ignoring consequences.

But universities are not like businesses that can quickly dissolve and reform, get bought, merge, consolidate, downsize, or disappear suddenly. They move slowly. They are ponderous. They are in business for the long term. They should invest that way. Are fossil fuels a good long-term investment for them?

The University is a "Universal Owner"

In 2013 there were 83 institutions of higher education in the United States with endowments of at least $1 billion, and an additional 73 institutions above $500 million (NACUBO, 2014). Most of these institutions own securities in a broad cross-section of the economy. Their investments are typically long-term and highly diversified. Such investors are known as "universal owners," as they are considered to own a slice of the economy (Monks and Minow, 1996). Because their fortunes are closely linked to the overall performance of the entire economy, more than to the individual performance of any particular asset or industry within their portfolio, it is in the financial best interest of universal owners perform to support a sustainable economy and efficient financial markets. As Hawley and Williams (2002) state: "…their portfolios' performance – hence their ability to provide for beneficiaries – depends more on the overall health of the economy than on the fortunes of any particular company." Universities with substantial endowments should have financial managers who consciously invest as universal owners because they own a mix of asset classes, including alternative assets such as hedge funds, private equity, commodities, and real estate, and because at least some of their investments are passively managed.

The United Nations Environment Programme estimated that the cost of environmental damage - $6.6 trillion, about one third caused by the world's 3,000 largest publicly traded companies - *places more than 50 percent of company earnings at risk.* Because the portfolios of universal owners are inevitably exposed to this risk by investing in these companies, they should attempt to "positively influence the way business is conducted in order to reduce externalities and minimise their overall exposure to these costs. Long-term economic wellbeing and the interests of beneficiaries are at stake" (UNEP Finance Initiative, 2010). UNEP notes that because "companies do not measure and deduct off-balance-sheet environmental liabilities from their revenues, profits inaccurately portray the company's actions as positive. The lack of international accounting standards to identify the full financial costs of environmental impacts presents a barrier to managing related financial risks for companies and investors." The coming reckoning for climate change is not being signaled in financial data. But universities should be smarter – they should have financial managers who will make the effort to see beyond the lack of financial signals and understand what's coming.

Financial managers have the legal fiduciary responsibility to maximize long-term investment results on behalf of current and future students, faculty, and retirees, among others. They must act "in the best interests of its clients."[8] This includes not just loyalty, but care. Here is an elaboration of the duty of care, described by the American Law Institute's Restatement of Trusts:

> "This standard requires the exercise of reasonable care, skill and caution, and is applied to investments not in isolation but in the context of the ... portfolio and as a part of an overall investment strategy" (ALI, 2012).

A university may have no reason to suspect that its investment managers and advisers are disloyal, but it should make an effort to determine whether they are showing due care in seeing the big picture. Universities should articulate the expectation that the due care owed to them by its fiduciaries includes accounting for foreseeable impacts. It is now foreseeable that industries that are the primary cause of climate change will be forced to make drastic adjustments to mitigate changes to planetary conditions. Great uncertainty now exists concerning the value of investments in these companies over the long-term. If investment decision-making is primarily based on analysis of past performance, and assumptions of business as usual continuation, and not on the eventual accounting for what are now externalities, its impact on future profits will not be seen.

Universal owners should be especially aware of the negative and positive externalities

[8] https://www.investmentadviser.org/eweb/dynamicpage.aspx?webcode=KI_Fiduciarydty

generated by their investment decisions. A traditional investor might invest in the stock of a firm that externalizes a cost of production by dumping contaminated wastewater into river (e.g., General Electric and PCBs in the Hudson River). A lower cost of production might improve the economic performance of the firm and thus benefit investors. In contrast, a universal owner may not benefit from such an investment because the externality is simply transferred to another company in its portfolio whose performance is damaged by the pollution (e.g., a fisheries or a municipality in the lower Hudson River). There is no place for the universal owner to hide from externalities. They come back into the portfolio as taxes, insurance premiums, inflated input prices, and the physical cost of disasters. (Seitchik, 2007). The long-term view also recognizes that businesses do eventually often face accountability, (e.g., G.E. is currently involved in Hudson River cleanup operations costing more than a billion, with continuing undetermined liabilities). In a similar vein, traditional investors may avoid firms that generate positive externalities such as education and training because the firm bears all the cost but only a fraction of the benefit. A universal owner recognizes that the benefits of a more educated workforce spill over to other portfolio companies, even though the company making the investment does not capture all the benefits (Hawley and Williams, 2002). Universal owners, therefore, have a distributed stake and the overall health of the economic system is an important goal for them.

Universities are also arguably better placed than others to see the repercussions of failing to account now for costs that are currently external to the balance sheet of polluters, because they are the eyes and ears of society, they are the brains of civilization. And because they hold themselves out as places of education, research, and the development of enlightened analysis and discourse, and because others look to them for this leadership, they fail others as well as themselves if they do not make the effort to invest for the long-term, rather than focusing on the next quarterly report.

Because the universal owner has an interest in the overall health of the economy, which is significantly harmed by the ability of polluters to escape accountability, universities help themselves by working with other universal owners to support public policy that internalizes the negative externalities associated with pollution. By definition, negative externalities distort the information generation by the market and lead to inefficient, sub-optimal decisions by producers, consumers, and investors. The scale of the distortion is large with climate change because, to varying degrees, it affects most natural systems, every sector of the economy, and every person. A universal owner's broad portfolio and need for a stable long-term position provides strong motivation to support policy measures that seek to correct such market imperfections, of which climate change is arguably the most pressing at this time.

Sustainability and Natural Capital

Sustainability is the ability to maintain or support an activity or process over the long term. In the context of human well being, sustainability refers to the ability to support the continued expansion of human development in the long term. Continued degradation of the planet's natural systems erodes the ultimate source of that wealth, as well as the health and wellbeing of those who would enjoy that wealth. The universal owner should be investing in sustainability because of its necessity for the long run well-being of society, specifically in the long run production and maintenance of wealth, and with the relationship between current and future generations. Because of the university's role as educator, it should be leading the way for all similarly constituted entities.

The universal owner is also interested in a closely related concept: natural capital. The production of goods and services requires human capital and natural capital; they are "essential" in that production is zero if either input is zero. Here human capital includes labor, manufactured capital (machines, factors, infrastructure), and social capital. Natural capital refers to the planet's physical and biological systems that provide us with ecosystem goods and services that sustain life and economic activity (Costanza and Daly, 1992). Just as a machine or a bridge can wear out, natural capital also depreciates through depletion (e.g., oil production) and degradation (e.g., air pollution that diminishes the productivity of a forest). The importance of investing in people and physical capital to support economic growth in the future is axiomatic in economics departments, business schools, and investment committees. There is a growing recognition that long-term economic growth also requires a commensurate investment in maintaining natural capital. This notion should be central to the thought process of a universal owner.

Accompanying the obligation to not invest in activities that damage natural capital is the need to recognize the opportunity cost of *not* investing in the profitable areas of the future. These are clean technologies that use renewable sources. These are not just of interest to the universal owner because they have the potential to provide jobs and economic stability, but because they are clearly needed to replace dirty fuels and processes, and because laws and societal momentum are clearly building to support their development. Universities should invest in these needed technologies because of the general benefit accruing to them as universal owners, because of the specific opportunities for short-term gains from those that break out of the pack and win acceptance in the marketplace, and because universities are expected, as educators and leaders, to help build the new economy that we need.

Climate change is a frontal assault on sustainability because it erodes the natural capital that underpins human development. It is in the best interest of universal owners—and their beneficiaries—to promote polices, behaviors, technologies, and institutions that prevent or mitigate the impacts of climate change, and to work together to develop approaches that create the sustainable technologies and practices the world needs.

Reasons to Divest

All Education is Sustainability Education

Climate change is the among the biggest challenges of our time, and it will grow to dominate the political, economic, and technological agendas of today's students. As noted by David Orr (1992), an early and insightful thought leader on this subject, this means that all education at some level is education about sustainability; it must be woven through all disciplines and infuse every aspect of the university. Orr also asserts that knowledge carries with it the responsibility to see that it is well used in the world. It is not enough to lay out the science and economics of climate change; through its teaching, research and engagement with society the university must see that knowledge is used to chart the way forward.

Universities are supposed to help create the better civilization of tomorrow. They are the realization of the Enlightenment's valuation of reason. If Universities do not play a leading role in guiding humanity through the transition to a sustainable human existence on the Earth, who will?

Align Investment with Teaching, Research, and Operations,

Education related to sustainability is a booming business in higher education. A 2008 survey by the National Council for Science and the Environment (NCSE) identified 840 degree-granting programs at 652 institutions that offer 1183 interdisciplinary environmental degrees (Vincent, 2009). Fifty-eight percent of the respondents in that survey indicated that their programs were growing. Excellent job prospects are one explanation for the high level of interest. The United States Department of Labor (2014) reported that employment of environmental scientists and specialists is projected to grow 15 percent from 2012 to 2022, faster than the average for all occupations. The NCSE survey indicates that the primary force behind the growth in programs related to sustainability is bottom-up interest by faculty and students. This is a strong signal of an objective reality. The need for knowledge in this area is widely perceived, and is generating concerted effort from many directions.

Mirroring the expansion of education in sustainability is a rise in interest in applying concepts of sustainability to campus facility management. Many universities have invested considerable effort in "greening" their business operations, including efforts to improve the efficiency of energy and water use, recycling, purchasing and procurement, building and renovation, and outreach to students, faculty, and staff. The Association for the Advancement of Sustainability in Higher Education (AASHE) has developed a strong network of university officials that collaborate to share best practices. AASHE has more than 1,000 members, of which 80 percent are institutions of higher education (AASHE, 2012). In 2006, twelve college and university presidents initiated the American College and University Presidents'

Climate Commitment (ACUPCC).[9] Second Nature, which administers the program, currently lists 685 signatories and 533 Climate Action Plans.[10] The Sustainable Endowments Institute's efforts to help universities establish Green Revolving Funds, dedicated to greening campus infrastructure, has resulted in more than $110 million in commitments in just three years.[11]

However, sustainability has not reached the boardroom to nearly the same extent as it has the classroom, the dining room, and the boiler room (Karp et al., 2014). The vision, action, and transparency that characterize education and campus operations are virtually absent from financial decision-making. Universities therefore face charges of being hypocritical. What message do you send when you grant degrees with titles such as "Sustainability," Environmental Science," and "Climate and Society" with one hand, yet with the other hand invest in the activities that drive the very problems those degrees aim to address? Charges of hypocrisy are damaging to the reputation of the university, and should be regarded as risks stemming not from irresponsible critics, but from a failure of integrity. As stated by Stanford University's Task Force on Sustainable Investing:

> "…climate change is a serious issue…addressing and accounting for this issue in a holistic way is necessary to produce the best possible returns in the long-term and *align the University's investment practices with its demonstrated commitment to sustainability.* (emphasis added)

Reduce Risk to Reputation

The ability of the university to sell itself to prospective students, faculty and contributors rests on its authority as a source of knowledge vital to humanity. If there is a misalignment of its teaching, research, operational, and financial behaviors, that authority, and the institution's viability, is put at risk. Failing to act carries a significant reputation risk, as the university's very existence is defined as a civilizing force. Universities seen to be complicit in destruction will likely lose position, students, faculty, and reasons to be proud of what they do. A 2004 report by the Center for Higher Education Research and Information commented that

> "Universities have frequently been regarded as key institutions in processes of social change and development. The most explicit role they have been allocated is the production of highly skilled labour and research output to meet perceived economic needs. But to this role may be added, especially during periods of more radical change, roles in the building of new institutions of civil society, in encouraging and facilitating new cultural values, and in training and socialising members of new social elites."[12]

[9] http://www.presidentsclimatecommitment.org/
[10] http://www.presidentsclimatecommitment.org/signatories/list
[11] http://opinionator.blogs.nytimes.com/2015/02/06/investing-in-energy-efficiency-pays-off/?_r=1
[12] http://www.open.ac.uk/cheri/documents/transf-final-report.pdf

Given that our current GHG trajectory will lead to a significantly less stable world, we clearly are in such a period.

Sustainability is an important issue for students and parents when choosing a college. A survey by the Princeton Review (2014a) of 10,000 college applicants indicated that 61 percent would use information about a school's commitment to the environment in their decision to apply to or attend the school. The Princeton "Green Ratings" (2014b) measure 861 colleges concerning their sustainability-related practices, policies and academic offerings. Peterson's online guide to colleges lists 809 colleges that have the keyword "sustainability" in the overview of their institution. Clearly, sustainability is increasingly on the minds of students and parents.

Reduce Financial Risk

Risk From Stranded Carbon: Signers of the Copenhagen Accord in 2009 agreed to try keep global average temperature increases resulting from GHG emissions to less than 2°C (3.6°F) (UNFCC, 2009). The goal was to limit dangerously disruptive climate impacts that are projected to occur at higher temperatures.

Juxtaposed with the 2°C target is the vast amount of carbon remaining in the Earth in the form of coal, oil, and natural gas (Figure 1). To have at least a 50 percent chance of keeping warming below 2 °C throughout the twenty-first century, the cumulative carbon emissions between 2011 and 2050 need to be limited to about 1,100 gigatons of carbon dioxide (Gt CO_2) (Clarke et al., 2014). However, the GHG emissions embodied in current estimates of global fossil fuel reserves[13] are about three times higher than this (Meinshausen et al., 2009), implying that any sort of "business as usual" scenario of fossil fuel combustion is incompatible with a warming limit of 2 °C. McGlade and Ekins (2015) illustrate that the geographic distribution of fossil fuel reserves and variations in production costs create sharp regional differences in the burden of unburnable reserves. The United States would have to leave 92 percent of its coal reserves in the ground, but very little of its oil (6 percent) and gas (4 percent) reserves. Some 74 percent of Canada's vast oil sands reserves and 61 percent of Middle East gas reserves are unburnable in an emissions scenario that meets the 2 °C target.

[13] In publicly traded companies, reserves have a fairly explicit definition. In the United States, for example, the Securities and Exchange Commission (SEC) defines "proved oil and gas reserves" as "those quantities of oil and gas, which, by analysis of geoscience and engineering data, can be estimated with reasonable certainty to be economically producible—from a given date forward, from known reservoirs, and under existing economic conditions, operating methods, and government regulations—prior to the time at which contracts providing the right to operate expire, unless evidence indicates that renewal is reasonably certain, regardless of whether deterministic or probabilistic methods are used for the estimation" (SEC, 2010). In most state-owned companies, reported reserves are not subject to independent verification and are influenced by political motivations, and thus are sometimes difficult to compare with reserve estimates from publicly traded companies.

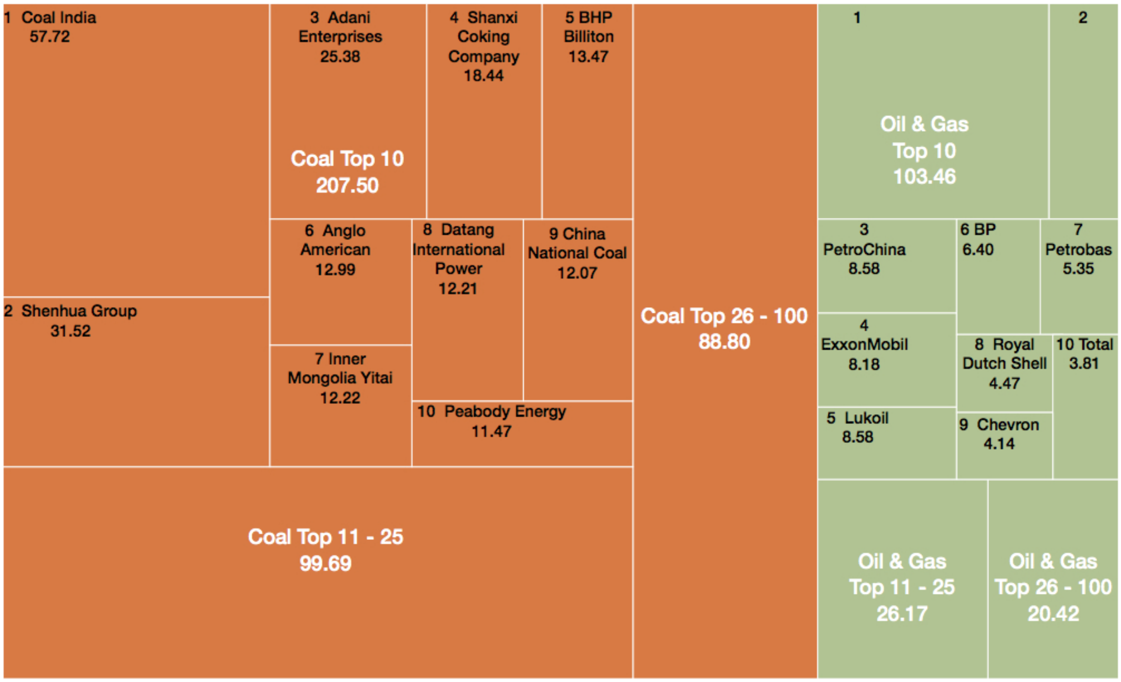

FIGURE 1. The Carbon Underground 200 The world's top 200 public companies ranked by the carbon content of their fossil fuel reserves. Units are GtCO2. Data from FossilFreeIndexes.com.

A far larger quantity of carbon exists in the form of currently uneconomic unconventional resources such as tight and heavy oil, oil shale, tight gas, coal bed methane, and natural gas hydrates[14], some portion of which would surely be viable as reserves in the future due to technical innovation (Rogner et al., 2012).

Material efforts to enforce this carbon budget will result in a dramatic loss of value for fossil fuel assets, principally in the form of stranded assets. In the context of upstream energy production, the International Energy Agency (IEA) (2013a) defines stranded assets as:

> …those investments which are made but which, at some time prior to the end of their economic life (as assumed at the investment decision point), *are no longer able to earn an economic return*, as a result of changes in the market and regulatory environment (emphasis added).

Bauer et al. (2013) estimate that the net present value of global fossil fuel rents[15] from 2010 to 2100 in a world with no climate mitigation policies is $29.9 trillion. In world

[14] Tight oil refers to crude oil produced from petroleum-bearing formations with low permeability formations that must be hydraulically fractured to produce oil at commercial rates. Shale oil is a subset of tight oil. Heavy oil is a type of crude oil characterized by an asphaltic, dense, viscous nature (similar to molasses). Oil shale is any sedimentary rock that contains solid bituminous materials (called kerogen) that are released as petroleum-like liquids when the rock is heated in the chemical process of pyrolysis. Tight gas refers to natural gas reservoirs locked in impermeable, hard rock. Coalbed methane is produced from coal seams; it is formed during coalification, which is the geologic process that transforms organic material into coal.

[15] Rent is the excess of the value from the production of a resource over the sum of all costs of production including the compensation to all factors of production. The latter includes the minimum return on capital required by the investor.

with policies that stabilize emissions at 450 ppm CO_2-eq,[16] roughly consistent with a 2 °C temperature increase, rents fall by $12.4 trillion. Oil rent falls the most, by about $5.7 trillion, followed by natural gas rent loss at $3.6 trillion. In a subsequent analysis, Bauer et al. (2015) use a multi-model scenario ensemble to assess the impacts of climate change stabilization policies on fossil fuel markets. The authors employ all known models in the scientific literature that assess climate change mitigation policies. They conclude that climate stabilization policies significantly reduce revenues from fossil fuel extraction. In a world with policies that stabilize emissions at 450 ppm CO_2-eq, the net present value of revenue for all fossil fuel extraction from 2010 to 2100 falls by 12 to 50 percent compared to a no-policy world.

Companies with large amounts of stranded carbon resources could see their stock prices fall, lowering the value of investment portfolios that hold the shares. The scale of this impact is enormous because fuels are an enormous asset class. The 2014 value of the 1,469 listed oil and gas firms is $4.65 trillion; 275 coal firms are worth $233 billion (Bloomberg New Energy Finance, 2014). As much as 30 percent of the value of some of the world's stock exchanges is in proven fossil reserves (Douglass, 2013).

The notion of "unburnable carbon," once an academic abstraction, is quickly becoming mainstream in investor circles. In 2013 a group of 70 global investors managing more than $3 trillion of collective assets launched a coordinated effort to spur 45 of the world's top oil and gas, coal and electric power companies to assess the financial risks that climate change poses to their business plans (Ceres, 2013). Analysts at Wall Street firms such as Goldman Sachs, Citigroup, HSBC, Bloomberg LP, and others are seriously grappling with the issue of stranded carbon assets.

Meyer and Brinker (2014) contend that the "stranded carbon" argument is based on faulty logic. They argue that the intrinsic value of most publicly traded oil and gas companies is based primarily on the valuation of proved reserves, most of which are expected to be monetized in 10 to 15 years, and not by the value of "probable" and "possible" resources that could be commercialized over a much longer planning horizon. This point is corroborated by the fact the reserve:production ratio in the United States consistently hovers in the range of 10-15 years for oil and natural gas. Meyer and Brinker (2014) also argue that the fossil fuel industry will not suddenly wake up one morning to find that their fuels are obsolete. Market forces will generate the signals that lead to a smooth and gradual transition to the next generation of fuels.

But there are several reasons to question this argument. First, the fossil fuel industry continues to invest heavily in its long-term future. From 1992 to 2006, the 57 largest United States oil and gas companies had new investments of $1.25 trillion (Enrst and Young, 2007). In 2012 alone, just five oil and gas companies spent $41.3 billion on new capital in the United States (Carew and Mandel, 2013). On a global scale, there is about $1.1 trillion dollars of capital expenditures planned through 2025 (Carbon

[16] A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as "million metric tons of carbon dioxide equivalents ($MMTCO_2Eq$)." The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. $MMTCO_2Eq$ = (million metric tons of a gas) * (GWP of the gas)

Tracker, 2014). Much of that investment will be in the Arctic and deep water regions where production takes longer to bring on line. The industry also continues to invest in its future via research and development of new technologies to enhance exploration and production, attracting about $7 billion in funding since 2003, specifically in the areas of shale gas, tight oil, and heavy oil (Choi, 2014). Investment in transportation and storage has also shown robust growth. Capital spending in oil and gas midstream and downstream infrastructure increased 60 percent from 2010 to 2013 in the United States, and is expected to remain strong in the near term (Fullenbaum et al., 2013). Pipeline and storage facilities are built for the long run; about 50 years in the case of a natural gas pipeline. Finally, many publicly traded oil and gas companies are entering long-term partnerships in China, African and Latin America. Clearly, this is an industry that believes its product will be in great demand for some time to come.

Second, many public companies have financial interests in state-owned oil and gas companies. The reserve:production ratios in many nations with state control of energy are in the 50 to 100 year range.[17] These nations face much greater risk from stranded carbon, and some of that risk spreads to publicly traded oil and gas companies whose business is connected to the state-owned entities.

Risk From Reduced Energy Subsidies: Energy subsidies that are properly structured can help new technologies gain a foothold in the market and provide relief to low-income households. But subsides must be monitored to insure that they serve the public interest and not merely a private one. Subsidies to oil, coal, and natural gas do not support innovative technologies or less-polluting energy: they nakedly support the production of more oil, coal, and natural gas. The perverse and destructive nature of subsidies to fossil fuels increasingly is the focus of widespread public criticism.

The International Monetary Fund (IMF) (2013) has urged policymakers the world over to reform subsidies for products from coal to gasoline, arguing that this could translate into major gains both for economic growth and the environment. The World Bank recently established the Energy Subsidy Reform and Delivery Technical Assistance Facility. Its purpose is to reduce the harm of distortive energy subsidies on the world's poor (World Bank, 2014). At the 2009 G20 summit in Pittsburgh, the group agreed to "rationalize and phase out over the medium term inefficient fossil fuel subsidies that encourage wasteful consumption." They reaffirmed this resolution at the 2013 summit in St. Petersburg. The social and economic cost of energy subsidies have been highlighted in energy exporting nations, where such subsidies can be as high as 20 percent of GDP (Krane, 2014). Aldy (2014) found that special tax provisions that subsidize United States oil, gas, and coal companies amount to nearly $5 billion a year. Finally, a number of organizations have made energy subsidies a principal focus of research and/or political action, which increases the likelihood that they will be reduced or eliminated (e.g., EarthTrack[18], the Global Subsidy Initiative[19], and OilChange International).[20]

[17] Current reserve:production ratios for crude oil: Iran (121 years), Iraq (111 years), Saudi Arabia (204 years).
[18] http://www.earthtrack.net/
[19] http://www.iisd.org/gsi
[20] http://priceofoil.org/

Once in place subsidies of any kind are hard to eliminate when they benefit powerful special interests. Yet subsidies to fossil fuels are increasingly in the spotlight because they exacerbate the harmful environmental and human health impacts of the fossil energy system. A reduction in such subsides will, *ceteris paribus,* raise the cost of exploration, production and use of fossil fuels, and decrease the profitability and investment in those industries.

Risk From Externalities: The use of fossil fuels imposes external costs on society. In addition to climate change, there are significant nonclimate-related damages, including the health impacts of combustion byproducts, land disturbed by extraction, water use, health impacts to workers in the energy industries, acid rain, contaminated land and water, hazardous waste generation, social unrest from corrupt sequestration of profits in many producing nations, and national security costs related to insuring access to foreign sources of oil. Externalities are the rule, not the exception, when talking about fossil fuels; they are pervasive and enormous. Combined with subsides to fossil fuels, externalities severely distort market signals, making the price of fossil fuels lower and their consumption higher than in a world with full accountability.

The world's annual environmental cost from human activity amounted to $6.6 trillion in 2008, equivalent to 11 percent of GDP. About two-thirds of that cost is accounted for by the impacts of climate change (UNEP, 2010). External costs for electricity production from fossil fuels in the EU range from about 1 Eurocent/kilowatt-hour (kWh) (advanced gas technologies) to 26 Eurocents/kWh (lignite) in 2005 – more than twice the retail value of electricity prices in 2005 (about 10 Eurocent/kWh) (EEA, 2008). EU-wide impacts of coal-generated electricity amount to more than 18,200 premature deaths, about 8,500 new cases of chronic bronchitis, and over 4 million lost working days each year. The economic costs of the health impacts from coal combustion in Europe are estimated at up to €42.8 billion per year (HEAL, 2013).

Numerous studies demonstrate that the external costs of coal are particularly pernicious (see the review by Grausz (2011)). A study by the National Academy of Sciences found that non-climate damages resulting from the use of coal in electricity generation amounted to $62 billion in 2005, or 3.2 cents per kWh, nearly 40 percent of the average price of electricity in 2005 (8.1 cents per kWh). These damages are twenty times higher per kWh than damages from electricity generated by natural gas. Climate-related damages ranged from 1 to 10 cents per kWh, depending on how much damage is assigned to one ton of CO_2-eq (NRC, 2010).

A growing number of studies find that the costs of coal outweigh its economic benefits. Epstein et al. (2011) estimated that the life cycle effects of coal and the waste stream generated are costing the United States public a third to over one-half of a trillion dollars annually. The value of electricity generated from coal in 2011 was about 0.2 trillion dollars. Nationally, the average economic cost of health impacts associated with fossil fuel usage is $0.14–$0.35/kWh. Averaging masks the substantial differences between sources. For coal the associated economic cost is estimated as from $0.19-$0.45/kWh. But oil is less than half that, ($0.08–$0.19/kWh), and natural gas is $0.01–$0.02/kWh. For coal and oil, these costs are larger than the typical retail price of electricity. (Machol and Rizk, 2013). Muller et al. (2011) estimated that the damages from coal-generated electricity range from 0.8 to 5.6 times the GDP generated by that sector of the economy. These studies suggest that if the market priced coal correctly, its use would cease to be a viable economic activity.

There is every reason to believe that the external costs of fossil fuels will grow due to the increased use of lower quality unconventional sources, and to the rising impacts of climate change. As the case of liquid fuels illustrates, lower quality and unconventional resources generally have great environmental impacts that conventional sources. Canadian oil sands crudes are more GHG emission-intensive than other crudes they may displace in United States refineries, and release about 15 to 20 percent more GHGs on a complete life-cycle basis ("well-to-wheels") than the average barrel of crude oil refined in the United States (Brandt, 2011; Lattanzio, 2014). Liquid hydrocarbon fuels derived from oil shale have 20 to 75 percent greater fuel cycle GHG emissions compared to fuels produced from conventional oil (Mulchandan and Brandt, 2011). Coal-to liquids release 128 percent more GHGs on a well-to-wheels basis compared to gasoline produced from conventional crude oil (Bartis et al., 2008). The greater environmental impact of lower quality and unconventional sources energy extends to the demand for water. On a wells-wheels basis, oil sands syncrude and shale oil use 3 to 4 times the water compared to the primary recovery of conventional crude oil (Schornagel, et al., 2012).

On the climate side, the leading economic models all point in the same direction: climate change causes substantial economic harm, costs are rising, and current estimates probably understate future harm because they underestimate costs such as social unrest and disruptions to economic growth (Revesz et al., 2014). One study of the expected rise in costs for escalating GHG emissions and climate change impacts estimated external costs of US$ 21 trillion in 2050 (UNEP, 2010), exceeding the combined estimated value of oil, coal and gas companies by more than four times.

The message here is clear: universal owners are highly exposed to large and growing external costs imposed on society by the fossil fuel industries, and the bill is coming due. A United Nations report estimated that the largest 3,000 public companies already caused over $ 2.15 trillion of global environmental costs in 2008, which equates to nearly 7 percent of their combined revenues. Environmental costs can affect portfolio values by reducing future cash flows for companies held in portfolios and lowering future dividends for all hydrocarbon fuels (UNEP, 2010). In particular, coal is destructive far beyond its value, and new sources such as oil sands, oil shale and coal-to-liquids exacerbate concerns: these sources require high oil prices to be competitive, may be constrained by their land and water requirements, have larger carbon intensities than conventional sources, and will face stiff public opposition in some regions (Ceres, 2010). It is in the interest of universities with large endowments to act in concert to address these environmental impacts, and to reduce the inevitable impacts externalities will have on their financial health.

Risk From Reduced Exemption from Environmental Regulation. The fossil fuel industry enjoys many exemptions from major environmental laws designed to protect public health via the protection of the nation's air and water resources. These exemptions were won by the political influence that oil, natural and coal companies enjoy in state and federal lawmaking. Environmental compliance is costly, so exemption is a form of subsidy that lowers the cost of fossil fuels relative to economic activities that must comply with the regulations, and thus further distorts the costs of bringing low carbon energy technologies to scale (Outka, 2012).

The most well-known exemption is the so-called "Halliburton Loophole" that exempts hydraulic fracturing and oil and gas drilling from certain sections of the Safe Drinking Water Act (SWDA) of 1974 and the Clean Water Act (CAA) of 1972. Then Vice President Dick Cheney was the former CEO of Halliburton, an oil and gas services company that holds an exclusive patent for hydraulic fracturing. The loophole means that the EPA does not regulate the injection of fracturing fluids under the Safe Drinking Water Act, despite the fact that drilling fluids contain high levels of total dissolved solids (TDS), fracturing fluid additives, metals, and naturally occurring radioactive materials. Hydraulic fracturing has used more than 2,500 products containing 750 chemicals and other components, hundreds of which are known carcinogens, hazardous air pollutants, or chemicals otherwise regulated under the SWDA and the CAA (House of Representatives, 2011; National Library of Medicine, 2011; Colborn, 2011).

The Clean Water Act requires permits for all discharges of pollutants to waters in order to prevent pollution. The law, however, exempts storm water discharges (surface water runoff resulting from rain or snow) from oil and gas drilling and production activities from this permitting requirement. The 2005 Energy Policy Act broadened this exemption to include storm water discharge from oil and gas construction activities.

The Emergency Planning and Community Right to Know Act requires companies to disclose information related to locations and quantities of chemicals stored, released, or transferred. Oil and gas exploration and production wastes are exempted from this requirement.

The Resource Conservation and Recovery Act (RCRA) was enacted by Congress as a "cradle to grave" regulatory framework for managing hazardous waste. In 1988, during the final year of the Reagan Administration's second term, the Environmental Protection Agency concluded that regulation of hazardous oil and gas waste under RCRA was unnecessary.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) created a framework for cleanup of toxic materials through creation of the

Superfund Program. In a nutshell, CERCLA established the Superfund program to ensure that parties contributing to an environmental mess are legally responsible for the cost of cleaning it up. Except if the mess is made by an oil and gas company. In a political compromise, the oil and gas industry was taxed in order to pay into the Superfund and in exchange was exempted from CERCLA's requirements. The tax expired in 1985, but the industry continues to enjoy the exemption.

The National Environmental Policy Act (NEPA) requires government agencies to consider the environmental impact of their actions, and requires public comment and evaluation of alternatives through an environmental impact statement process when a significant impact is likely. The 2005 Energy Policy Act (section 390) created a categorical exclusion for some types of oil or gas well expansions, allowing them to occur with limited review. The public now has to prove significant harm to challenge anything on the basis of NEPA violations.

Coal also benefits from lax oversight on health and environmental fronts. Weak enforcement of health and safety laws in coal mines has produced a resurgence in coal workers' pneumoconiosis, or black lung, which has been called an "epidemic" by scientists at National Institute for Occupational Safety and Health (Blackley et al., 2014). The Mine Safety and Health Administration allowed more than 2,700 mines delinquent in $70 million in safety penalties to continue to operate dangerous mines. The delinquent mines reported 4,000 injuries in the years they failed to pay, including accidents that killed 25 workers and left 58 others with permanent disabilities from 1994 to 2014 (Berkes et al., 2014). New EPA rules on the disposal of coal ash, the waste left over when coal is burned to generate electricity, have been widely criticized because they treat the ash as a non-hazardous solid waste, and thus exempt from the more rigorous control under RCRA (Pianin, 2014). Coal ash contains low but potentially harmful levels of such toxic chemicals as arsenic, mercury, chromium and thallium. The new rule also grants wide authority to states to regulate the ash, which is problematic in states where extractive industries wield substantial political clout.

The emission of GHGs from electricity generation is the largest exemption from environmental oversight, but that situation is changing rapidly. EPA's Mandatory Reporting of Greenhouse Gases rule (2010) requires facilities that emit 25,000 metric tons or more per year of GHGs to submit annual reports to EPA. In June 2014 the EPA announced its "Clean Power Plan" for existing facilities that will establish different target emission rates (lbs of CO_2 per megawatt-hour) for each state, with the goal being to reduce carbon emissions from the power sector by 30 percent from 2005 levels by 2030 (EPA, 2014a). The EPA plans to add rules for new and modified power plants in mid-2015 that will require the use of carbon-capture technology by coal plants if and when that technology becomes available, which would significantly impact the price of electricity from those facilities. In contrast, lower emitting new natural gas combined cycle (NGCC) power plants are expected to meet the proposed standard without costly additional investments in emission control.

The exemptions enjoyed by the fossil fuel industries are under increasing legal challenge and public scrutiny. Lawsuits span every phase of the fossil energy system: damages from climate change, the federal leasing process for oil, gas, and coal on federal lands, mountaintop removal in coal mining, hydraulic fracturing, health and safety issues, and toxic chemicals released into the air, water and land. For example, 2015 began with a suit by a coalition of groups to force EPA to remove the exemption from EPCRA, suits to force EPA to take action against Kentucky and West Virginia for not regulating water pollution from coal company mountain-top removals, and the governor of Louisiana arguing in defense of a law recently found unconstitutional in state court that banned suits against oil companies for damaging wetlands. A compilation by the firm Arnold and Porter and made available through the Sabin Center for Climate Change Law at Columbia Law School lists hundreds of cases in the United States alone, related to climate change.[21] Litigation and public scrutiny are likely to increase along with concerns about climate change and hydraulic fracturing, and the growing awareness about the perils of coal. Investors face increased risk on a several fronts in this regard. The cost of production will rise if compliance is enforced or expanded, and access to resources on public lands may diminish.

Reduce Risk from Shareholder Advocacy

Public fossil fuel companies face increasing pressure from their shareholders, which comes in two forms. Companies in every sector are being asked to describe and quantify their exposure to operational, financial, and reputational risks associated with hydraulic fracturing, oils spills, flaring, stranded carbon, and other climate-related risks. Fossil fuel companies face more targeted pressure. Their investors want to know the nature and magnitude of the risk associated with a potential drop in the demand for fossil fuels.

During the 2013 proxy season, there were 110 shareholder resolutions filed with 94 United States companies related to climate change, and voting that supported climate-related resolutions was 50 percent higher than in 2007 (Ceres, 2014). The Ceres data do not evidence a critical mass of shareholder support for climate-related initiatives; just 29 percent of climate resolutions were passed, and many large mutual funds did not support any climate resolutions in the 2013 proxy season. But the trend is clear: investors are increasingly concerned about climate change, and more generally in the issue of sustainability. Environmental and social resolutions accounted for more than 40 percent of all shareholder resolutions submitted in 2012, up from 30 percent in 2011 (Ernst and Young, 2014).

In January 2015, a coalition of UK investors in Shell representing about $300 billion filed a resolution that challenged the company to reconcile its business model with the realities of climate change. Shell urged the shareholders to vote for the resolution, one of the first such actions by a major fossil fuel company. A similar resolution was filed with BP.

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[21] http://web.law.columbia.edu/climate-change/resources/us-climate-change-litigation-chart

Other energy companies appear to be less interested in engagement. Exxon-Mobil has stated "… divestment represents a diversion from the real search for technological solutions to managing climate risks…," that divestment "…would immediately jeopardize the basic standards of living for billions of people around the world," and that not using fossil fuels "…is tantamount to not using energy at all..." (Cohen, 2014). Overlooking the false contention that fossil fuels are the only viable source of energy available, the pertinent inference to be drawn from these statements is that divestment would have an impact on Exxon-Mobil.

Reduce Risk from Oil Price Volatility

Morris Adelman (2003), the founder of modern oil economics, once said that "Oil is so significant in the international economy that forecasts of economic growth are routinely qualified with the caveat: 'Provided there is no oil shock.' '' Adelman's observation derives from the fact that oil prices are connected to many barometers of macroeconomic performance, including inflation, recession, unemployment, consumer expenditures, investment by firms, and the performance of the stock market.

Oil prices are affected by "market fundamentals" (supply/demand for oil), speculation, and so-called exogenous forces (violent conflict, strikes, embargoes, weather, government policy). Whatever their cause, shocks cause volatility in oil prices (Narayan and Narayan, 2007) (Figure 2). The markets for oil products have historically been more volatile than the markets for most goods and services (Regnier, 2007), and that volatility has increased due to the financialization of the oil market, fundamental structural changes to the oil market, and other forces (Ebrahim et al., 2014; Huntington et al., 2014).)

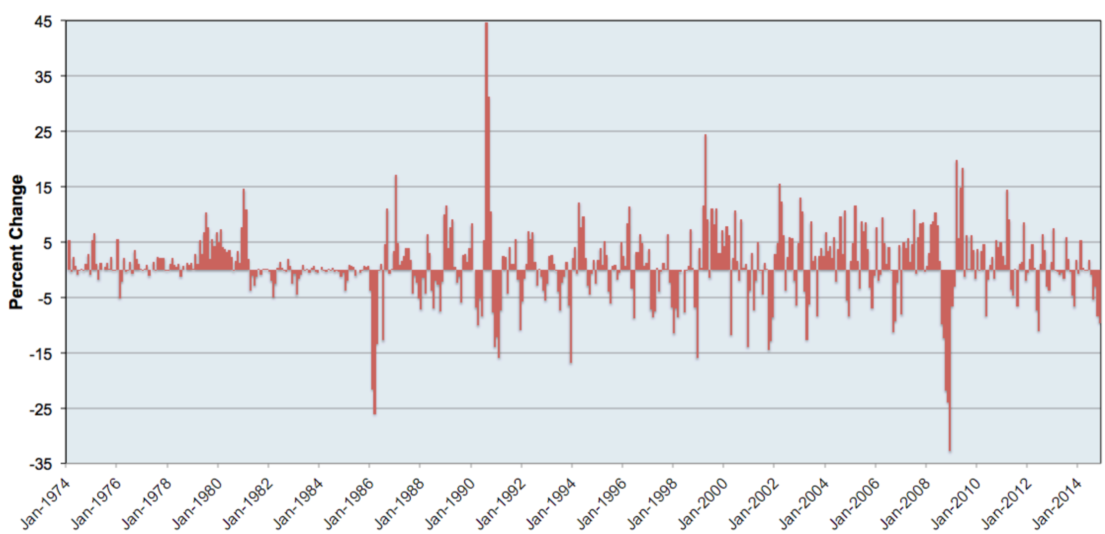

FIGURE 2. Oil Price Volatility Monthly percent change in the refiner acquisition cost of crude oil in the United States, January 1974 through December 2014. Data from U.S. Energy information Administration.

The stock value of publicly traded companies of the nonrenewable energy sector are negatively affected by swings in the level of oil prices (Bianconi, and Yoshino, 2014) and by the volatility in oil prices in the United States (Elyasiani et al, 2011) and China (Broadstock et al, 2012). The most recent example of this is the 20 to 30 percent drop during the six-month period ending February 1, 2105 in the value of funds heavily invested in fossil fuels, corresponding to the rapid and sharp decline in the price of oil (Figure 3).

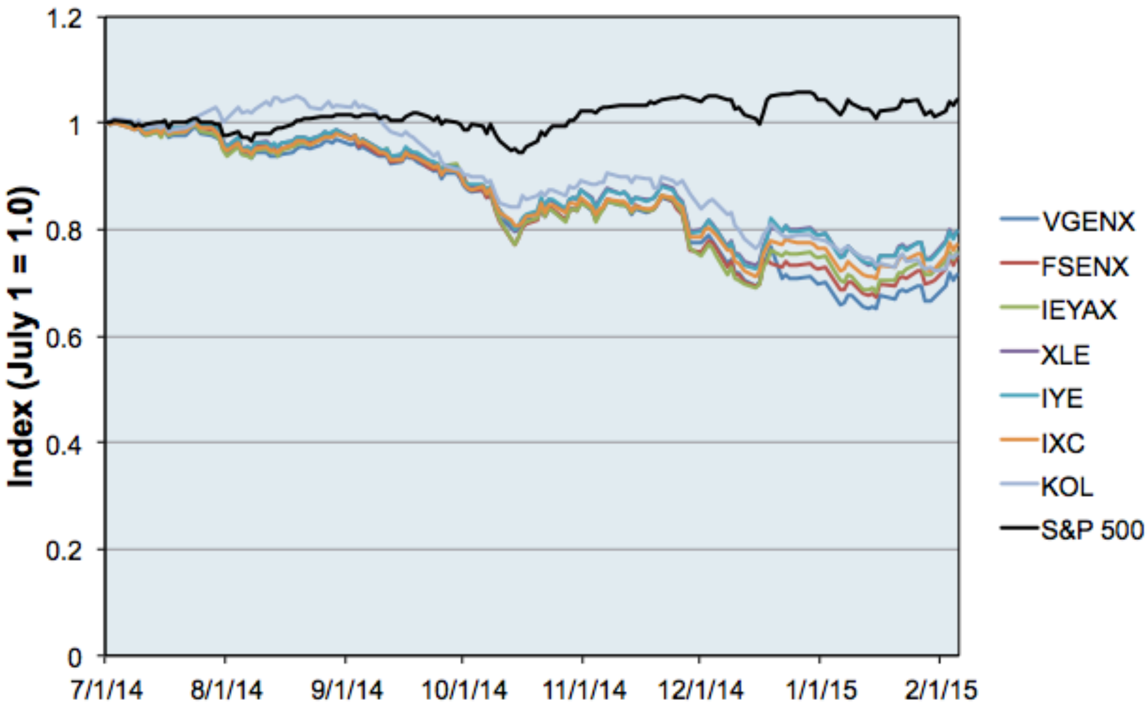

FIGURE 3. Energy Fund Performance Performance of energy funds with large holdings in fossil fuels. Vanguard Energy Inv (VGENX); Fidelity Select Energy Portfolio (FSENX); Ivy Energy A (IEYAX); Energy Select Sector SPDR ETF (XLE); iShares US Energy (IYE); iShares Global Energy (IXC); Market Vectors Coal ETF (KOL). Data from Yahoo! Finance.

Debunking Conventional Wisdom

Universities Should Not Get Involved in Politics

Endowments are used to advance the teaching, research, and public service missions of the university. Some use this fact to justify the rejection of divestment to avoid getting involved in "politics." As Cornell's president, David J. Skorton, Cornell's president stated, "We must resist, in almost all cases, the temptation to manage these precious funds to further social or political causes, no matter how worthy."[22] In a similar vein, Drew Gilpin Faust, Harvard's president, said, "The endowment is a resource, not an instrument to impel social or political change."[23]

These statements may strike one as absurd. Not only are universities heavily involved in local, regional, and national politics, but to decline responsibility for climate action is itself a political act. Mandery (2014) observed:

> Let's separate what universities say from what they mean. Their appeal to the image of university as ivory tower, where objective research is conducted in social isolation, rings hollow. Universities have cultivated relationships with businesses, governments and donors for commercial and political purposes. Derek C. Bok, a former Harvard president, wrote, "The 'ivory tower' has been breached at so many points and the connections with the outside world have grown so numerous and close that the term no longer has descriptive value." Every university president knows this.

Even if a university wishes to be nonpolitical, it must still avoid complicity in damaging prospects for civilization or the health of the planet. This is not being a political actor; this is simply being responsible. Eschewing the use of investment as an instrument for political change does not relieve you of the responsibility to avoid having your investments used as instruments for harm. This is not political action, it is the behavior expected of a quality source of education. Forsaking that role creates the risk that people will no longer turn to you as a resource.

Universities should embrace political action. They are expected to uphold the heritage of the Enlightenment, and this is a fundamentally important political task, urgently needed at this time. Supporting reason, civil discourse, intellectual capacity, thoughtful planning, and vision should be seen as necessary political action in a free democracy, and universities have a key role in improving the quality of the exchange of ideas. They cannot turn from this duty without being inconsistent with the statements they make about their role in society, and the expectations we have of them.

Renewable Energy and Energy Efficiency are not Ready for Prime Time

One of the frequent arguments made against divestiture is that low carbon forms of energy are more expensive than fossil fuels, so "forcing" a transition will impose a significant cost on society. As a blanket statement, this is demonstrably false; but a thorough and nuanced analysis is needed to reveal the actual landscape of energy costs.

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[22] http://www.news.cornell.edu/stories/2014/02/skorton-responds-faculty-senate-call-divestment
[23] http://www.harvard.edu/president/fossil-fuels

Electricity Generation

Electricity generation is the largest source of GHG emissions in the United States, accounting for 32 percent of total emissions since 1990 (EPA, 2014). The world's power sector is in the midst of a rapid transformation. In 2010 for the first time global net investment in renewable electricity generation exceeded that for fossil fuels (Morales, 2011). Then in 2013 the global new installed capacity for solar-powered photovoltaics (PV) (36.7 gigawatts (GW)) first exceeded that of wind power (35.5 GW) (Bloomberg New Energy Finance, 2013). In 2013, renewable energy (excluding large hydro) comprised 41.3 percent of new electric capacity additions and raised renewables' share of the total electricity generation worldwide to about 9 percent.

The rapid adoption of renewable energy has been driven by government subsidies and steep declines in cost. The most frequently used quantity to compare energy technologies is the levelized cost of energy (LCOE). It is determined by dividing a project's total life cycle cost by the total lifetime energy production. Key inputs to calculating LCOE include capital costs, fuel costs, fixed and variable operations and maintenance (O&M) costs, financing costs, and, in the case of electricity generation, an assumed utilization rate for each plant type. LCOE calculations can also incorporate energy subsides, a negative cost.

Multiple independent studies and the observation of actual investment patterns are unequivocal one point: the cost of onshore wind power in many regions of the world is now in a competitive range with base load electricity generation from coal, natural gas, and nuclear sources, even when subsidies are excluded (EIA, 2014a; Kost et al., 2013; OpenEI, 2015; Lazard, 2014; WEC 2013; IRENA, 2012). Regional considerations are important for renewable technologies due to the intermittent nature of wind and solar radiation, and to geographic variations in the wind and solar energy resource bases. In the United States, new onshore wind capacity in the best locations is cheaper than some new natural gas facilities, and cheaper than the best new coal and nuclear facilities (EIA, 2014; Lazard, 2014).

Electricity from offshore wind and solar photovoltaic (PV) facilities are, on average, more expensive than power from conventional sources. But in some locations in the United States, new grid-connected PV capacity is cheaper than most new coal facilities, and it comes in at or below the average cost of new nuclear plants. Grid-connected PV is still significantly more expensive than electricity from new natural gas power plants (EIA, 2014a; Lazard, 2014).

Over the past couple of decades the LCOE of electricity from wind and PV has declined by 15 to 20 percent for each doubling of cumulative production. In the United States and Europe the LCOE from wind (excluding subsidies) has dropped by a factor of 5 since 1980, and is projected to fall another 20 to 30 percent by 2030 (Lantz et al., 2012). PV technologies demonstrate an even more dramatic decline. The price for PV technologies has dropped from $50-80 per watt in the 1970s to less than $1 per watt today, (Carr, 2012; Fraunhofer Institute, 2014), and is expected to continue to do so in the coming decade (Feldman et al., 2014). Lower cost drives adoptions; about 26 percent of all new electric capacity in the first of 2014 in the United States in 2014 was solar (EIA, 2014b). The decline in the cost of PV power is driven by technological innovations such as the use of less-expensive and better-performing materials, improved designs, reduced material consumption, more-efficient production processes, better solar cell efficiencies, and economies of scale due to automated mass production of components (Barbose et al., 2014).

LCOE by itself is not a complete metric for comparing energy technologies because it fails to account for the fact that (a) the value or wholesale price of electricity varies widely throughout the day, month and year, and (b) intermittent generating technologies have very different production profiles from the production profiles of conventional dispatch able generating technologies such as coal, nuclear and natural gas (Joskow, 2011). Wind may have a low average LCOE, but if it is only available at night when demand is low, or is not available at peak demand, then its value to society is overstated relative to dispatchable alternatives.

This can be captured by avoided cost, a measure of what it would cost the grid to generate the electricity that is otherwise displaced by a new generation project. Wind and solar decline in competitiveness when avoided cost is considered compared to LCOE (EIA, 2014a; Frank, 2014) because they are unreliable, have low capacity factors, and are not dispatachable base load power. The EIA analysis of avoided cost suggests that new onshore wind capacity (with no subsidy) successfully competes with new coal and nuclear capacity, but not with new natural gas capacity. Notably, the EIA projects that by 2014 both wind and solar will be very competitive due to cost reductions from learning effects.

Most fossil and nuclear technologies are mature and therefore do not exhibit these dramatic cost declines. With relatively static costs for conventional energy and falling costs for renewables, the economic incentives based on cost will continue to shift towards renewables.

Transportation

Transportation is the second largest source of GHG emissions in the United States, accounting for 27 percent of emissions since 1990 (EPA, 2014b). The electrification of passenger vehicles has the potential to significantly reduce the emission of GHGs and other air pollutants, and reduce the nation's dependence on oil. The latter effect has several macroeconomic and national security benefits.

Alternatives to conventional internal combustion vehicles powered by gasoline are already economically viable. The lifetime cost paid by owners of hybrid electric vehicles (HEVs) and plug-in hybrid electric vehicles (PHEVs) with small battery packs are about the same as the lifetime cost paid by owners of conventional gasoline vehicles (Michalek et al., 2011). PHEVs with large battery packs and battery electric vehicles (BEVs) are considerably more expensive, and their emissions depend heavily on the mix of energy used to generate the electricity used to charge the battery packs. BEVs can markedly reduce emissions if power generation shifts to low carbon sources and if battery costs are significantly reduced. Lithium-ion (Li ion) batteries have declined dramatically in cost since their commercial introduction in 1991 (Kromer and Heywood, 2007). Costs were nearly halved from 2010 to 2014 for electric vehicle battery packs (Liebreich, 2014).

Energy Efficiency

Discussion about alternatives to fossil fuels tends to focus on the supply side, i.e., comparison of the cost of wind or nuclear power to electricity generated from coal or natural gas. But the demand or end use side of the energy equation is just as important as the supply side. Reducing the quantity of energy required to perform a task can reduce monetary costs and the quantity of GHG emissions.

The improvement of energy efficiency is costly, so one can calculate the cost of saved energy (CSE), which is analogous to the LCOE for facilities that produce energy. Several recent "bottom-up" studies indicate that the average levelized CSE in the United States is in the range of 2 to 4 cents per kWh (EPA, 2006; Billingsley et al, 2014; Molina, 2014). This makes some investments in energy efficiency cheaper than *all* forms of new generation capacity. These results are consistent with the finding that many of the most cost-effective ways to reduce GHG emissions are gained from improvements in the efficiency of lighting, appliances, vehicles, and buildings. The cost of GHG abatement from new low carbon generation capacity—nuclear, solar, wind, and fossil plants with carbon capture and storage—generally are higher than costs from investment in energy efficiency (Enkvist et al., 2010).

Renewables Are Growing Only Due to Government Subsidies

Renewable energy currently receives a diverse and erratic array of subsidies in the form of feed-in tariffs for electricity, production, investment, and income tax credits, support for research and development, among others. Though many are temporary, complicated, and limited, these subsidies have contributed to the large increases in investment in renewable energy in the United States and Europe. Some analysts suggest that these subsidies lead to erroneous investment decisions and "create the illusion of cost competitiveness" (Roff, 2014). But discussions about the desirability of subsidies for renewable energy cannot be considered in isolation from the issues of energy subsidies *writ large.* Energy subsidies are massive and ubiquitous. The International Energy Agency (IEA) (2014) estimates that in 2012 the world's fossil fuel industries received $554 billion in subsidies. The International Monetary Fund (IMF) puts the total nearer to $2 trillion (Clements et al., 2013). The subsidies for renewable energy? About $101 billion according to the IEA. The subsidies for energy efficiency? About the same as renewable energy. On a global scale the playing field is still clearly stacked against renewable energy and energy efficiency.

In the early 2000s, fossil and nuclear sources received about two-thirds of United States federal energy subsidies (Koplow, 2007). Over the past decade there has been a relative shift towards renewables in some subsidy categories, e.g., energy-related tax preferences (Sherlock, 2011), but when the full range of subsidies is accounted for, conventional sources still receive far more support than renewables. The ongoing boom in domestic fossil energy production nearly doubled the government subsidies for the exploration and production of oil, natural gas and coal from 2009 to 2103. Such subsidies amounted to $21.6 billion in 2013 (Makhijani, 2014).

The subsidy gap between fossil and nuclear fuels grows wider when we consider the historic "sunk cost" of subsidies. Throughout the United States entire history, government subsidies overwhelming favored fossil and nuclear fuels. From 1918–2009, the oil and gas industry received $447 billion (adjusted for inflation) in cumulative energy subsidies. Renewable energy sources received an inflation-adjusted $5.93 billion from 1994–2009 (Pfund and Healy, 2011). Some subsidies remain in effect despite the fact the issue they were intend to address – expected shortages of supply - has long since disappeared. The gap widens even further if we consider all types of government support beyond the narrow definition of a subsidy as a direct governmental financial transfer. Other types of support include risk (e.g. insurance indemnification for nuclear power), taxes (e.g., capital gains treatment of royalties on coal or the oil depletion allowance), regulation (oil and gas exemption from major environmental laws), access (below market value for coal, oil and gas leases on federal lands, including the continental shelf), stockpiling (no interest charges for the Strategic Petroleum Reserve), and research and development. Historic support for conventional fuels swamps that for renewables (Koplow, 2004).

Energy subsidies are still biased in favor of fossil and nuclear fuels, and many of these have been consistently in place for a long time. Subsidies for renewables have a history of irregularity, and consistency is crucial in securing and lowering the cost of investments. The Renewable Electricity Production Tax Credit in the United States expired on December 31, 2014, and subsidies have also declined in Europe due to economic austerity (Frankfurt School, 2103). Even so, there is mounting evidence that renewable power can increasingly compete with conventional power with reduced government support due to ongoing cost declines (Cardwell, 2014; Bakewell,2014). In addition, the global PV market no longer depends on just a few countries and is therefore more resistant to changes of the subsidy conditions in individual countries (Kost et al., 2013).

Natural Gas is a "Bridge Fuel"

Another argument against divestment from fossil fuels is that a blanket approach ignores the fact that fuels differ significantly in their contribution to climate change. Natural gas appears to be particularly virtuous in this regard because it contains 29 percent less CO_2 per joule compared to crude oil, and 43 percent less than bituminous coal. In addition, new natural gas power plants in the United States are 25 percent more efficient than coal-fired plants, leading to a much lower carbon intensity (CO_2/kwh) for electricity from natural gas. These advantages have produced the widely held notion that natural gas is the key to the eventual transition to a low or zero carbon future. In one of his first public statements, Secretary of Energy Moniz described natural gas as a "bridge to a very low carbon future…it affords us a little bit more time to develop the technologies, to lower the costs of the alternative technologies, to get the market penetration of these new technologies" (Moniz, 2013). In his 2014 State of the Union Address, President Obama stated "if extracted safely, natural gas is the 'bridge fuel' that can power our economy with less of the carbon pollution that causes climate change."

The implicit assumption in this argument is that natural gas has a better carbon footprint compared to coal, which it certainly does, so displacing coal with gas must be the right move. But the goal is to reduce *total* carbon emissions from the energy system, not the *intensity* of its constituent parts. Focusing on the latter instead of the former is like trying to fall more slowly off a cliff, or hoping for partial pregnancy. The atmosphere is overloaded with carbon, and simply slowing continuous overloading is insufficient. Furthermore, the competitive impact of natural gas on renewables inhibits their growth.

The mix of energy used to generate electricity is determined by a complex array of economic, technological, political, and social forces. Recent research suggests that in the absence of strong climate policy, abundant and low-cost natural gas would not significantly reduce emissions. There are several forces at work here. First, natural gas competes with coal *and* renewables in the electric power sector. Even with cost declines for renewable power, natural gas will crowd out coal, nuclear, and renewables in the absence of strong climate policy. Working against the initiatives to promote renewables dismantles, rather than builds, a bridge to them. Second, lower natural gas prices spur economic growth, which expands the energy system, and thereby total emissions, while simultaneously reducing investment in energy efficiency. Third, fugitive emissions of methane are estimated to be 1 to 9 percent of dry natural gas production (Schwietzke et al., 2014).[24] An expansion of the natural gas system would increase fugitive emissions of methane, whose warming potential is 21 times that of CO_2.

The net effect is that, in the absence of strong climate policy, cheap and abundant natural gas would dramatically change the global energy system, and especially the electric power sector, without significantly affecting GHG emissions and climate forcing. This is a robust conclusion supported by a variety of modeling approaches that embody a range of assumptions, methods and data (IEA, 2012; EMF, 2013; McJeon et al., 2014; Shearer at al., 2014).

[24] In this context, fugitive emissions refer to methane that escapes to the atmosphere during the drilling, extraction, processing, and transportation processes.

Carbon Capture and Storage Will Save the Day

Carbon capture and storage (CCS) captures CO_2 produced by power plants and large industrial facilities and then injects it deep into a rock formation where it is permanently stored. If feasible, CCS is an ideal technology to combat climate change because it reduces CO_2 emissions to the atmosphere while enabling us to enjoy the benefits from the use of fossil fuels. The feasibility of the individual components of a CCS system have been demonstrated, but CCS has not yet been applied to a single large, commercial fossil fuel power plant (Bruckner et al., 2014). Geologic and technical challenges aside (see NRC (2015) for a review), there are two pressing issues. The first is scale. The IEA (2013b) concluded that the total CO_2 capture and storage rate must grow from the *tens* of megatons of CO_2 captured in 2013 to *thousands* of megatons of CO_2 in 2050 in order to address the emissions reduction consistent with a 2 °C scenario. Given that the technology has yet to be commercially verified, this implies a long time to scale.

The second issue is cost. Benson et al. (2012) estimated that CCS could increase the cost of electricity by 50 to 100 percent due to the large capital cost and to the fact that the technology eats up 15 to 30 percent of a power plant's electricity output. The EIA estimates that CCS would increase the cost of electricity from a new combined cycle natural gas power plant in the U.S. by about 42 percent.

The upshot here is that CCS may well end up being an important technology in the long run to reduce emissions. But the time to scale suggests that it will not play a significant role in the short effort to reduce emissions that must begin immediately Energy efficiency and low-carbon energy are viable today and have reasonable costs. Their widespread deployment must not in any way be slowed by assuming that CCS is a silver bullet for the climate challenge.

Carbon Humanitarianism

The relationship between energy and material affluence is well-established; richer nations consume more energy than poorer nations. Fossil fuel has been a key to economic growth, as evidenced by the use coal for the large scale generation of cheap electricity, the use of natural gas to produce the fertilizers that underpin world food production, and the liquid fuels from oil that power the world's transportation system. Indeed, one would be hard pressed to identify any significant improvement in the material condition of life that does not owe its existence to the direct or indirect use of fossil fuels.

Poverty is caused in part by energy poverty: the lack of access to modern energy services. Over 1.3 billion people lack access to electricity and 2.6 billion people lack clean cooking facilities (IEA, 2011). Nearly 2.7 billion people – almost 40 percent of the world population and about half of those living in developing countries – rely on the traditional use of biomass for cooking, and each year 2 million people die from diseases caused by the indoor smoke from those fuels — more than deaths from malaria (UNDP/WHO, 2009).

Some argue that the solution to energy poverty lies in the replication of what worked in the developed world: increased use of fossil fuel. Some fossil fuel companies paint the need to develop more fossil fuels as an act of “carbon humanitarianism” (Klare, 2015). For example, ExxonMobil’s outlook to 2040 has renewable energy supplying less than 10 percent of the world’s electricity (ExxonMobil, 2014), arguing that fossil fuels are the only viable choice for meeting the growing demand of energy use in the developing world.

The carbon humanitarianism argument implies, of course, that if you oppose the expansion of fossil fuels then you must be uncompassionate and inhumane. This is a transparent dodge by the fossil fuel companies that is based on erroneous assumptions and analysis.

First, carbon humanitarianism embodies a fatal logical flaw. The increased use of fossil fuel is deemed necessary to eliminate global poverty. Yet the emissions of GHGs from the use of fossil fuels will cause changes in climate whose effects fall disproportionally on the very poor people that the fuels are supposed to help. There is widespread consensus that the poor are most vulnerable to climate change (IPCC). Vulnerability ranges from the cost and availability of food (Nelson et al., 2013), mortality and morbidity (Hales et al., 2014), and displacement by sea level rise (Dasgupta et al., 2009). It is antithetical to claim that you are concerned about poverty, while simultaneously promoting a behavior that directly and disproportionately harms the poor.

Second, fossil fuels generate enormous costs as well as enormous benefits, but our economic and financial accounting systems are set up to only measure the benefits. This sends biased signals. Global warming, acid deposition, particulate matter, and urban smog are driven principally from the byproducts of fossil fuels and their byproducts such as petrochemicals. The earlier discussion described the substantial size of the non-monetized costs. Some of the United States’ epic environmental disasters—the Deepwater Horizon Oil Spill, wetland loss in coastal Louisiana, the Kingston Fossil Plant coal fly ash slurry spill—are directly connected to the fossil fuel energy system. The nation’s list of Superfund sites is a Who’s Who of petrochemical facilities. The health and economic impacts of the United States’ energy system are lopsidedly felt by low-income households (Maxwell, 2004). The rise of resource nationalism surrounding oil development in the early 20th has generated economic, social, and political tumult in Russia, Latin America, and the Middle East that reverberates throughout the world (Jaffe, 2015). Air pollution has caused the population in northern China to lose more than 2.5 billion life years of life expectancy, and the average person to lose about 5 years of life expectancy (Chen et al., 2013).

Multinational oil companies have a checkered history of social and environmental responsibility. Shell's environmental and human rights behavior in the Ogoniland region of Nigeria was divisive to the extent that the company was stripped of its "social license to operate"—the local population no longer tolerated its presence (Ruggie, 2013). Chevron is engaged in an epic court battle to fight a $9.5 billion judgment handed down by an Ecuadoran court, and a number class action lawsuits in United States courts, for health and environmental damages caused by the mismanagement of drilling wastes and leaks from the Trans-Ecuadorian pipeline caused by Texaco over the span of nearly three decades (the companies emerged in 2001). Chevron did not report the Ecuadorian litigation until it found its way into a footnote the company's 2008 annual report (Buccina, et al., 2013).

Third, carbon humanitarianism presumes that fossil fuels are the only viable route to poverty alleviation. If one assumes there is no viable alternative, then one tends to adopt Maslow's (1966) hammer, i.e., "if all you have is a (fossil fuel) hammer, everything looks like a nail." Few expect economic growth in the developing world to undergo an overnight shift in reliance to renewable energies. However, there are widespread, independent analyses that demonstrate the economic and technical feasibility of scaling up a broad portfolio of renewable energy options to tackle poverty reduction. The United Nations' Sustainable Energy for All initiative (SE4ALL) seeks to double the role of renewable energy from 18 to 36 percent of world energy use from 2010 to 2030. The IEA (2014b) concluded that up to 45 percent of world electricity generation can be integrated without significantly increasing power system costs in the long run. The Global Energy Assessment concluded that energy efficiency and renewable energy are technically feasible in the developing world, and can meet many essential social, economic, and environmental imperatives (Johansson et al., 2102). China can increase its use of renewable energy from 13 to 26 percent of primary energy, and can expand renewables in the power sector from 20 to 40 per cent by 2030 (IRENA, 2014). Renewables often are distributed sources of energy that communities can more easily finance and own, as opposed to large, highly capitalized centralized sources. Investing in these sources rather than conventional energy increases the likelihood that profits and jobs stemming from energy production will benefit the communities in which the energy is used.

A Drop in the Bucket

Oil, natural gas and coal companies are mammoth. As measured by sales, 12 of the 20 largest public corporations in the world sell energy (Forbes, 2014). Some investors look at this and think that the divestment of a single investor, even a large one, is a "drop-in-the-bucket" that will not be noticed the energy behemoths. "If I don't buy the shares, someone else will." A related argument is that one institution's investment is responsible for only a tiny fraction of the world's GHG emissions. This perspective was illustrated by Bruce Shepard, president of Washington University who defended the decision to remain invested in fossil fuels by stating, "Everybody understands that divestment by our foundation would have no material effect on climate change" (Shepard, 2014).

This is faulty, self-serving logic for several reasons. First, university endowments are material contributors to climate change. On average, every dollar that flows in the United States economy is associated with the release of about 0.4 pounds of CO_2. For large endowments, this translates to significant overall emissions.

Second, we have passed the threshold where the release of a GHG has no negative impacts. When fossil fuels began to be burned in significant quantities some 200 years ago, individual emissions did not matter because the human role in the Earth's energy balance was very small. One could argue that if an individual's own GHG emissions produce no change in global temperatures regardless of the background level of GHG emissions produced by other actors, then there is no state of the world in which the emissions cause increased environmental damage and thus, apparently, no negligence in the individual act (Adler, 2007).

But we no longer live in that world. The instrumental temperature record and other barometers of climate change show us that emissions are altering natural systems in a way that harms society. The impact of one person or one institution may be small, but it is real and discriminable. Thus, every person or institution or whose actions trigger the use of fossil fuels has an obligation to reduce the associated emissions.

Third, reducing emissions through divestment does not impose large economic costs. As discussed above, a transition to a more efficient and low carbon energy system would not cripple our way of life, and its benefits compare favorably to the massive external costs of the fossil fuel energy system.

Wendell Berry (1977) couched the "why bother" question in terms that capture the disconnect in our current thinking that must change:

> The split between what we think and what we do is profound…Once our personal connection to what is wrong becomes clear, then we have to choose: we can go on as before, recognizing our dishonesty and living with it the best we can, or we can begin the effort to change the way we think and live.

The argument that one is too small to make a difference is a rationalization used to avoid what Al Gore called an "inconvenient truth." But because everyone looks to universities to help us sort out the world, they should picture others following their actions. If they turn from destructive investments, others may do so as well, and they will have great effect. Universities that do not work on this problem risk being hypocritical if they continue to act as if they are preparing students for the future, and the leaders of the world to come. In the film *Paul Jacobs and the Nuclear Gang*[25] the activist is asked why he works so hard on such a difficult task, when he himself is

[25] Produced by Jack Willis. Quote is from a review in the December, 1979 issue of the *Bulletin of Atomic Scientists.* Paul Jacobs was a journalist covering the exposure of citizens, soldiers, workers and the rest of us to radiation, such as fallout from testing nuclear weapons.

suffering from cancer. He replies, quoting the Talmud: “It is not incumbent upon thee to complete the task. But neither art thou free to desist from thy part in it.”

Fossil-Free Investments Underperform

A recent study commissioned by an oil industry trade group concluded that divestment would fail to achieve its goals due in large part to high investment costs that “substantially impair the future value of endowments and other investor funds” (Fischel, 2015). This view seems consistent with the current reality that, as an asset class, fossil free investments do match the overall attractiveness of fossil fuel assets in regards to scale, liquidity, growth, and yield (Ritchie and Dowlatabadi, 2015). However, this situation is rapidly changing, and forces are at work to maintain that momentum. There is a growing suite of choices for investors that seek to insulate themselves from the risks associated with fossil fuels. These opportunities employ instruments that explicitly screen fossil fuel companies or that explicitly target low carbon technologies. Universities that are focused on the long run health of their endowment and on their obligation to address climate change should heed these trends. Results indicate that climate conscious investment can pay off.

BlackRock, the world’s biggest fund manager, and the FTSE Group, a leading index company, created the FTSE Developed ex Fossil Fuel index that eliminates the companies that explore, own, and directly extract carbon reserves. From 2006 through 2014, the FTSE Developed ex Fossil Fuel index tracked its benchmark (the FTSE Developed Index) very closely but exhibited lower volatility. From 2009 through 2014, its 5 year return (6.6 percent) was 29 percent higher than its benchmark (5 percent) (FTSE, 2014).

The Fossil Free Indexes US (FFIUS) is based on the capitalization-weighted S&P 500 index negatively screened for The Carbon Underground 200 (CU200), i.e., the top 100 public coal companies globally and the top 100 public oil and gas companies globally, ranked by the potential carbon emissions content of their reported reserves (Fossil Free Indexes, 2014). The early returns for the FFIUS are positive. In 2014, FFIUS outperformed the S&P 500 by about 1.5 percent, a notable performance considering that less than 10 percent of the market capitalization of the S&P 500 is in companies that are part of the CU200 and, therefore, excluded from the FFIUS (Schacter, 2015).

Morgan Stanley Capital International (MSCI) back-tested the performance of their Investable Market Index (MSCI ACWI IMI), a broad and investable global equity benchmark, with (i) an index that included the upstream sectors of the world’s world’s major oil and gas corporations and the largest coal corporations, and (ii) an index that excluded all of those companies from the MSCI ACWI IMI. The study found that the fossil fuel energy sector is consistently among the most risky sectors in the global economy since 2005. Thus, fossil fuel divestment has the potential to reduce overall portfolio risk. This result is consistent with the more general observation that Socially Responsible Investments (SRI) exhibit lower risk premiums than conventional ones (Ameur and Senanedschv, 2014). The study also found that the 1-, 3- and 5-year results showed modest risk-adjusted *out*performance from divestment; 10-year results showed modest risk-adjusted *under*performance from divestment, primarily as a result of high oil prices in the early years of the time series (MSCI, 2013). MSCI also produces the custom MSCI KLD 400 Social ex Fossil Fuels Index (KLD 400 was one of the first SRI indexes). The Green Century Equity Fund (GCEQX) invests in the companies that comprise the KLD400 ex Fossil Fuels Index, and from 2005 through 2014 it has performed about as well as the S&P 500.

Impax Asset Management (2014) performed a similar analysis in which they excluded fossil fuel sectors from the MSCI World Index. They also constructed (i) an index that replaced the fossil fuel stocks of the MSCI World Index with a passive allocation to an investable universe of renewable energy and energy efficiency, (ii) an index that replaced the fossil fuel stocks of the MSCI World Index with an actively managed portfolio of renewable energy and energy efficiency stocks, and (iii) an index that replaced the fossil fuel stocks of the MSCI World Index with an actively managed allocation of stocks selected from a wider range of resource optimization and environmental investment opportunities. From 2008 to 2013, they found that removing the fossil fuel sector in its entirety and replacing it with fossil free portfolios of energy efficiency, renewable energy, and other alternative energy stocks, either on a passively managed or actively managed basis, would have improved returns with limited tracking error (Impax, 2014).

Geddes et al. (2014) constructed hypothetical equity portfolios by excluding carbon industries from standard market indices in Australia, Canada and the United States, as well as the global MSCI ACWI index. Then hypothetical portfolios were built to track that respective index as closely as possible subject to the exclusion of the fossil fuel sectors. The found that the carbon-free portfolios have closely tracked the United States market since 1988 and the global market since 1997. The data also indicate that the impact on risk may be minimal because carbon-free investments with low tracking error could have been implemented by shifting the allocation from fossil fuel sectors to the utilities and materials sectors. The same general conclusions were made for Australia using a similar methodology (Australia Institute, 2014).

The financial world is quickly generating new decision support tools to guide investors on the issue of climate change. One example is the MSCI Global Low Carbon Target Indexes that aims to reflect a lower carbon exposure than that of the broad market by overweighting companies with low carbon emissions, and those with low potential carbon emission. The MSCI Global Low Carbon Leaders Indexes aim to achieve at least 50 percent reduction in the carbon footprint by excluding companies with the highest carbon emissions intensity and the largest owners of carbon reserves (MSCI, 2015).

There are a growing number of investment opportunities (stocks, funds, bonds) that explicitly target renewable energy. Their performance exhibits wide and fluctuating results. Taken as a whole, most investments have not performed as well as standard benchmarks such as the S&P 500 and the Dow over the past decade. Many of the indexes that renewable energy investments track show a similar trend in the recent past: a sharp downturn in the recession of 2007-2009, a recovery, and then another drop in 2011-2012 from which many have not recovered. Falling natural gas prices, financial austerity in Europe, over capacity in the wind and solar supply chain, and uncertainty about future energy policy in Europe and the US combined to reduce investor confidence in 2011 and 2012 (Liebreich, 2012). Over shorter periods renewable investments have performed well. Over the past two years, indexes such as the Renewable Energy Industrial Index (RENIXX), the WilderHill New Energy Global Innovation Index (NEX), and the Market Vectors Global Alternative Energy ETF (GEX) have performed as well or better than the broad benchmarks. Nearly all classes of energy investments started to tumble when oil prices began their free fall in the summer of 2014. *However, many renewable funds exhibit a smaller decline than funds dominated by the major fossil fuel companies; they perform significantly better than funds dominated by holdings in coal.*

There are other signs that the investment tide is turning away from carbon and towards renewables. In 2014, Barclays downgraded the entire electric sector of the United States high-grade corporate bond market to underweight, saying it sees long-term challenges to electric utilities from solar energy. The Barclays credit strategy team stated:

> We believe that solar + storage could reconfigure the organization and regulation of the electric power business over the coming decade. We see near-term risks to credit from regulators and utilities falling behind the solar + storage adoption curve and long-term risks from a comprehensive re-imagining of the role utilities play in providing electric power (Aneiro, 2014).

Socially Responsible Investing, also known as “sustainable,” “ESG,” “socially conscious”, “mission,” “green” or “ethical” investing, refers to investor behavior that is motivated by environmental, social, and corporate governance (ESG) criteria to generate long term, competitive financial returns, while simultaneously generating positive social benefits. SRI uses a “stick and carrot: by investing companies that align with your core values (the carrot) and avoiding buying shares of those companies that offend your core values (the stick) (Chamberlain, 2013). SRI typically eschews social “bads” such as tobacco, alcohol, human rights violations, and gambling, while investing in social goods such as renewable energy and clean technology.

SRI is big business and growing rapidly. The total US-domiciled assets under management using SRI strategies increased from $0.63 trillion in 1995 to $6.57 trillion at the start of 2014, a 10-fold increase (USSIF, 2014). These assets now account for more than one out of every six dollars under professional management in the United States (USSIF, 2014). Hypotheses regarding the performance of SRI run the gamut from claims that they underperform, outperform, or perform about the same as conventional portfolios.

Investigation of the performance issue indicates that on average, SRI methods perform on par with conventional techniques, neither outperforming nor underperforming them on a consistent basis. This finding is drawn from theoretical performance simulations (Adler and Kirtzman, 2008; Gladman, 2011) and from the behavior of SRI products in the market (see the reviews by Kiymaz, 2012; RBC, 2012). The range of results stem from differences in data, assumptions, time period, and statistical methods.

Green Bonds. Green bonds are instruments that connect the proceeds of a bond issue to "environmentally friendly" investments. To date the majority of the green bonds issued are green "use of proceeds" or asset-linked bonds whose proceeds are earmarked for green projects but are backed by the issuer's entire balance sheet. Climate bonds are issued in order to raise finance for climate change solutions, for example mitigation or adaptation-related projects (Climate Bonds Initiative, 2015). Pension funds and other long-term investments see serious exposure to risk from climate change; green bonds and climate bonds hedge that risk. A good example here is the Swedish pension fund AP3 that purchases green bonds to support low-carbon investments, and in doing so balances that nation's commitment to responsible investing with long-term risk/return goals.

The Green Bond concept was developed in 2007/2008 by the European Investment Bank and the World Bank. The amount issued has shown explosive growth, from $3.1 billion in 20012 to 34.3 billion in 2014. While small compared to the total bond market—more than $80 trillion—the green bonds are a significant shot in the arm for sustainability initiatives, including low-carbon energy. In 2014 a consortium of investment banks and other issuers, including BlackRock Inc. and JPMorgan Chase & Co, announced their support for the Green Bond Principles[26], a set of voluntary process guidelines for issuing green bonds. Oversight of the Principles is coordinated by the International Capital Markets Association. In 2014 Barclays and MSCI launched their Green Bond Index, responding to what they described as "a burgeoning new asset class with an increasingly diverse investor base" (Barclays, 2015).

Too Big to Fail

It is hard to imagine life without fossil fuels and the companies that produce them. Fossil fuels supply more than three-quarters of the world's commercial energy use, and energy companies are among the largest in the world. Most of the essential energy services we rely on—heat, light, mobility, power—are derived from fossil fuels.

An energy transition is the time between the introduction of a new primary energy source (oil, nuclear, solar) and its rise to claiming a substantial share (20 percent to 30 percent) of the overall market, or even to becoming the single largest contributor or an absolute leader (with more than 50 percent) in national or global energy supply (Smil,

[26] http://www.icmagroup.org/Regulatory-Policy-and-Market-Practice/green-bonds/

2011). Major energy transitions take a long time to unfold, typically playing out over decades and generations, not years (Grubler, 2012).

At its apex in about 1920, coal accounted for about 75 percent of primary energy use in the United States, coal mining employed nearly 3 percent of the non-farm civilian workforce and generated nearly 2 percent of the nation's GDP. Coal steadily declined in importance as it was replaced by superior fuels in the forms of oil and natural gas. But the demise of its major energy system did not sink the economy; in fact the opposite was true. The rise of oil and gas after World War II underpinned a period of rapid economic expansion through the early 1970s. Coal mining regions were certainly hit hard by the decline in coal, but for the nation as a whole it was not calamitous.

The entire supply chain of the oil and gas sector (from oil field to gas station) now accounts for about 65 percent of primary energy use, employs about 1.6 percent of the nonfarm civilian workforce, and generates about 3.3 percent of the nation's GDP.[27] Thus, its current position is not unlike "King Coal" in 1920. There is no *a priori* reason to fear the structural change in the economy associated with a transition away from oil and gas would have contractionary macroeconomic effects. Prosperity does not have to be linked to a single fuel, or even to a particular suite of fuels.

The key variable here is the speed of, and drivers behind, the transition from fossil fuels. The shift from wood to coal, and then from coal to oil and gas, were driven by a combination of technical, economic, social, and political factors that played out over decades. There was no single, guiding imperative in earlier energy transitions; external costs were not a driving force. The transition to a low carbon energy systems will also take a significant amount of time, but the climate challenge means that we cannot rely on "business as usual" mindset. The pace of change must be accelerated with purposeful policy and behavior that catalyzes the replacement of fossil fuels with low carbon energy sources relative to the transition that would occur without such action.

Divestment Doesn't Work

Many argue that divestment does not work. The movement to divest in South Africa provides some perspective. There may not have been a lot of economic pain caused by the divestment movement that targeted apartheid (Teoh et al., 1999). But economic pressure was just part of the story. Labor and human rights activist Cecilie Counts (2013) writes that things really began to change when the movement

> …engaged people from all walks of life in daily demonstrations and in civil disobedience for more than a year. Shantytowns sprung up on college campuses that had not yet divested, an international campaign against Royal Dutch Shell was launched in 1986. The groundswell of

[27] The data for coal and for oil and gas refer only to direct employment. Those industries also generate indirect or induced jobs and economic activity that range from 1.2 to 3.5 times the direct contributions to employment and GDP. For details, see NPC (2011) and NMA (2014).

> opposition to apartheid led Congress to override President Reagan's veto of the Comprehensive Anti-Apartheid Act of 1986. Divestment began to affect South Africa as corporations let apartheid leaders know that it had become too expensive to continue operating there. Some would argue that many corporations simply shifted to indirect investments, but when banks began to refuse to renew loans it caused some real pain as the value of the rand fell.

Global warming activist Bill McKibben (2014) argues that fossil fuel divestment should and will proceed in a similar fashion. Divestment, he notes, won't directly affect share prices because

> …these companies are the richest enterprises in history. Instead, as the country's colleges, cities and denominations begin to cut their ties, we'll start to revoke the "social license" of these firms. Many of the nation's elites sit on college boards, forcing them to grapple with the fact that the fossil fuel industry is now an outlaw against the laws of physics. To understand 'social license,' consider that Philip Morris was once a respectable company, able to win political battles; tobacco divestment at places like Harvard was one of several tools that helped erode their power. Or consider South Africa in the 1980s — Nelson Mandela credited American divestment as one key to its liberation, not because it bankrupted companies, but because it started to make them pariahs.

The goal of divestment is to change the definition of what is good, and to cause people who wish to be perceived as good, or to think of themselves that way, to change their behavior. If the divestment movement can help people to see the need, and muster the will to act, it will be a success. In the end its value will be how well it poses a social question: are you willing to contribute to widespread social and environmental damage, or are you willing to see and take responsibility for the consequences of your actions? We should see it as part of a great effort to improve humanity's capacity to be responsible, and accord it a success for identifying a task worth undertaking.

Better to Fight for Change "Within the System"

Another common argument against disinvestment is that leverage for changing the system is lost if an entity ceases being a shareholder in key organizations. How can you change an oil company's actions if you are no longer one of the co-owners of that company? Thus, an alternative to divestment is to remain invested and to work with other investors to change practice. In her list of reasons for why Harvard will not divest, President Drew Faust remarked:

> Generally, as shareholders, I believe we should favor engagement over withdrawal. In the case of fossil fuel companies, we should think about

> how we might use our voice not to ostracize such companies but to encourage them to be a positive force both in meeting society's long-term energy needs while addressing pressing environmental imperatives.

Asking the oil and coal companies to "green" their supply chain will not solve the problem. We need to stop producing oil and coal. Shareholder advocacy, if it is to contribute to solutions, must be used to influence a company to transition to new business activities.

The transition to a sustainable energy system requires vision and leadership. We cannot expect the fossil fuel industry to lead the way. Although many have made investments in alternative sources (BP was once said to stand for Beyond Petroleum), the trend has been to shed much of their investment in wind and solar to focus on their "core business" (Juhasz, 2013; Ferris and Gronewold, 2014). In addition many have participated in funding a campaign of disinformation about climate change (Oreskes and Conway, 2012), and are fighting tooth-and-nail against efforts to include externalities in the price of fossil energy. To trust the industry that lobbies heavily to retain market-distorting subsidies and remove those for clean alternatives is patently unwise and unworthy of educational institutions.

Divestment from fossil fuel companies will help create a stigma associated with producing hydrocarbon fuels. The individual institutions that divested from tobacco companies and business in South Africa did not expect their act to create immediate financial pressure. They expected to draw attention to the perils and tobacco and the injustice of apartheid, and in doing so help create social pressure to abandon those activities.

Divestment is Hypocritical

Divestment from fossil fuels while at the same time using those fuels to run campus operations has been characterized as hypocritical by some. But hypocrisy only arises if one's investment behavior is misaligned with the nature of your research and teaching programs, and with your campus operations. No one expects to flip a switch and be divorced from fossil fuels. But many universities have expansive research programs that provide elements of the roadmap to a sustainable future, teaching programs that prepare young adults to navigate life in that future, and campus operations that reduce the institution's carbon footprint and overall environmental impact. In this situation there is no hypocrisy in divestment, even if the institution continues to rely on fossil fuels for some time.

The hypocrisy argument is far too passive a position for an institution of higher education. Many of the ills we experience in the world have their source in the passive position of consumers who may feel their role is simply to select what is offered by producers. But a growing movement of "environmentally preferable purchasing" intends to change that; some universities lead the way on this front. Consumers engage with producers to prompt them to develop greener products such as wood products certified by the Forest Stewardship Council and seafood recommended by the Monterey Bay Aquarium's Seafood Watch. University investors can "shop" for investment portfolios that reduce GHG emissions without sacrificing fund performance. In doing so universities provide an example of active and responsible consumers of, and investors in, energy services, whose practices help create the demand for cleaner sources that will motivate producers to change.

It's Too Late

Some respond to the call for disinvestment with a fatalism that asserts that actions we take will not be enough to make a significant difference. This goes farther than the recognition that each single actor is too small on their own, but encompasses the idea that even acting as a group it is too late, and we simply have to learn how to live with what we are doing to the planet. This way of thinking hardly deserves an answer, because it is not rational. It is not true that steps to mitigate emissions will have no effect. A certain amount of damage from climate change is unavoidable, but we can desist from actions that make things even more disastrous. Moreover, to indulge in fatalism is actually an admission that there is a serious problem that needs to be dealt with. It is really an unconscious recognition of responsibility. It should be seen as a desperate and pathetic attempt to avoid guilt, or perhaps to reduce the impact of fear by promoting acceptance, which is really capitulation. Fatalism is a maladaptation to reality and nothing more than an abandonment of responsibility.

Recommendations and Conclusions

There are three general conclusions from our assessment of divestment. First, addressing climate change is central to the mission of every institution to higher education because it imperils vital aspects of human existence and, therefore, crosses every academic discipline and profession. Universal owners such as universities have an obligation to their students, facility, alumni and society to understand the nature of, and the risks posed by, climate change. To the best of their abilities they must see that such knowledge is used in society's best interest. This is obligation holds regardless of whether or not divestment is being considered. Second, divestment is feasible, and intelligently implemented should not threaten the financial health of endowments. Third, universities do not have to go it alone. There is a rapidly expanding set of informational resources, analytical tools, and institutional partnerships that support the planning and implementation of divestment.

Here are actions that universities could take to fulfill its obligations; they are drawn directly from Generation Foundation (2013), Ansar et al. (2013), UNEP (2010), and Carbon Tracker Initiative (2013).

1. Utilize the university's most valuable resource—the minds of faculty and students—to create a climate of open scholarly discourse about climate change in all

of it multifaceted aspects. This conversation should include the entire university, and should be complemented by efforts to carry the conversation to broader society. Public awareness is essential to the mitigation of risk associated with climate change.

2. Express demand to regulators, analysts, ratings agencies, advisers and actuaries for them to stress-test their respective contributions to the financial system against climate and emissions risks, particularly valuation and risk assumptions.

3. Closely monitor fossil fuel exposure. Conduct an audit of the carbon emissions of portfolio constituents. There are a wide range of current and emerging environmental risks (e.g., shale gas) that could result in stranded assets. These risks are poorly understood and are regularly misplaced due to externalities, which may result in a significant over-exposure to environmentally unsustainable assets throughout portfolios. Passive managers should also identify their exposure to carbon risks since funds that track major indices are vulnerable to stranding risk, because fossil fuel-dependent assets make up large fractions of most major exchanges.

4. Request regular reporting from investment managers on how they are addressing fund exposure to risks associated with climate change and other environmental costs, and how they are engaging with portfolio companies and regulators. Higher reporting expectations for asset managers will improve the quality of information that is used in deciding how best to account for environmental externalities within investment processes.

5. Pressure fossil fuel-based companies' boards and management teams to explain the company's strategy related to mitigating carbon risk. Consider joining climate-related shareholder resolutions. Utilize the work of the Sustainability Accounting Standards Board (SASB)[28] that identifies the material sustainability risks and opportunities facing companies, including climate change. Utilize the work of The Carbon Disclosure Project[29] that has built a global system for companies to measure, disclose, manage, and share key environmental data.

6. Diversify investments into companies that will prosper in a low carbon economy. This action comes in two parts. First, shed assets that carry a carbon stranding risk. Second, acquire assets that will grow in a low carbon economy. This hedging strategy will reduce the risk associated with extreme carbon risk while potentially capturing the upside of the transition away from fossil fuel assets. Utilize the Investor Network on Climate Risk[30] that has more than a decade of experience investing in portfolios with reduced carbon risk.

7. Divest fossil fuel-intensive assets to reduce or eliminate risk related to carbon. Engagement and purposeful diversification may have a limited effect on the reduction of carbon risk. In such cases complete divestment is a prudent strategy. Utilize the

[28] http://www.sasb.org/
[29] https://www.cdp.net/en-US/Pages/HomePage.aspx
[30] http://www.ceres.org/investor-network/incr

Global Investor Coalition on Climate Change and similar organizations that facilitate the exchange of information among investors related to climate change.

Instead of viewing the choice as "business as usual" or "disinvest," universities should engage with other universal owners and learn how to invest responsibly. Aligning their financial interests with their commitments to sustainability will not be accomplished overnight, but that does not justify turning a blind eye to the fact that a healthy portfolio requires a health economy. Universities can first disinvest in the highest polluting and irresponsible operations, and launch a process of learning where to reinvest in the cleaner opportunities of the future. For example, in 2014 Stanford University announced that it will begin by divesting in coal, stating that "moving away from coal in the investment context is a small, but constructive, step while work continues, at Stanford and elsewhere, to develop broadly viable sustainable energy solutions for the future."[31] Developing the capacity to identify good investments that make sense from both a moral and a financial standpoint will help inform the rest of us. Doing this work visibly fulfills the university's role in society, and will attract high quality students, faculty, and donors. Once this work is commenced, the question concerning where the line is to be drawn recedes in importance.

These actions would provide the world with a lesson worthy of educational institutions that really are concerned with the future. These actions would demonstrate that universities understand that money management is not separate from its moral and environmental consequences, and that they will not participate in the fiction that holds that they are separate. That alone would have incalculable value because it would help convince others. Even the most cold-blooded investor will eventually have to acknowledge that these risks are growing, as is the value of industries that are not vulnerable to regulation, resistance, and devaluation. University leaders should recognize how intelligently going down the road of divestment fulfills their role in society, and that failing to fulfill the university's basic mission will eventually degrade its reputation and capacities.

[31] http://news.stanford.edu/news/2014/may/divest-coal-trustees-050714.html

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