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Reflecting on *Environmental Alpha*

Angelo A. Calvello, PhD

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Three things have become clear to me in the years since the publication of *Environmental Alpha: Institutional Investors and Climate Change*.[*]

1. My reason for writing the book (and starting the *JEI*) have proven correct: Institutional investors, specifically asset owners, needed (and still need) help understanding the risks and opportunities associated with climate change.

2. I was early to the trade: When I was writing the book, there was a growing optimism that civil society, with the strong participation and support of asset owners, would act to reduce greenhouse gas (GHG) emissions. President Obama was beginning his first term and had made clear statements that he would act to stem GHG emissions. His appointment of Steven Chu, Carol Browner, John Holdren, Jane Lubchenco, and others signaled the strength of his intention. We were heading into COP15 with momentum. But exogenous factors, especially the financial crisis of 2008 and the ensuing economic collapse, the recalcitrant Republican opposition to climate change, the war of terrorism, and the failure of COP15 soon derailed meaningful actions.

3. "The global concentration of carbon dioxide in the atmosphere—the primary driver of recent climate change—has reached 400 parts per million for the first time in recorded history," according to data from the Mauna Loa Observatory in Hawaii. The recent Paris Agreement signals good intentions but, in the words of some academics, offers only "false hope." The actions agreed to represent a diplomatic success (and signal that further climate action will best be achieved through more peer-to-peer global solution networks), but the actions are simply too weak to get anywhere near the global warming targets of between 1.5 and 2 degrees C. Moreover, the pledges are not sufficiently binding and require no immediate action. This leaves us in a rather

[*] *Environmental Alpha: Institutional Investors and Climate Change*, edited by Angelo Calvello. Hoboken, New Jersey: John Wiley and Sons, Inc. 2010.

dangerous situation, given the increase in emission in the past five decades and the convexity of carbon dioxide. Imminent action is required and, from where I sit, such action is unlikely. (Here in the United States, a leading presidential candidate, Ted Cruz, continues to maintain that climate change is a "pseudo-scientific theory.")

So I was right, early and late, all at the same time.

The challenge for investors, specifically asset owners, is to now recognize the temporal exigency associated with climate change and, like good quants, accept the evidence presented by climate science: There is consensus among researchers that greenhouse gases have been rising and, correlatively, global average temperatures have been rising and that a primary source of these emissions is human activities.

One of the best reflections of that scientific consensus is found in the Climate Change 2014: Synthesis Report released by the Intergovernmental Panel on Climate Change (IPCC). Three international working groups contributed their expertise to the measured analysis:

> *Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane, and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are* extremely likely *to have been the dominant cause of the observed warming since the mid-20th century.*

Specifically, asset owners should recognize that carbon emissions are embedded throughout their portfolios and pose a material risk to the performance of the underlying assets. They should understand their exposure to carbon, quantify the associated risks, and manage this risk, just as they would manage other systemic, materials risks. Such action is clearly in line with their fiduciary duty.

Asset owners should also recognize that there are bona fide climate-related investment opportunities, investments that can present robust returns-per-unit-of-risk and orthogonal exposures. I am not suggesting asset owners engage in some type of grave dancing but, rather, that the dire circumstances we face require the development of technologies to mitigate greenhouse gas emissions and allow us to adapt to the consequences of changes in climate. There is simply no way governments and NGOs can provide the capital necessary to develop and deploy the needed technologies at scale and scope. Investment from asset owners is required—but these investments should only be made if they meet

their investment and risk targets and policies are firmly in place to support such investment decisions. Beneficial investing is a fiduciary, not philanthropic, activity.

(As a side note, I believe that from an investment perspective, the fossil-fuel-divestment movement will prove impotent but it is at least raising the awareness of asset owners to climate risks and opportunities. See my article, "Divestment as Capitulation.")

So while my assessment might sound a bit bleak, I remain hopeful that the combination of collective political will and the collaboration of various stakeholders, including the active engagement of asset owners, will lead to a global solutions network that will enable us to avert the most devastating of consequences to physical and human systems.

Regardless of whether my hope is fulfilled, you can continue to count on the *JEI* as a clearinghouse of valuable, sound information on all aspects of environmental investing.

In closing, I want to thank the contributors to this issue for their thoughtful essays. I also must express my heartfelt gratitude to BE Bio Energy Group AG, our steadfast sponsor for the past five years. Their unwavering support of the *JEI* has allowed us to explore our own editorial vision, engender critical discourse of all aspects of environmental investing, and provide readers with open access to our content. Readers might not know this firm but BE Bio Energy was an early actor in environmental investing and continues to contribute to the reduction of GHG emissions.

Best wishes,

Looking Back

Cary Krosinsky
Editor

Looking back on Angelo Calvello's *Environmental Alpha*, one is struck by the prescient points that still resonate in a modern context, even though the field is rapidly evolving as we speak.

For example, the opening sections on climate change predicted almost exactly what has occurred since the book's publication in 2010, hence giving further validity to longer-range concerns about pending climate catastrophe, which investors now need to address.

Richard Betts said, "The effects of our CO_2 emissions have not yet been fully realized, partly because of a feedback mechanism of carbon uptake by the biosphere and partly because fossil fuel burning also produces aerosol particles, which exert a cooling effect by reflecting sunlight. Continued emissions of GHGs are confidently expected to lead to further warming, resulting in further sea-level rise and rainfall pattern changes with consequent impacts on society" (p.29). This is pretty much exactly what has happened—changing weather and record-high global-average temperatures in 2014 and 2015 have contributed to increasing concerns about future directions, while raising the need for environmental considerations within all investing. It's also exactly the theme of this book and what Calvello called for.

Dimitri Zenghelis strongly suggested, "Delayed action will eventually be the antigrowth strategy," (p. 51); again, exactly where we appear to be headed, towards a clash of energy consumption and climate change realities that can only be walked back through positive intention and investment action.

David Gardiner's view on policy also still resonates, foreseeing as he did that "there will never be one single uniform international climate response" (p. 75). Rather he saw coming what just happened at COP21 in Paris, a "large and varied set of policy approaches utilized by different actors" (p. 75). While we have a deal out of Paris, it is, in effect, a collection of different approaches and commitments playing out, even within countries such as Canada, where each province will take a different approach to pricing carbon, for example.

Part One of *Environmental Alpha,* as a result, stands as a testament to how prediction can lead to investment expectations that can be prejudged. And, standing here as we are in 2016, we can see that the value of looking forward, as Calvello also argued was critical, becomes even more mission-critical as the list of global environmental risks and exposures only grows in relevance, encompassing fresh water, local pollution, greenhouse gas emissions, their regulations, and more. Over the next five years, getting these things right will be increasingly relevant for shareholder value and societal outcomes.

The rest of the book is filled with essays from thought leaders whose work has only evolved. Mindy Lubber wrote on emerging risks, including the physical risk of drought and the competitive risk to utilities. Of late, the work of CERES, where she is president, has gone from strength to strength. Paul Watchman's overview of fiduciary duty represented an evolving body of work that continues to grow in relevance, as reflected in the development of investment beliefs by asset owners and in the late 2015 Department of Labor ruling clearing the way for more applications of ESG within investments.

Matthew Kiernan, as always, makes a cogent plea for more positively focused sustainable investing: A dynamic we have also long written on, and which retains potential to create a better society through a race for capital. Value investing has emerged as the winning formula, with outperformance demonstrated by Generation and Parnassus, and through the Value Driver Model body of work and other examples in academic literature that look at performance. Additional investment and policy strategies are also highlighted throughout the book and are useful to look back on. So is the discussion on the potential for collaboration between investors, which has had arguably the most resonance to date, whether through PRI or CDP participation or in record levels of shareholder resolutions against management on climate change.

Much more work, of course, is needed, but this earlier book set a foundation for where we are now, and where we next need to go.

In this regard, we are very proud to provide you with this latest issue of the *JEI*, which attempts to do exactly that, provide a look forward from a variety of perspectives. In particular, I am proud that my own teaching and association with Yale University has helped lead to four of the perspectives included in this issue: the inadequacy of deforestation standards and what can be done about them; a look at the challenges to industry-led scaling of low-power supply; a review of climate investment; and a look at socialism, price, and sustainability from Juan-Victor Seminario and Todd Cort. I had the honor of collaborating with Cort, of the Yale School of Management, on a recent piece for the *Financial Times* in which we called for better standards and quantification of benefits on green bonds and on investment in general. If we don't do our proper due diligence,

then environmental investing could become its own form of greenwashing, so we need to do this job and do it well.

In general, we need to look forward, to predict the future, or risk being stuck with old ways of business and investment. Science tells us the latter will be disastrous for society and therefore for value—half the value of investing is potentially at risk, according to the University of Cambridge. Environmental investing itself, then, becomes a necessary hedge for the needed state of the world as well as for maximizing value in general. Making this happen is our job.

Reflections on *Environmental Alpha*

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Chief Executive, Inflection Point Capital Management

Matthew is the author of Chapter 6, "SRI or Not SRI?", in *Environmental Alpha: Institutional Investors and Climate Change.*

As I write this, COP21 in Paris is scant weeks away, and the results there may make a mockery of much of what I say here, but here goes a reflection on the earlier chapter in *Environmental Alpha,* with the benefit of six years of hindsight. . . .

In retrospect, early in the chapter I certainly overestimated the amount of political capital President Obama was prepared to invest in the environmental file—at least for the first 80% of his presidency. During the last year, however, his rejection of the Keystone pipeline from Canada's tar sands and a series of dramatic commitments on the eve of COP21 have signaled a much stronger stance and concern for an environmental legacy, so perhaps my early optimism may have been justified after all.

As for the secular global megatrends that were emphasized in the chapter, unsurprisingly they remain very much in evidence (that's one of the things of course that defines a megatrend: it is most unlikely to disappear in the space of six years!). Climate change was referred to as arguably "the mother of all " megatrends, and certainly the attention generated by COP 21 has brought it to the fore today.

At one point in the chapter, I had mused that one of the impediments to more climate-savvy investment was the intellectual conflation in many investors' minds between environmentally aware investing and "socially responsible investing." They were largely convinced that the latter was a recipe for alpha destruction, and so "guilt by association" had a dampening effect on investors' appetites for climate-aware investing as well. I am happy to report that today there are strong signs that the distinctions between the two are becoming much clearer to investors, so that one impediment seems to have weakened markedly. Today, many institutional investors who still want no part of socially responsible investment are quite prepared to at least entertain the notion that climate change has by now morphed into a legitimate, mainstream investor issue.

That said, though, I stand by my original criticism in the chapter that institutional investors have not yet responded to climate change in a sufficiently forceful or systematic manner. On the positive side, one thing has changed in the intervening six years: investor awareness of climate change has increased exponentially, especially in Europe and Australia. Organizations such as the Institutional Investors Group on Climate Change, (IIGCC) in Europe, Investor Group on Climate Change (IGCC) for Australasia, CERES in North America and the United Nation's Principles for Responsible Investment (UN PRI and Environment Programme's Finance Initiative (UNEP FI) have done a stellar job in raising awareness. But awareness has yet to catalyze action beyond a few hardy pacesetters. The following statistics are telling in this regard: There are currently roughly 1410 signatories to the UN PRI (in which climate change features prominently), only 110 to the Montreal Carbon Pledge about disclosure, and a paltry 18 signatories to the Portfolio Decarbonization Coalition, which commits signatories to action. Enough said.

My critique remains twofold:

- Not enough investors are taking meaningful, concrete action of any kind.
- Even those that are doing so have so far invested in only a tiny subset of their total portfolio

With regard to the first point, leading-edge organizations such as Sweden's AP4, France's FRR and ERAPF, and the UK's Environment Agency Pension Fund are conspicuous exceptions to the general rule. The vast majority of institutional investors are contenting themselves at best with supporting collective research studies and/or "engaging" with portfolio companies. They are not, as a rule, changing their capital allocations. The organizations mentioned earlier in this paragraph, by contrast, have already done so or are in the process of doing so.

With regard to the second criticism, for even the majority of climate-aware investors, the totality of their response to date has been to invest in clean tech. However worthy such investments may be, however, they represent far less than 1% of most institutional portfolios. Yet precisely the same global forces creating the clean tech opportunity are also bearing down on the other 99% of the portfolio as well. Climate change is part of a much broader global industrial restructuring, and as such has implications for every asset class in the institutional investor's portfolio: listed equities, fixed income, private equity, real estate, infrastructure, and real assets such as farmland or timberlands. Take infrastructure as just one example: the Organisation for Economic Co-operation and Development (OECD) pensions study has revealed that, on average, pension fund investors have less than 1% of their assets allocated to infrastructure of any kind; for low-carbon infrastructure the figure is less than 0.1%. There are opportunities to be found just about everywhere for climate-aware investors: transitional companies such as Siemens,

which already generates roughly 30% of its revenue from renewables; green bonds; green real estate and energy efficiency retrofits; low-carbon infrastructure; best-in-class carbon emitters who are decarbonizing faster than their peers; and, of course, pure-play clean tech companies.

So, much remains to be done if institutional investors are to move beyond understanding and rhetoric into action. The good news is that investor awareness of climate change is now at an all-time high, and there is a greater sense of urgency. The better news is that we now have several concrete examples of leading-edge institutions that are prepared to actually allocate capital in a climate-conscious way. So on the whole, I'd say the outlook has improved significantly over the six years since the original chapter and book were written.

Biography

Dr. Kiernan is founder and Chief Executive of Inflection Point Capital Management (IPCM), a specialist, research-driven investment management boutique headquartered in London, with offices in New York, Paris, and Melbourne. IPCM was founded in 2009, and has roughly $1 billion under advisement. The firm will be launching new, environmentally driven investment strategies in both listed real estate and climate finance in early 2015.

Dr. Kiernan has lectured on sustainable investment and finance in executive programs at the Wharton School, Columbia Business School, Oxford University, Stanford, the London Business School, and HEC Paris, among others. He also served on the guest faculty of Cambridge University's Executive Program for Sustainability Leadership, founded by HRH The Prince of Wales. He holds advanced degrees in political science and environmental studies, as well as a doctorate in strategic management from the University of London.

He has published dozens of articles and book chapters on sustainable finance, and his most recent book is *Investing in a Sustainable World.* Dr. Kiernan is a frequent speaker at international investment conferences, and has addressed the World Economic Forum in Davos, Switzerland on a number of occasions. He received an award from the UN Environmental Program's Finance Initiative for "innovations in carbon finance" in 2007.

Reflections on "Effective Clean Tech Investing"

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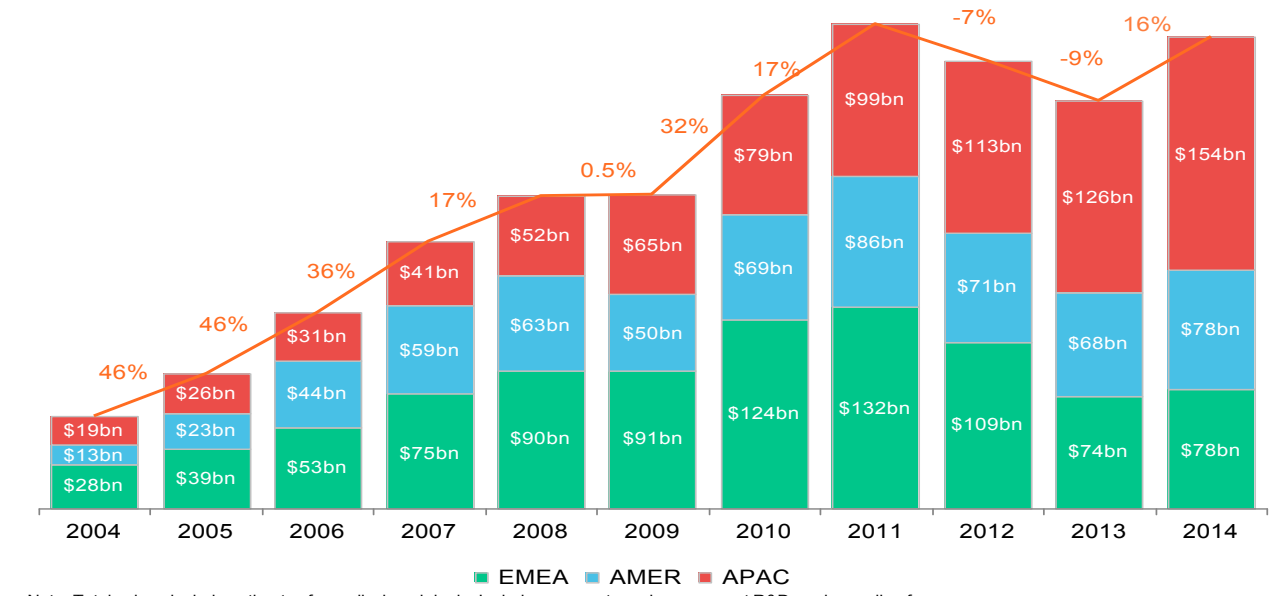
Russell and John are the authors of Chapter 11, "Effective Clean Tech Investing," in *Environmental Alpha: Institutional Investors and Climate Change.*

Since the publication of our chapter "Effective Clean Tech Investing" over half a decade ago, the market and opportunity for investing in clean tech has undergone a significant and ultimately healthy transformation. Specifically, two distinctive classes of clean tech investment have emerged—(1) ***Income***: those focused on generating project income, generally under long-term contracts with governments, utilities, or other companies, and (2) ***Growth***: those company investments seeking to transform the production and utilization of the world's natural resources. This short follow-on article is intended to elaborate on these important developments and is divided into the following four sections: Investments in Clean Tech, Emerging Trends and Technologies, Future Evolution of the Fuel Mix (Oil, Gas, Coal, Nuclear, and Renewables), and Implications for Future Investment.

Investments in Clean Tech

Despite the temporary slowdown in renewables and clean tech investments stemming from the global financial crisis of 2008–2009, the overall trend in investment has been largely sustained and significant. Investments in clean-energy opportunities, in particular, have increased by 17.8% annually over the decade from 2004–2014 (Figure 1). That said, perhaps the biggest surprise has been that such investment growth over the past half decade has been almost exclusively focused on the Asia-Pacific (APAC) region rather than either the Europe, Middle East, and Africa (EMEA) or North and South America (AMER) regions. However, persistent and increasing concerns regarding the potential for global warming, the impact of environmental pollutants of all stripes, and the depletion of the world's natural resources in the face of sustained economic development across the world's emerging markets have now focused the attention of policymakers and investors alike around the globe.

Figure 1: Global Clean-Energy Investment over the Past Decade



Note: Total values include estimates for undisclosed deals. Includes corporate and government R&D, and spending for digital energy-storage projects (not reported in quarterly statistics).

Source: *Bloomberg New Energy Finance.*

What has emerged are essentially two classes of investment geared to meet the distinctive portfolio needs of international investors—those project investments that seek to provide meaningful and regularized *income,* and those company investments that are geared toward providing meaningful capital gains *growth* over time through the introduction of innovative and transformative technologies. Of these two categories of investment, growth

opportunities have remained largely concentrated in North America and Europe while income opportunities have developed globally with accelerating interest in the APAC Region. Importantly, Bloomberg New Energy Finance data also reveal that project investments have emerged as the dominant global clean tech investment, accounting for roughly two-thirds (or $257 billion of the $385 billion) of global clean-energy investments during 2014. Company investments (including mergers and acquisitions) account for the remaining one-third of clean-energy investment. Although clean tech investments generally had their origins among wealthy, developed economies, investments in the emerging markets now account for the majority of clean-tech project investments, a trend that is likely to continue. It is especially notable, for example, that both Saudi Arabia and Pakistan plan to displace Germany in its role as the most significant country deploying solar-energy projects.

Emerging Trends and Technologies

From a technology-performance perspective, it seems that the recent revolution in the efficiency of alternative-energy technologies, including solar and wind (and to a lesser extent biofuels and geothermal), has also generally failed to anoint specific companies as persistent winners. However, given the industry consolidation, experienced internationally along with the elimination of potentially disruptive country-specific subsidies, the prospects for the emergence of clear industry leaders have grown significantly. Such companies have further increased the global appeal of alternative-energy infrastructure by providing warranties and long-term service contracts. As investments, these projects have generally produced income streams under contract with utilities, governments, and companies. They trade or are offered at a slight premium to traditional infrastructure projects, and emerging-markets projects oftentimes offer double-digit yield opportunities.

Batteries

Perhaps the most exciting innovations in new technology development will occur when battery storage becomes less expensive than peak power generation. This will likely occur when the cost of battery storage falls below $200 per kilowatt-hour of storage and efficiencies exceed 70% and cycle life exceeds 3,000 cycles. At the current pace of innovation, batteries are expected to reach this price/performance level within the next three years (by 2018–2019). The benefit of improved battery storage comes from running a baseload power plant at less expense than turning power on and off to match peak periods. If battery-power storage becomes cheap enough, energy will be stored in batteries at night and released during peak periods during the day, thereby eliminating the need for additional daytime power generation that uses fossil fuels. The power industry currently has about 33% excess generation capacity to handle peak periods. The capital cost and carrying cost of that excess capacity will become less important if battery technology

continues to improve its price/performance. Trading peak generating capacity for battery storage will likely save power companies a significant amount of money in the process.

Another significant advantage to battery storage is that its development and deployment can remedy some key weaknesses in current electricity grid systems. For example, during peak hours, the grid bringing power to city centers is heavily loaded, increasing the temperature of power cables and decreasing the efficiency of transmission. Up to 50% of power generated can be lost on the grid before reaching the customer. With battery storage set up in the inner city, however, power could be transmitted and stored at night, when the grid is lightly used, and then delivered from the inner city batteries during the day, thereby reducing losses during peak times.

It should be noted that lithium-ion chemistry is the front-running technology for creating batteries of light weight and high-power density. These qualities make lithium-ion ideal for transportation applications, such as in cars and planes. However, it is likely that grid-based batteries, particularly those used in inner cities, will be based on a different technology because lithium is also highly flammable and burns more aggressively if dowsed with water. Other technologies, such as zinc-based batteries, may prove far safer and more scalable.

Finally, low-cost battery storage will reduce the primary problem of renewable energy from wind and solar—unreliability. With the advent of low-cost battery-storage systems, wind and solar power could be harvested when available, and the energy delivered when needed, rather than requiring windy and sunny conditions for power generation. This enhanced ability will enable significant growth in wind and solar power by shifting their economics and reliability.

Microgrids

Another technology-driven trend to monitor is the emergence of microgrids. Since the industrial revolution, the grids that deliver power to customers have grown dramatically. One of the determinants of a country's economy has been the availability of reliable, low-cost electricity to industry. There are many similarities between our massive power grid and the telephone cable infrastructure that was necessary before the invention of cellular phones. If wind, solar, and battery storage continue to improve their economics, then smaller, less expensive local "microgrids" may replace massive grid structures.

This trend is in its infancy, but countries in Asia and Africa with less reliable power could experience faster growth through the adoption of microgrids.

Low-cost energy storage is critical to enabling microgrids, however, because intermittent renewable sources would be replacing steady base-load generation.

Materials (Including Cement and Metals)

Finally, we recommend watching the emergence of innovations that greatly improve the functionality of materials or use less energy and lower emissions to produce materials. Most people are unaware of the energy content and carbon emissions of materials. For example, the carbon emission from the manufacture of cement is equal to the emissions from half the world's automobiles, or about 8% of total global greenhouse gas. Steel production accounts for approximately 5% of greenhouse gas. A final example of the energy intensity of materials: producing one ounce of platinum requires processing eleven tons of earth mined from up to 1,000 meters below ground.

New technologies that radically reduce the amount of materials needed for various processes and reduce the volume of their emissions are beginning to be commercialized. In some cases, the price/performance of greener processes is superior to current practices. For example, at least one company is making a superior (that is, stronger) cement at about half the cost of normal Portland cement and, in the process, is lowering greenhouse gas emissions by more than 90%.

Another example is the ability to make materials far stronger than normal by reducing crystal size to nano-metric dimensions or by eliminating crystal formation altogether by making metals amorphous (glassy). A glassy metal can be ten times stronger than the same metal in its normal crystalline state. For example, if aluminum were made ten times stronger, aircraft could be ten times lighter, thus resulting in significant fuel savings. Similar gains are expected to come from using fiber-reinforced materials, such as in the Boeing 787. Commercial activities are also finding uses for super-reinforcing materials made from carbon nanotubes and graphene.

Investments in materials are not generally thought of as green investments. However, just the elimination of greenhouse gas from cement production could have a greater positive environmental impact than the wind and solar industries combined.

Future Evolution of the Fuel Mix (Oil, Gas, Coal, Nuclear, Renewables)

A version of an old Danish proverb, "Predicting is difficult, especially as it relates to the future," applies nicely to energy. Looking forward, we think that certain trends in fuels are easier to predict than others. Coal for example will continue to decline as a percentage of total power in developed countries. However, it will still likely constitute a major percentage of total power production in 20 years. Wind and solar will continue to increase,

particularly if driven by improved energy-storage technologies, such as better batteries, and bolstered by subsidies. Nuclear energy is also unlikely to grow significantly. The Fukushima accident will make new licensing of nuclear power plants all but impossible in the developed countries. Any growth in nuclear energy will likely come in Asia, the Middle East, and Africa. Natural gas will see healthy growth in countries like the United States that embrace fracking technologies.

Technology remains a wild card for energy. Innovations in drilling technologies over the last three decades have caused the abundance of cheap natural gas in the United States. There is also a chance that new drilling technologies will enable growth in geothermal energy. If this happens, we could enjoy a major shift in sustainable power.

Steady improvements in solar energy are highly likely. The semiconductor industry has demonstrated the ability to constantly improve price/performance. Wind will likely innovate less rapidly than solar. Wind technology will focus on withstanding harsher environments with higher-quality winds, such as in offshore locations. Biofuels will continue to suffer from the low cost of oil, unless a major innovation occurs in microbial growth and processing. Biologically produced products will likely first attack other markets with higher-value products like cosmetics and proteins before moving to fuels. Successes in these other markets can thus become leading indicators that biofuel economics are improving and that scalable biofuel production could become achievable.

The other wild card is government intervention. Governments today make bold but oftentimes economically irrational decisions. It could be argued that Germany's response to Fukushima is overly aggressive: It is attempting to replace nuclear power (18% of its current total power generation) by the year 2022. The replacement fuels will likely include coal, gas, and renewables, resulting in a net increase in greenhouse gas emissions overall.

Governments in Europe and the Americas will likely focus on regulations to reduce the use of coal. However, the cooperation of China will be needed to create real change. If the UK abandoned coal-fired electricity completely, for example, it would only equal the *increased* amount of coal burned in China for a single year. Technologies that utilize and sequester vast amounts of carbon dioxide will likely also be sorely needed in order to forestall potentially dangerous levels of global warming.

Implications for Future Investment

Although the investment landscape for clean tech opportunities has been rapidly evolving because of technological innovation, uneven interest from potential clean tech investors, high volatility, and the currently low prices among energy commodities, the following six distinctive implications can be discerned:

1. Clean-energy investment across the Asia-Pacific Region (particularly China) is growing and now accounts for the majority of clean tech investment worldwide, while the rest of the world is exhibiting relatively small increases annually.
2. Wind and solar opportunities are (and will continue) dominating clean-energy investments overall—as biofuel opportunities drop rapidly.
3. Clean tech investing has underperformed in the public markets (particularly among publicly traded stocks), so effective marginal investment has shifted largely to project investments (which are able to produce attractive income) and asset acquisition/merger opportunities (with specifically identifiable and credible growth potential).
4. The strategy of sacrificing short-term profitability in anticipation of earning long-term gains has generally not been viewed as credible by the public-equity markets, and has resulted in the underperformance of publicly traded stocks that took such an approach.
5. Fracking technologies will likely keep natural gas prices very low in the United States, causing a further drop in green-project investments across North America; however, because natural gas prices should remain higher outside of North America, clean-energy project investments will likely be concentrated elsewhere around the globe.
6. Batteries are the next enabling technology likely to propel long-term investment into wind- and solar-project opportunities.

Although recent, the significant and sustained drop in global oil prices deserves particular attention, despite its impact not yet being fully captured in clean-tech investment data. Indeed, in combination with persistently low U.S. natural gas prices, the economics of U.S. wind and solar will likely continue to suffer. Government subsidies in the United States have evened the field somewhat but have proved in the past to be unreliable over the long term. The recent renewal of wind and solar tax credits will prop up investments through artificial economics—but will they last only through the life of the investments? Recently, the UK government slashed the subsidies for solar, citing, among other things, the stress that intermittent power generation puts on the grid.

Wind and solar account for 90% of clean-energy investments, and both are more expensive than power generated from fossil fuels—especially when the price of natural gas in the United States is below $2/million BTUs. Regardless of the availability of subsidies, the low prices of fossil fuels will drive investment money away from wind and solar in the United States. International investors, particularly those capable of investing across Asia, will likely not respond in the same way as U.S.-focused investors, however.

Natural gas prices in Asia are much higher than in the United States. The government of China seems to be willing to continue a major bet on renewable energy driven by a desire for energy independence, the creation of new export businesses, and a reduction of the stifling air pollution in northern China. Asia in general is also becoming the core geography for the deployment of new battery technologies, owing largely to the intermittency of wind and solar power.

Although international investment has thus evolved substantially over the past decade, its future landscape and milestones have likely become much easier to discern and forecast.

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Biographies

Russell Read is currently senior advisor to Mountain Pacific Group, which is the exclusive manager of FTSE World Parity Unit (WPU), a currency unit used to manage and minimize the currency risks for international investors. Until recently, Dr. Read served as CIO and deputy chief executive of the Gulf Investment Corporation (GIC) based in Kuwait City. In that capacity, he led 70 investment professionals and 190 total staff charged with transforming the Gulf Cooperation Council (GCC) Finance-Ministries-owned enterprise into the development investor for the Gulf region and partner of choice for international organizations seeking to allocate business to the Gulf region. During his leadership tenure at GIC, he played a central role in reestablishing the mission effectiveness of the organization, substantially improving its profitability, and attracting country-level investment partnerships from Japan, Korea, and Germany to the Gulf region, thereby also enhancing GIC's credit rating by three notches, from BBB (Baa2) to A (A2).

Previous to his role at GIC, Dr. Read founded and led C Change Investments (later merged into New York City-based TEM Capital), a private-equity investment firm dedicated to profitably transforming the production, distribution, and consumption of the

world's natural resources. He was also CIO of the California Public Employees' Retirement System (CalPERS), North America's largest pension system. While at CalPERS, he internationalized the portfolio and developed its new programs in infrastructure, commodities, forestland, and sustainable technology investments. Before his work at CalPERS, Dr. Read was deputy CIO for Scudder Investments/Deutsche (bank) Asset Management, and director of Investment Product Design, Commodities, and Quantitative Strategies for OppenheimerFunds in New York City, where he designed and managed the first commodities-based mutual fund (the Oppenheimer Real Asset Fund) and related institutional products.

Dr. Read has been a resource for international regulatory agencies, state governments, and the U.S. House and Senate for over two decades and served as chairman of the Investors' Committee of the President's Working Group on Financial Markets under Treasury Secretary Henry Paulson. He is currently a board member for both the Hedge Funds Standards Board (London) and the New York Academy of Sciences (NYAS). *SmartMoney* (November 2007) named him one of America's 30 most influential players in business and finance, and *Institutional Investor* listed him as #35 of the 75 most effective chief executives.

Dr. Read received his undergraduate degree in statistics and his MBA in finance and international business, both from the University of Chicago, and his master's in economics and doctorate in political economy from Stanford University. His doctoral work, *The Politics and Policies of National Economic Growth,* focused on the particular economic roles of natural resources in economic development. He has taught graduate-level courses at the University of California at Davis, the University of Maine, and Stanford University and has been a guest lecturer/class instructor at Columbia University, New York University, and the University of California at Berkeley.

John T. Preston is the managing partner of TEM (Transformative Energy & Materials) Capital, former managing partner of C Change Investments, and former head of the MIT Technology Licensing Office. (CET). His primary expertise is in energy, environment, technology, and entrepreneurship.

Before starting CET, Mr. Preston was the director of technology development (and licensing) at MIT, where he was responsible for the commercialization of intellectual property developed at the university, which generates roughly two inventions per day on a research budget of about $750 million. During his career at MIT, Mr. Preston oversaw activities that led to the creation of hundreds of new technology-based companies; the negotiation of thousands of licenses with existing companies; and many complex consultations, including one as MIT's representative on the HDTV Grand Alliance, which

created the U.S. standard for high-definition television. Mr. Preston also taught entrepreneurship at MIT as a senior lecturer.

Former President Francois Mitterrand of France awarded Mr. Preston the rank of "Knight of the Order of National Merit of France." In the United States, he received the "Hammer Award for Reinventing Government" by Vice President Gore. He chaired President George H. W. Bush's conference announcing the president's technology initiative and co-chaired a conference for HRH Prince Charles, the Prince of Wales Technology Awards Conference. He also advised the Clinton White House in preparation for the Kyoto Summit on climate change and spoke at President Reagan's White House Conference on Superconductivity. Mr. Preston testified before Congress seven times as an expert on technology innovation and has been on advisory boards for the U.S. Department of Defense, NASA, the U.S. Department of Commerce, and numerous others.

He is the recipient of many other awards and honors including the Thomas Jefferson Award, given to the leading American in technology transfer and the Renaissance Engineering and Science award from Stevens Institute of Technology. Mr. Preston is an Honorary Alumnus of the Massachusetts Institute of Technology.

Mr. Preston received a BS in physics from the University of Wisconsin and an MBA from Northwestern University.

Corporate Responsibility, Reporting, and Environmental Investing—A Retrospective

Tony Hoskins, MBA

Tony is the co-author with Martin Batt of Chapter 15, "Corporate Responsibility, and Environmental Investing," in *Environmental Alpha: Institutional Investors and Climate Change.*

In 2009, when *Environmental Alpha* was published, considerable pressure was on corporations to take greater responsibility for their environmental impacts and for their investors to take those impacts into account in their investment decision making. This was before the Copenhagen climate change summit in 2010, when the replacement for the Kyoto Protocol was expected to be ratified. The failure of this summit was somewhat of a game changer for many executives in corporations, who became uncertain about legislative intentions regarding climate change.

Certainly since 2009, the focus on climate change has grown in some sectors. These include those companies in the extractive industry that have stranded fossil fuel assets (where total reserves, if extracted and consumed, would far exceed a carbon budget set to avoid global warming of 2°C), and those high-energy intensive industries operating in countries where carbon-trading tax regimes impose additional operating costs.

However, for lower energy-intensive industries operating in countries with carbon tax regimes (for example, the UK's Carbon Reduction Commitment), the regimes have not had the cost impact that was expected, and the impact has been insufficient to internalize climate change externalities. This is because energy costs (even before the drop in oil and gas prices) did not represent a significant percentage of operating costs, and the tax imposed was insufficient to affect that percentage. In addition, emissions in many of these companies have already been dropping (independent of management actions) either because of government actions to change the balance of electricity generation toward lower emission energy sources, or because of intergovernmental pressures on motor manufacturers to reduce the emissions of motor vehicles.

Our experience of the "environmental actions" taken by these corporations is that whilst they reduce environmental impacts, including those of climate change, the rationale for implementing them tends to be one of overall cost reduction. As an example, for those companies with large vehicle fleets, especially those in the services or logistics industry, a significant focus is on the use of engine mapping to improve engine efficiency; software to improve route optimization; and on-board technology, such as telematics, to improve driving behaviors. The impact of such changes is to reduce fuel consumption (and hence emissions), but the business objectives are more likely to relate to improving driver productivity, vehicle utilization, and driving standards (leading to fewer accidents and reduced insurance premiums). These business priorities are more significant than reducing emissions per se. We have found that gaining traction with a company's board on issues such as climate change can be challenging. An effective way to frame the issues is to focus on the business-oriented objectives and their implications, which board members can easily relate to and understand.

The challenge lies in the extent to which environmental externalities are internalized as costs and taken into account when operational decisions are made. Without environmental taxes, this is unlikely to occur, and even with such taxes, for the majority of corporations, these are unlikely to be of sufficient magnitude to have the desired effect.

Nevertheless, there is evidence that a focus on environmental matters will affect a corporation's share price. Two studies indicate the way in which responsible environmental policies and practices can have an impact on share values.

The first study[1] was conducted by New Amsterdam Partners, a boutique U.S. asset management firm. Their research focused on whether all aspects of responsible investing are equally important for stock analysis, and addressed stock returns and return on equity (ROE). The study showed that environmental, social, and governance (ESG) overall scores have predictive power over total stock returns and financial performance measured by ROE. Good companies (more strengths than weaknesses in ESG) tend to have higher medium-to-long-term (three- to five-year) returns and ROE. Corporate governance scores were the best predictor of stock returns, especially over the longer three- to five-year horizons, followed by environmental management, but over a longer term.

1. Claymann, Michelle R. (CFA), and Indrani De (CFA). 2010. "Are All Components of ESG Scores Equally Important?" July 14. *Finance Professionals Post*, the journal of the New York Society of Security Analysts. Available from http://post.nyssa.org/nyssa-news/2010/07/the-impact-of-esg-on-stock-returns-and-profitability.html.

The second study[2] was undertaken by academics at Harvard and London Business Schools, and took a longer set of data—over 20 years. The study showed that corporations that had voluntarily adopted environmental and social policies over a long time period (described as High Sustainability corporations) had fundamentally different characteristics from corporations that had almost none of these policies in place (described as Low Sustainability corporations). Of particular significance is that the High Sustainability corporations significantly outperformed the Low Sustainability corporations over the long term in both stock market and financial performance. The study also found that the High Sustainability corporations were more likely to have members of the board who had responsibilities for sustainability. Low Sustainability corporations reflected traditional corporate profit maximization in which social and environmental issues are often regarded as externalities.

My interpretation of these studies is that good governance, together with good environmental approaches, is a surrogate for a detailed management philosophy within a company, which will lead to better performance and, ultimately, a higher share price.

The challenge of implementing the findings of these studies in a corporation is that the correlation to share price only materializes over the long term. Those hoping to gain a share-price improvement in the short term are unlikely to succeed by embedding sustainability in the corporation with a short-term agenda. This is a difficulty when the average length of tenure for chief executives tends toward the four-year mark. Probably few chief executives will take a long-term perspective and internalize the external costs into their corporation's business strategy programs (with the notable exception of those like Paul Polman at Unilever who introduced "Sustainable Living" as part of the company's main stream initiatives).

But perhaps focusing on business-oriented objectives (while also delivering environmental improvements) is not such a bad thing. At least then the chief executives would be able to articulate to investors the business rationale behind such initiatives. Of greater concern is the extent to which corporations are taking into account risks that may result from climate change. My experience is that few corporations are taking a long enough view of such changes—on the basis that the executives involved in making such decisions would not be around in the corporation to see the effects of any climate change impacts, and if such impacts occurred in the short term, there is unlikely to be any blame attributed for any indecisiveness on their part.

2. Eccles, Robert G., Ioannis Ioannou, and George Serafeim. 2011. "The Impact of a Corporate Culture of Sustainability on Corporate Behavior and Performance." Harvard Business School. Retrieved from the Harvard Business School website: http://www.hbs.edu/research/pdf/12-035.pdf.

From the perspective of the investor, it is to be hoped that one outcome of the 2015 Paris summit will be that those governments signing up to the new protocol will start considering how they can ensure corporations in their own countries will sign up to the responsibilities involved. Additionally, governments should ensure that the corporations act on those obligations, rather than just relying on governmental initiatives, such as renewable energy programs, to take away the burden from them, or conforming to legislative emissions reporting requirements (such as the UK's mandatory greenhouse gas reporting, which may have little visibility beyond the annual report).

If this acceptance of corporate responsibility and accountability does take place, then investors will have a more justifiable basis from which to ask the corporations in which they are investing "what are your long-term environmental objectives? how will they be delivered? and who will deliver them?" If investors really are looking for long-term income streams, they have to be able to gain greater clarity on the issues that may affect corporations over the longer term. But investors will need to start asking some of the more difficult questions of chief executives, over and above "what are your profit forecasts for next year?"

Biography

Tony Hoskins has extensive experience in corporate responsibility (CR) reporting, annual nonfinancial reporting, and stakeholder communications. He consults for major multinational companies, and has an in-depth understanding of the issues faced in integrating these matters into business practices and strategy. In addition to working on these areas with Asesoria, he delivers training on CSR and Corporate Governance for ICSA, and the Investor Relations Society. He is the author of thirteen books on these subjects.

Tony is actively involved in local environmental projects. He has an MBA from London Business School, and graduated in economics and statistics from Bristol University. He is a retired chair of the RSA's UK South Central Region.

Into the Blue

Liesel van Ast
Natural Capital Declaration Programme Manager, Global Canopy Programme

Water as a critical resource is virtually invisible to capital markets. Yet the landmark international climate-change agreement adopted in Paris in December 2015 invites financial institutions to provide information on how climate finance will incorporate "climate-proofing."[1] The deal aims to strengthen the global response to climate change by making "finance flows" consistent with a pathway toward low greenhouse gas emissions and climate-resilient development. Implementation will need to include assessing risks from changes in water availability and understanding the financial implications for sectors that include mining, food and beverages, and power utilities. A transition to a low-carbon economy could either increase or decrease water use for electricity production, depending on the choice of technologies and cooling systems.[2] Investments made to decarbonize sectors will need to take into account exposure to more frequent and severe droughts and floods, along with related unanticipated costs, reduced cash flows, or stranded assets. Energy is often among the biggest water users in a country, while the water sector can be among the biggest energy users. The financing of both climate-change mitigation and adaptation must take place concurrently.

Many investors and the rating agencies Moody's and Standard & Poor's are at the early stages of exploring ways to evaluate the implications of water risk for credit quality or investment risk. One of the challenges is that water shortages have localized impacts in

1. The Paris Agreement under United Nations Framework Convention on Climate Change. December 12, 2015. "Adoption of the Paris Agreement." Draft decision-/CP.21. Available from http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf.

2. , Jordan Macknick, Robin Newmark, Garvin Heath, and K. C. Hallett. 2011. *A Review of Operational Water Consumption and Withdrawal Factors for Electricity Generating Technologies.* Prepared under Task No. DOCC. 1005 U.S. Department of Energy, National Renewable Energy Laboratory. Available from http://apps2.eere.energy.gov/wind/windexchange/pdfs/2011_water_consumption_electricity.pdf.

certain regions, such as parts of Brazil, California, South Africa, Thailand, and India, and thus are not major drivers of global ratings across issuers in any sector.[3] The Natural Capital Declaration (NCD), a joint initiative between the UN Environment Programme Finance Initiative and the think tank Global Canopy Programme, released two tools in 2015 to raise the bar on integrating water-risk factors into financial analysis.[4] The NCD worked with Bloomberg to co-develop the Water Risk Valuation Tool to include water stress in copper- and gold-mining equity valuations. The tool models potential asset stranding based on future physical water scarcity and estimates the effects of this water risk factor on earnings and share price.

UBS, Robeco, J. Safra Sarasin, Pax World, and Calvert were among financial institutions that road-tested a Corporate Bonds Water Credit Risk Analysis tool co-developed with partners, including the German Society for International Cooperation (GIZ) GmbH Emerging Markets Dialogue on Green Finance. This tool enables users to evaluate exposure to water stress through bond issuers in the power utilities, diversified mining, and beverages sectors. Applications include peer analysis to inform investment analysis, engagement programs, due diligence on individual securities, and product development.

Both tools include the option to apply a "shadow price" of water as a proxy to quantify financial risk from water stress. This calculation can be used to test sensitivity to water-related costs that could be internalized through higher capex or opex costs, reduced cash flows, or the loss of a social license to operate, for instance. The tools provide value from data on physical water stress and water use, which analysts would usually find difficult to synthesize and directly link to financial outcomes. They include information on future water availability that can be used for modeling exposure to changing operating conditions.

Expanding the tools to evaluate companies and sectors further would require companies to disclose their water use at a global level, as well as their operating or ownership data at a facility level. The Global Reporting Initiative disclosure guidelines, used by most multinational companies, include the following indicators:

- Total water withdrawal by source (for example, surface water and ground water).
- Water sources significantly affected by withdrawal of water (for example, the size of water source and whether or not it is designated as a protected area).

3. Moody's Investors Service, Moody's Approach to Assessing the Credit Impacts of Environmental Risks, 30 November 2015.

4. Natural Capital Declaration (NCD). Resources. Available from http://www.naturalcapitaldeclaration.org/resources/.

More detailed data is needed on where companies are using water—in operations or supply chains— in order to assess and manage exposure to water shortages.

Water Investment Opportunities

Investment in green and grey infrastructure can be among the actions taken to mitigate risks from water stress. An estimated US$1 trillion in new investments in infrastructure are needed in the U.S. alone, over the next 25 years.[5] Water-related equity funds have evolved over the past 10 years, largely focused on water supply, infrastructure treatment, and the companies providing water-related technologies. Morningstar lists 52 water equity funds from managers, including J Safra Sarasin, RobecoSAM, UBS, Pictet, and BNP Paribas. For fixed income options, investments in water projects are rare in the green-bond universe, which has mostly focused on renewable energy and energy efficiency over the past five years. One of the few green bonds to include water projects is the US$500 million issuance by the African Development Bank in December 2015, which includes sustainable water upgrades and water management.[6]

Water projects supported by green bonds are set to grow. Sustainable water management is among categories of green projects identified in the high-level ICMA Centre Green Bond Principles 2015, while the Climate Bonds Initiative is consulting until 12 February 2016 on a draft Water Climate Bonds Standard with proposed eligibility criteria for water projects.[7] The protection or restoration of natural infrastructure (forests, aquifers, wetlands, and so on) is increasingly likely to feature alongside the investment in "hard" water infrastructure. Establishing green-bond standards to clarify definitions and processes for the use of proceeds could help to expand water-related bond issuance. In turn, "Blue Bonds" with greater liquidity could attract investors looking to drive capital toward water-related projects and assets. Projects that are financed to increase resilience could also be designed to provide measurable financial benefits from reduced risks.

Additional drivers for water-related investments include the increasing significance of regulatory controls, access to freshwater, and security of supply among industrial users. These considerations prompted Resonance Asset Management to raise more than US$100 million in 2015 for an industrial water fund to provide equity financing for projects of

5. Sherree DeCovny. 2016. Invest Opportunities Flow from Water Initiatives. Available from https://blogs.cfainstitute.org/investor/2016/02/10/investment-opportunities-flow-from-water-initiatives/

6. African Development Bank Returns to Green Bond Market. 2015. *Environmental Finance,* 9 December.

7. Climate Bonds Initiative. 2015. "Water Climate Bonds Standard: Defining Expectations for Water-Related Climate Bonds in a Dynamic Climate." Water technical working group. Background Paper to Eligibility Criteria, November. Available from https://www.climatebonds.net/standards/water.

some US$20 million with typical 10-year horizons.[8] Its first investment supports a high-recovery wastewater-treatment system for a chemicals company.

Water-related financing will also be boosted by the international UN Sustainable Development Goals and targets agreed on in September 2015. It includes targets to improve water quality; increase water-use efficiency across all sectors and ensure sustainable withdrawals; protect water-related ecosystems; and ensure sustainable management and the efficient use of natural resources.[9]

Biography

Liesel van Ast is the Programme Manager for the Natural Capital Declaration, a joint initiative between Global Canopy Programme and UNEP Finance Initiative. She manages a work programme to build capacity for financial institutions to strengthen management of environmental risks and opportunities. As part of the NCD Secretariat, she oversees practical projects to support implementation of commitments to understand, embed, account for, and report on natural capital.

8. Ian Elkins. "Resonance Fires up Industrial Water Fund." 2015. *Global Water Intelligence* (*GWI*), September 16(9).

9. United Nations. 2016. Post-2015 Sustainable Development Agenda: Goals, Targets, and Indicators. UN Sustainable Development Knowledge Platform. Available from https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=775&menu=1515.

Reflecting on My Journey from Student to Practitioner: *Environmental Alpha* Against a Backdrop of Industry Change

Katherine Burstein McGinn, CFA

When a professor first introduced me to the concept of sustainable investing, the academic literature in which I immersed myself mostly explored the positive and negative impacts of *exclusionary* screening. That was 2007.

At the time, there was already evidence that of the three categories of typical exclusionary screens—environmental, social, and governance (ESG) —the environmental one had standout potential to act as a proxy for the overall quality of corporate management. When I entered the industry as an intern at Calvert Investments that year, I realized that the potential went much deeper than that. For example, I saw that shareholder advocacy around ESG issues was a powerful tool for gathering insight into corporate management and exploring long-term corporate visions.

Flash forward to 2009. Through my academic studies and my continued internships in the field, I could tell that the sustainable investment community was at an inflection point. The United Nations Principles for Responsible Investment was growing rapidly, and the concept of exclusionary screening had assumed more of a supporting role to the idea that ESG factors were crucial to risk management and active portfolio construction.

When *Environmental Alpha* hit shelves in 2009, the conversation was shifting. The book jacket reads: "The definitive guide for how institutional investors should approach the risk and opportunities associated with climate change." This sentence captures perfectly the industry scene at that time—global, institutional investors were inserting ESG factors into mainstream conversations around strategic asset allocation, risk management, and fundamental analysis.

I joined the Responsible Investment Team at Mercer Investment Consulting in 2009 at just about the same moment in industry history. My first projects involved the group's seminal Climate Change Scenarios study and the academic meta-review *Shedding Light on*

Responsible Investment.[1] These works made a strong case for the general inclusion of ESG integration in investment decisions and were widely referenced in the mainstream financial press.

Since then, the sustainable investment industry has continued to grow, expand, and overlap with mainstream finance. The UN Principles for Responsible Investment now represents over $59 trillion in assets. Nearly all of the global asset management houses have invested in research, product development, and consumer engagement around sustainability.

Despite this explosive growth, the conversation still remains quite similar to the one in 2009, when I joined the field as a full-time practitioner. While some institutional investors have become quite advanced in their methods for ESG integration, others are still puzzling over nonstandardized corporate sustainability reporting and waiting for mandates around disclosure to formalize their approach.

Opportunities for true leadership are still, in my opinion, up for grabs. Although there are many institutional investors with successful track records in the sustainable investing space, there are only a few that have woven sustainability into the fabric of their culture, investment outlook, and processes. Many times, the sustainability team is a separate entity within an organization.

In any case, I am quite optimistic looking forward. Almost two years ago, I began working with individual investors as a financial advisor. When I explain the concept of ESG integration to my clients at Pell Wealth Partners—the idea that we need to look at all material factors, not just ones that have been tracked in the past—they usually respond by asking why professional investors haven't been thinking this way all along.

I believe that the industry will continue to evolve, and companies will continue to disclose information about their ESG practices. Mandated reporting in some of the largest global markets is even a real possibility. More investors are asking questions about ESG factors than ever before. What I see is a cycle, one that has started, but is not yet complete. New patterns of institutionalized behavior take time to root, and, considering where the industry was when I started, we've come a very long way.

So here's to the next chapter. This *Journal* captures conversations within the sustainable investing industry just as *Environmental Alpha* allowed a broader audience to view the change taking place among the largest and most forward-thinking institutional investors at

1. Available from http://www.law.harvard.edu/programs/lwp/pensions/conferences/cm_europe12_09/Shedding_light_on_responsible_investment_free_version.pdf

the time. I look forward to catalyzing continued change with my *Journal of Environmental Investing* colleagues and our readers.

Biography

Katherine Burstein McGinn, CFA, is the book review editor for the *Journal of Environmental Investing* and a financial advisor at Pell Wealth Partners, A Private Wealth Advisory Practice of Ameriprise Financial. She is also a guest lecturer for Columbia's Master of Science in Sustainability Management program.

Six Years Back, Six Forward

Tony Lent, MBA
Co-Managing Partner, Aldwych Environmental and Renewables Group

This past December, 196 governments signed on to a global climate agreement in Paris. One of the surprises of the conference was the strong turnout of major corporations and asset owners making public their commitment to address climate within their remits. The government plans that were agreed to, if fulfilled, would lead to 3.6°C warming by 2100, though the signatories also agreed we can barely afford 1.5–2°C warming (we are already at 0.8°C). These national commitments resulted in part from the belief that investing in mitigation will hurt economic growth. As the last six years have shown, the mainstreaming of renewable power to a profitable global industry demonstrated that low-carbon energy could provide a rapidly growing share of global energy, while contributing to economic growth and wealth creation.

This article reviews some of the finance innovation, savvy signaling, and luck that have helped to scale low-carbon energy since 2010 and points to where the next successes could appear. It then explores the rise of the impact investment and how its unusually proactive mindset can help address the finance challenges ahead.

Four major changes have occurred in scaling capital for renewables and climate mitigation since 2010; each represents a different facet of the change: (1) the rise of infrastructure investing since the crises, with renewables becoming a dominant infrastructure investment segment; (2) the invention of the residential solar financing model, supporting residential capacity growth of 30% per year; (3) the setting up of the green and climate bond markets laying the foundation for a low-carbon debt market positioned to power growth going forward; and (4) the successful signaling of fossil reserves liabilities leading to a public markets reassessment.

None of this would have occurred without a glide path of subsidy to support investment while costs were higher than fossil energy. And without manufacturers continually improving technology, the industry would have been unable to compete with shale gas after 2011. In just the last six years, equipment makers have driven down the cost of wind electricity by 60% and solar by 80%. Grid parity has been achieved for onshore wind.

Utility-scale solar is at most 24 months behind. In many emerging market countries where electricity is unreliable, distributed solar is often less than half the cost of fossil.

The numbers provide a sense of scale. Investment in low-carbon energy is $324 billion per year and concentrated in the largest GHG emitters: China, the United States, and Europe. About two thirds of that investment is for project assets, mostly for wind and solar. Globally, zero carbon electric supply grows at 9% per year.

Project investment in renewables ($198 billion in 2015 per BNEF) has leveraged project finance tools developed for the independent power industry in the 1980s. These financing structures, well understood globally, allowed renewables to scale on a proven template. Post crises, renewables benefited from the rise of infrastructure as a subclass of alternative investment. Asset owners were drawn to infrastructure after the public markets reset because it provided predictable returns above their hurdle rates and came from long-term contracted revenue with investment grade counterparties. Renewables have taken market share because returns are equivalent to conventional power, but have no long-term fuel price exposure. In 2015 renewables became the largest infrastructure investment category, eclipsing fossil power, transport, and ports.

Growing at 30% per year, the residential solar finance industry is about self-invention. To address initial costs consumers could not comfortably afford, industry leaders including SolarCity, Sungevity, SunRun, and Vivint could only grow by becoming consumer finance companies. Instead of selling systems, they created a short-form residential power-purchase agreement to create payment streams that could be used to create third-party leases. With access to that long-term cash flow stream, bulge brackets provided warehouse lines enabling developers to scale their lease pools. After achieving tens of thousands of installations with default rates lower than mortgages, installers were well positioned to recapitalize. In September of 2013, SolarCity issued the first asset-backed securitization (ABS). Six more rated issuances followed, setting up a new ABS category. With the addressable rooftop market in excess of $100 billion and just 3% penetration, solar could scale to a significant consumer credit category in the United States and in many other developed markets.

If ranked by the potential to enlarge the pool of available investment capital, the development of the green and climate bond market could become the most powerful environmental finance enabler of the decade. Pioneered by Scandinavian pensions, environmental finance NGOs, and bulge bracket banks, and incubated by the World Bank/IFC, green bonds are designed to enable climate mitigation investment to tap public debt capital markets, demarcating a new credit category. From 2008 to 2012, issuances slowly ramped from $2 billion to $5 billion per year. Those in 2013, 2014, and 2015 were $12 billion, $36 billion, and ~$46 billion respectively. After being dominated by DFI

issuances, over the last three years green bonds have been issued by municipalities, power utilities, banks (for green lending), and corporations (for green product lines). Demand has been brisk; most green bonds have been oversubscribed. We could see the green bond category scale to hundreds of billions of issuances over the next five years.

What the green bond market should do next is tap directly into renewables projects, the largest pure-play low-carbon investment category. Since new projects are funded with 65%–80% debt from banks that will be constrained by ramping Basel III requirements, access to a liquid project bond market could help maintain and accelerate the build rate. And green project bonds may create two other network benefits: providing an equivalent or better yield than similarly rated corporates that have significant equity market beta. And by expanding low-carbon infrastructure returns to a wider investment audience, policy makers may feel more confident in advancing stronger policy commitments.

Turning to efforts to flag climate risk, we can see that accounting and communications have had an outsized effect. The Carbon Disclosure Project (CDP) and allied efforts were designed to signal climate risk to capital markets by using a financial risk-disclosure approach, and they have been exceedingly successful. Today more than 700 institutions task CDP to assess the carbon liabilities of public companies, and its assessments have been become widely read and recognized. As a tipping point, the 2012 Carbon Tracker Initiative report, "Unburnable Carbon," and Bill McKibbon's *Rolling Stone* article, describing a limited carbon budget, reframed the risk and the discussion. Without ever seeing a carbon price, these linked concepts changed investors' and the public's perception of the value of fossil fuels to a liability, circling all fossil reserves with a yellow or red pen. Informed by these concepts, what started as a limited divestment movement at university endowments upscaled to hundreds of financial institutions which—post crisis—looked at the issue through the lenses of value at risk and systemic (too big to fail) risk. Starting from 2013 and accelerating after Paris, dozens of asset owners have begun to identify investment opportunities in low-carbon energy and climate change mitigation as a response. Many of them are joining newly formed investor groups that are focused on proactive engagement and in which climate is now considered an issue intrinsic to long-term financial stewardship. As of December 2015, the combined equity market cap of the largest coal companies on U.S. exchanges was $10 billion, down from [~$200 billion] in 2012, this despite the industry having produced the same 900 million metric tons of coal and having the same reserves as in 2012.

The Mindset of Impact Investing

In the past 20 years, environmental finance developed tools and methods to value ecosystem services, to assess environmental and social risks, and to benchmark ESG performance. SRI funds embraced them, as did DFIs, the insurance industry, and some

corporations, but most investors remained skeptical. This is partly due to two investor biases widely held since the 1980s: first, that the purpose of a corporation is to maximize shareholder wealth; and second, that any other objective, such as investment that considers environmental or social outcomes, must lead to inferior returns. This trade-off framing makes it easier for policymakers to conclude that investing to slow climate change must hurt economic growth. In the investment community, this viewpoint led to a prejudice against businesses that addressed sustainability challenges.

Prevailing mindsets guide us in business, policy making, and investment decisions. They can limit us. And they can enable us. Which is why the advent of impact investment and its proactive mindset is important.

From its seeds in 2008–2010, impact investing has evolved from a community of evangelists to the mainstream faster than environmental or sustainable finance efforts before it. Impact investors describe "impact" as investing to generate positive social and environmental outcomes while achieving competitive risk-adjusted returns. It rests on two enabling concepts that have a bearing on all environmental finance challenges: that prosperity and profit will result from solving the most pressing problems facing society and, as a corollary, that there need be no trade-offs. Impact investing has a broad remit, which is another of its strengths—it includes environment, financial inclusion, climate change, education, health, sustainable agriculture, forestry, and poverty alleviation. With that list, you could say impact is sustainability remarketed but with less academic language, better branding, and more of a "get it done already" attitude.

Impact is a big tent and it is attracting a diverse and powerful crowd: from venture capital, private equity, emerging markets finance, corporate strategic investment, DFIs, foundations, and ultra-high-net-worth investors. It is drawing in some of the most energetic billionaires and best entrepreneurs of the generation who are competing with each other to see who can most successfully address big problems. It is attracting millennials who seek purpose at work, the wealthy who seek to align investment portfolios with their values, and financial institutions that sense a shift in the market. In the last five years, Credit Suisse, UBS, HSBC, JP Morgan, Black Rock, Morgan Stanley, and Goldman Sachs have all begun building out impact investment groups.

Impact assets under management lie mainly within private equity and are growing at about the same pace as green bonds: $46 billion in 2014 to $60 billion in 2015, according to the GIIN and JP Morgan study *Eyes on the Horizon*.

2015 was a headline year. In April, San Francisco-based DBL saw its third venture fund oversubscribed ($400 million) in part due to impact positioning. June saw Goldman Sachs acquire Imprint Capital, a leading impact advisory, with a plan to apply Imprint's

expertise across all of Goldman's asset management businesses. In October, Bamboo Finance, in partnership with commodity specialist Louis Dreyfus, launched a sustainable agriculture fund for Africa. LeapFrog, an emerging markets financial inclusion fund, won investment from TIAA-CREF and, in December, an additional $200 million from OPIC, making it one of the few impact platforms to cross $1billion in assets under management. Behind that list are many more small and mid-sized funds that have been well subscribed and a handful of cross over funds that combine broad new themes and impact overtones, such as the one launched by S2G with a focus on the nutrition and organics verticals, along with transparency and authenticity in the food brands it funds.

As an emerging field, the impact investment community does have its internal divisions. Making the field confusing to outsiders looking in, some impact investors are stridently "profits first" and dismissive of the DFIs and philanthropists that helped to found the space. Some are impact, first and foremost, and either deeply ambivalent about high returns or unconcerned about returns. These tensions and some odd combinations have led to investing strengths. Whereas sustainable finance focused on environment, and cleantech on technology solutions, impact investing is more nuanced, catalyzing collaboration between investors with different risk profiles, interests, and domain expertise. Examples of this collaboration range from USAID's providing a first-loss tranche to Althelia's ecosystem conservation–finance private equity fund, to M-Pesa, the African mobile payments pioneer, incubating and calving off M-Kopa, now the fastest growing village solar company on the continent, to Planet Labs funded by elite venture capital funds and most recently, the IFC. Planet Labs drastically lowered the costs of satellites, launching in three years a global network of more than 80 satellites that monitor climate conditions, crops, and weather, globally, in real time.

Climate and ecosystem science are saying we have about 30 years before things accelerate from a disconcertingly bad situation to one where we have caused irreparable and widespread harm. In the global energy system, renewables have scaled from a financial backwater to a rising global industry. Low-carbon energy has positive momentum; that said, getting to near-zero carbon in 30 years is going to take far bolder investment going forward. Addressing the next set of environmental finance challenges will benefit from a more muscular investment mindset with a bias toward solving big problems. The impact investment community has that mindset. It is dynamic and parts of it are intrepid. While the impact bus is still unproven, it is leaving the station, charting course to the problems that matter and attracting outstanding talent and resources along its course. Environmental investing can benefit from hopping on board.

Biography

Mr. Lent has 20 years of private equity investment and financial advisory experience focused on low-carbon energy, resource efficiency, and sustainable real assets. He was previously a managing director of Wolfensohn Fund Management, where he had oversight for clean energy and served on the Investment Committee for the fund. From 2003 to 2009, he was a cofounder and managing director of US Renewables Group, an $800 million private equity fund focused on proven renewable energy and scaling promising energy technologies. He led or participated in fourteen investments, spanning solar, wind, geothermal, biomass, first- and second-generation biofuels, energy storage, and wind. From 1994 to 2002, he cofounded and was a managing director of EA Capital, a financial advisor focused on cleantech commercialization and the development of funds in renewables, carbon, sustainable forestry, and biodiversity. From 2005 to 2010, Mr. Lent served on the Investment Committee of the Sea Change Fund, an impact venture fund focused on sustainable fisheries-linked investments. Mr. Lent received an MBA focused on technology management from UC Berkeley, and a BS in biology from Tufts University.

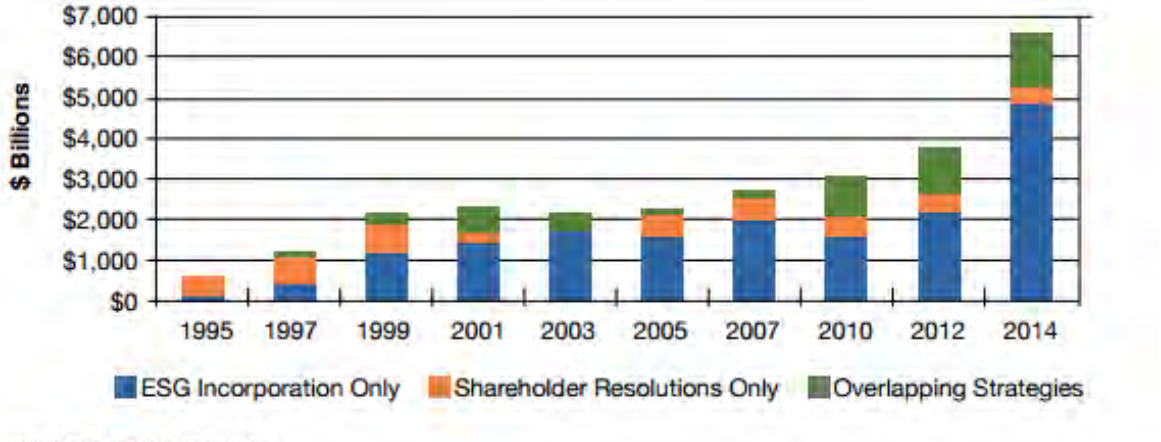
The Supply and Demand of Environmental Disclosure

Lee O'Dwyer, CFA
Equity Market Specialist, Bloomberg L.P.

There has been much reference in the Environmental, Social, and Governance community to the growth in assets under management that are targeting sustainable responsible investing. There is also great discussion around double counting and the true value of those assets, along with a debate on the very definition of "targeting"—Is it social currency or real intention on the part of the institution?

I opened a presentation at RI Asia 2015 with an illuminating chart (Figure 1). The point I was illustrating to the mostly APAC audience, was the shift toward integration strategies in the United States. The chart resonated with me since I witness this shift daily when talking to clients, but the growth trajectory was most interesting because it is directly supported by our client's growing appetite for data.

Figure 1: Sustainable and Responsible Investing in the United States 1995–2014



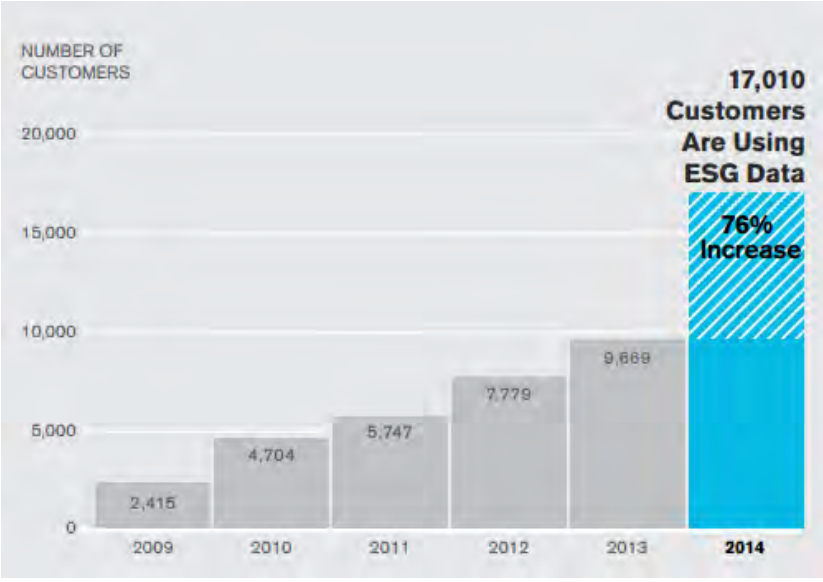
Source: *U.S. SIF Foundation. Report on U.S. Sustainable, Responsible, and Impact investing Trends. Fig. A, p. 12*. http://www.ussif.org/Files/Publications/SIF_Trends_14.F.ES.pdf.

The study by the Forum for Sustainable and Responsible Investment (U.S. SIF) Foundation (of which Bloomberg is a sponsor) notes that over the course of two years the AUM targeting SRI has grown 76% to $6.57 trillion. Assigning those assets to strategies shows that the vast majority of the growth has come from the evolution of SRI integration, or "assets that are managed with ESG factors explicitly incorporated into investment analysis and decision-making."

The left-hand side of the chart illustrates the long-standing tradition in the United States of filing resolutions at companies' annual general meetings to address environmental, social and governance concerns. We then had the Market's "Lost Decade." Total allocated SRI assets didn't suffer a retracement during this period, but there was a movement away from resolutions, as shareholders increasingly sought to integrate ESG opportunities and risks into the investment decision-making process. As U.S. markets rebounded, allocated assets grew substantially, and with that, a focus on using all the tools at their disposal to engage with companies on ESG issues: Carbon foot-printing of portfolios, screening, benchmarking, ESG activism around divestment strategies, and a large emphasis on identifying the key performance indicators for sectors.

Note the similarity between the 76% growth of SRI assets and the growth in Bloomberg client demand (Figure 2). Bloomberg collects Environmental, Social, and Governance data from the published materials of over 11,000 companies globally. The data is fully integrated into the terminal, and the number of clients using the data is growing dramatically.

Figure 2: ESG Customers and Funds



Source: *Bloomberg Impact Report 2014*.
http://www.bloomberg.com/bcause/content/uploads/sites/6/2015/06/15_0608-Impact-Report_Web.pdf.

While the targeting of these themes by assets is on the rise, the amount of environmental data reported by corporations varies widely. Consider U.S. companies, for example: Bloomberg Data shows that only 27% of the Russell 3000 discloses environmental data of any kind. Moreover, less than 10% disclose more data than their U.S. industry peer average; in other words, the level of disclosure is heavily skewed towards poor disclosure or none at all. This might be easily explained by the fact that only 329 of the companies in the index currently discuss risks of climate change in the management discussion and analysis section of their latest annual reports, and an even fewer number, 114 companies, link executive compensation to ESG.

The figure of $6.57 trillion should confirm that SRI themes have escaped the fringe label—in fact, an endless stream of conferences and pronouncements from central bank heads, business leaders, and heads of state has made the theme mainstream. As recently as two years ago, I was introducing the data to clients—now they proactively seek it out. Clearly, the efforts of the last half of this decade need to refocus on disclosure because developing effective investment strategies based on anemic disclosure will be almost as challenging as the climate problem itself.

Biography

Lee O'Dwyer, CFA, Bloomberg Equity Market Specialist. Drawing from twenty years of experience in traditional and alternative investments, Lee O'Dwyer helps Bloomberg clients gain maximum leverage of their terminal toward actionable strategies.

Discussing ESG data, equity fundamental valuations, earnings & idea generation tools, and portfolio analysis with top analysts and portfolio managers, O'Dwyer's experience and communication style lets him calibrate around the varied needs and styles of clients, allowing him to interpret their comments and provide meaningful and useful support.

Originally from England, O'Dwyer is a member of the CFA® Institute and has earned the right to use the Chartered Financial Analyst (CFA®) designation.

Beyond Intrigue

William H. Page, MBA
Portfolio Manager, Essex Global Environmental Opportunities Strategy (GEOS)

Since we launched the Global Environmental Opportunities Strategy (GEOS) at Essex Investment Management over six years ago, we have been constantly reminded by industry peers, prospects, friends, and family that we are "very well positioned." My co-manager, Rob Uek, and I frequently laugh that we would be at asset capacity if we had a nickel for each time someone has exclaimed, "You guys are in the right space." Or, "I am really intrigued with your fund." We hear these comments frequently in social settings, and do know they are stated with the best intentions. Fact is, intrigue does not pay college tuition.

I have dedicated the bulk of my professional career to some form of ESG investing. The idea for GEOS was formulated back in 2006 after (AB) 32 passed in California, with regional cap-and-trade markets emerging. I met with senior management of Siemens that spring, and over lunch, we talked of the long-term business opportunities that would be unleashed as economies strove to lower their carbon intensity. After a Ceres event at the UN, and seeing that large pensions such as CalPERS were funding clean technologies, I set out to design and implement what I believed then, and still do now, is the optimal solution for environmental investors. I wanted to bring environmental investing to the extreme—to hold companies for the *long term* and invest thematically in related environmental industries that by my definition are clean-technology focused.

My influences for this design were from the sustainability and environmental circles, rather than those of finance. I studied and spoke with Robert Repetto, who was very early on to the need to internalize environmental externalities as a cost to business. I used some of Bob's early work with asbestos litigation to model carbon as a cost to business. I spoke with Matthew Kiernan, the founder of Innovest, on his theories and models of valuation from beyond the financial statements to below the water line of the proverbial iceberg. When I read the IPCC reports, and saw the work of Robert Socolow of the Princeton Environmental Institute, coupled with the Stern Review, all influences pointed me to a

thematic approach to environmental investing. I developed nine climate-change mitigation and adaptation themes, all interrelated, allowing asset owners exposure to most of the economic sectors of the economy. GEOS offers a liquid alternative, or complement to direct cleantech exposure. By our definition, there are about 600 companies that are publically traded and liquid, providing at least 25% revenue exposure to at least one of our GEOS themes. We believe the best expression of our investment philosophy is with smaller market-capitalization companies, as they have full focus on clean technology development.

Over the past six-plus years, we have increased our investor base to include single- and multi-family offices, small foundations, and religious endowments. Most of our investors would describe themselves as social impact investors, and many have aligned their mission and investment objectives. All our clients believe they can deploy environmental investing with no performance sacrifices, and their investment advisors and consultants have vetted GEOS first on investment management process. Our investor base consists of asset owners who believe in long-term investing, yet our allocations reflect the higher volatility of our segment of listed equity, relative to the calmer waters of larger-cap sustainability approaches. We strongly believe however that the companies represented by GEOS express environmental investment goals with more intention. To quote Matthew Weatherley-White of the CapRock Group, within listed equities, "You guys peg the dial on social impact."

Asset-owner interest in cleantech investing has been waning of late, despite indications that the catalysts for "doing more with less" are not abating, but are actually strengthening. The world is facing an energy paradox: Countries need enormous amounts of energy to support economic growth, even as this growth threatens the health of their people and planet. The energy problem facing the world today is no longer where to find energy sources, but how to power society as cleanly and efficiently as possible. Although global energy consumption is already transitioning toward less carbon-intensive sources like natural gas and renewables, truly solving this energy challenge calls for a complete transformation of how we produce, distribute, and consume energy. I improperly assumed at the time that Macondo, Fukushima, and Hurricane Sandy were tipping points, yearly-reminders that the urgency for scaling appropriate energy was growing shriller. Alas, as UNPRI and the Investor Network on Climate Risk (INCR) signatories have reached new heights with increasing commitments on the part of asset owners, little has been done in the way of listed-equity investment.

At this time, we see unprecedented opportunity, as the fundamentals grow stronger with currently fair valuations. We believe cleantech will continue to grow, as many segments such as LED lighting and solar power surpass incumbent technologies in costs and efficiencies. We have been vocal over the past few years that companies are investing in

these technologies because they can lower business risks while achieving strong returns on capital. By investing in distributed technologies such as solar power, companies know and control their costs for the life of the asset, often over twenty years. While clean technology can exist without subsidies, government support is one catalyst that strengthened this past week, with progress from Paris at COP21, and significant extensions of domestic investment tax credits for solar power and production credits for wind power. We have seen more support for cleantech in the past two weeks than was experienced over the past five years.

We have consistently managed GEOS over the past six years, to our unwavering investment philosophy. The expression of this investment process has been with consistently smaller companies, which we have held as investors, with low portfolio turnover. At this time, as asset owners cry for scalable investments to meet climate-change goals and aspirations, we can only point to the listed-equity markets. Listed-equity cleantech equities are liquid, with less technology risk that that of private equity. It is scalable, with business models that have been in place for decades in many cases, representing technologies that were invented in some cases forty years ago and reaching commercial viability today. It is time to move beyond intrigue to investment action.

Biography

Bill Page is a Portfolio Manager on the Essex Global Environmental Opportunities Strategy (GEOS) and directs environmental investment policy and research for Essex. Before joining Essex in 2009, he spent eleven years at State Street Global Advisors (SSgA); worked in product management for Wellington Management Company, LLC; and worked for Fidelity Investments in asset allocation. During business school, Bill worked on socially responsible investment research at KLD Research & Analytics. He earned a bachelor's degree in economics from Boston University and an MBA from the F.W. Olin School of Business at Babson College.

Impact through Shareholder Engagement

Tim Smith
Director of Environmental, Social & Governance Shareholder Engagement, Walden Asset Management

In the early 1970s, business history was made when religious investors filed the first shareholder resolutions on a social issue. The company was General Motors and the issue was GM's investment in South Africa, a country known for apartheid and racial segregation. In those early days, a small but growing number of investors encouraged companies to improve their records on issues such as diversity, economic justice, and the environment. The moral case for the issues raised was strong, but the business case was an early "work in progress."

While investors were sending a straightforward message to companies' management about what concerned them, they were often ignored because there was not a compelling case for why the desired change was good for the company or investors. Still, many of the issues addressed gained considerable traction and prompted companies to change policies or practices for the better. For example, hundreds of companies responded to the unrelenting global pressure related to South Africa and withdrew their operations from that country.

Seeds were planted that grew deep and wide. In the process, investors embraced their identity and responsibility as owners of company shares with the ability to influence company decisions. Concurrently, many companies grew to find value in input from their shareowners and began to reach out to their investors proactively for discussion.

Fast Forward to 2016

Today, investors operate in a different world. We give voice to numerous ways environmental, social, and governance factors (ESG) affect long-term company performance.

Evidence of growing investor interest in company engagement abounds. The Principles for Responsible Investment (PRI) membership includes global investors with over $59 trillion in assets who proclaim their commitment to incorporate ESG analysis into

investment processes and company engagement. Investors with over $95 trillion in assets have joined CDP (formerly the Carbon Disclosure Project), supporting its efforts to encourage effective and transparent company responses to climate change, including substantial reductions in greenhouse gas emissions. In the aftermath of the historic agreement reached in December at COP21, the UN Conference on Climate Change, the 2016 Investor Summit on Climate Risk hosted in January by Ceres and the United Nations brought investors together to explore clean energy opportunities that would support a transition to a low-carbon economy.

These coalitions and collaborations are signs of a growing and active breed of investors who believe in exerting their influence on the companies they own to promote more sustainable business practices. For many investors this activism translates into engagements that encompass private and group dialogues with companies, sponsorship of shareholder resolutions, and proxy voting practices that support improvement in environmental and social performance. According to the Institutional Shareholder Services, over 1,030 shareholder resolutions were filed at companies for votes in 2015 alone. (Social and environmental resolutions for votes in 2016 are captured in the proxy book of the Interfaith Center on Corporate Responsibility [ICCR]. In addition, PRI has set up a number of global engagements with companies where its members can come together to address selected companies on governance, climate, labor and human risks, and other issues.

Investors who engage on ESG policies and practices are a diverse group. They include investment firms like my firm Walden Asset Management; mutual fund companies such as Calvert Investments and Domini Social Investments; foundations and faith-based investors, including members of the ICCR; municipal and state pension funds, including CalPERS, CalSTRS, New York State, New York City, State of Connecticut, and State of Vermont; and trade unions such as the AFL–CIO and AFSCME.

ESG Topics Addressed by Shareholders

Investors are championing improvement in corporate performance on numerous ESG issues.

Under the governance category, investors are seeking the right to nominate directors (known as proxy access), a separation of the Chair and CEO roles, majority vote policies (ensuring that directors must receive more than 50% of votes to be elected), and annual elections of directors as opposed to “staggered” elections in which just one-third of directors are on the proxy ballot. Dialogues and resolutions encouraging concrete actions by companies to add women and racial minorities to their boards—a measure of good corporate governance—have also surged in recent years.

Examples of social topics addressed include fostering best practices with respect to equal employment opportunity policies, human rights risk assessment and management, political spending and lobbying transparency, and labor standards throughout company supply chains. With the launch of the new UN Sustainable Development Goals, discussions regarding the corporate role in tackling extreme global poverty are also increasing.

Climate change is center-stage on the environmental engagement front: greenhouse gas (GHG) emissions reduction strategies, energy efficiency, and renewable energy goals. A core focus of Walden's climate-related engagement is to encourage companies to adopt robust climate policies and science-based GHG goals, consistent with reports by the Intergovernmental Panel on Climate Change, or IPCC. This translates to a reduction in GHG emissions of 55% globally by 2050 compared to 2010, the likely minimum decrease needed to avoid the most disastrous consequences of global warming. Other prominent environmental impact issues addressed by investors include water risk, hydraulic fracturing, use of toxic materials, recycling, and waste management.

Does Engagement Matter?

Of course the key question is whether or not shareowner engagement makes any difference in corporate boardrooms or executive suites: Does engagement encourage improvement in company policies, practices, and transparency?

Fortunately, there is an impressive public record demonstrating decades of positive ESG impact fostered by investors. Still, there is no assurance that a company will respond in a substantial manner, and some companies ignore shareholder petitions altogether. To be fair, not all shareholder dialogues and resolutions are grounded in a strong business case, and some focus on esoteric topics that do not deserve investor support.

My company, Walden Asset Management, carefully tracks the reach and impact of our engagement activities and provides an annual summary (see Shareholder Engagement Updates, Fourth Quarter 2015). While our public reporting describes significant challenges associated with "measuring impact," such as attribution, recent examples of progress on climate change following engagement by Walden in cooperation with other investors include:

- **Qualcomm** announced a substantial new target: a 30% absolute reduction in GHG emissions from global operations by 2025 relative to 2014 levels.
- **Lincoln Electric** published new 2020 GHG and energy-intensity reduction goals of 15% and 30%, respectively (baseline of 2011). The company also launched an external environmental and safety microsite.

- **Costco Wholesale** committed to keep GHG emissions growth to less than sales growth over the next five years. The big-box retailer also included a climate statement in its 2015 Sustainability Report with scientific context from IPCC and resumed reporting to CDP, the leading global repository of corporate responses to climate risk.
- **Union Pacific** adopted a new goal to reduce its locomotive fuel consumption rate by 1% annually through 2017, reportedly equating to an annual GHG decrease of 1%.
- **PNC Financial Services** adopted a more stringent mountain top removal (MTR) financing policy (coal producers cannot exceed 25% of production from MTR) and an enhanced due diligence process in financing high-risk sectors that includes internal environmental stress tests.

Leadership from the New York City Comptroller's Office to encourage proxy access is an example of an extraordinarily successful, fast paced, issue-based engagement strategy. NYC is pursuing a focused initiative that asks companies to allow shareholders holding a minimum stock position of 3% for three or more years to nominate directors and put their names on the proxies for a vote (for up to 25% of board seats). In 2015, NYC submitted over 75 proxy access proposals; most that went to a vote garnered majority support. To date more than 125 companies agreed to adopt the proposed governance reform. Over just a two-year period, NYC has successfully launched a governance reform movement that is rapidly taking hold.

A November 2014 publication by Croatan Institute, *The Impact of Equity Engagement*, provides ample documentation of ESG progress through various shareholder engagement strategies (http://croataninstitute.org/documents/IE2_Report.pdf).

What's Next?

Shareowner engagement—from behind-the-scenes discussions to public shareholder resolutions—is expanding considerably. More and more investors see these initiatives as integral to common sense investing, particularly as a means to address risk. Other investors see engagement as an opportunity to promote long-term shareholder value alongside societal impact. Either way, the engagement genie will not be put back in the bottle.

Of course there are critics. The U.S. Chamber of Commerce has mounted a campaign to limit the right of shareholders to pursue resolutions and at least two members of the Securities and Exchange Commission have supported curtailing this right in recent years. Fortunately, numerous companies respond respectfully to investor interaction on ESG

topics, demonstrating to us that they also view responsiveness to shareholders as a matter of good governance.

As investors continue to build a strong business case for ESG progress, we expect shareholder engagement will encourage more win-win improvements in corporate policies, practices, and transparency. We believe strong ESG performance is an indicator of high quality management—and that's good for business, good for investors, and good for society.

Biography

Tim Smith serves as the director of ESG Shareowner Engagement at Walden Asset Management, a division of Boston Trust & Investment Management Company. Walden has been a leader in sustainable and responsible investing (SRI) since 1975. As of June 30, 2015, Walden managed approximately $2.7 billion in assets for individual and institutional clients.

Mr. Smith joined Walden in 2000 to lead Walden's ongoing shareholder engagement program to promote greater corporate leadership on ESG issues. This includes company dialogues, shareholder proposals, proxy voting, and public policy advocacy. One of Walden's priority issues is Board diversity pursued through letters, company dialogues, shareholder resolution, and proxy voting.

Previously, Mr. Smith served as executive director of the Interfaith Center on Corporate Responsibility (ICCR) for 24 years.

On Socialism, Price, and Sustainability

Todd Cort, BS, MS, PhD
Yale School of Management and Yale School of Forestry and Environmental Studies

Juan-Victor Seminario, BA, MBA, MAM
WaterAid America

Why did socialism fail? Apologies to those in Venezuela and Cuba, but I refer to the grand experiments in socialism undertaken by the Soviet Union and China. In both of these experiments, socialism gave way to a somewhat free-market-based economy. For the USSR, the transformation was a quick and traumatic upheaval, while in China, it has been a drawn out process of evolution. Regardless, the result is the same: failure (at least in economic terms).

But why did socialism fail? And what does that have to do with sustainability?

The short answer to both is *price.*

Prices are a critical signal of supply and demand. When prices rise, new suppliers wish to enter the market and provide additional supplies. In a free market, prices freely adjust. Under socialism, prices are set and slow to adjust, frequently for reasons other than economic—such as political will. The result under socialism: Supply was frequently not met or cost of production was subsidized due to artificially low prices.[1]

1.Shleifer, Andrei, and Robert Vishny. 1991. *Pervasive Shortages under Socialism*. Working Paper No. w3791. National Bureau of Economic Research.

Many of you just read that last paragraph and said, "But wait a minute . . ."

- "That is an oversimplification."
    - I agree, but let's simplify for purposes of the sustainability argument below.
- "Prices are not perfectly fluid in our market economy."
    - I agree, but compared to socialism, free-market price fluctuations move at a reasonably quicker clip.
- "Prices are not a perfect reflection of reality. Take externalities for instance!"
    - Exactly, let's discuss externalities and sustainability shall we?

Price, Externalities, and Sustainability

Many of us in the sustainability field would argue that price has abjectly failed to reflect the true cost of many aspects of our economy (and for purposes of discussion, sustainability here refers to environmental, social, and broader economic aspects as discussed in the Global Reporting Initiative). For example, the cost of carbon, the cost of waste and pollution, the subsidized cost of water and energy, the costs of below-living-wage payments to employees and suppliers, and so on. While few would argue that the government should set prices on these externalities, most see a role for government in which it creates rules so that the true price of externalities can be reflected in the price of goods and services.

Under these idealized roles of government and the market, price still reigns supreme. Externalities are appropriately valued into the price and the price then interacts with supply to drive a sustainable social-environmental-economic system. For example, if a government builds in an appropriate value of carbon, through a tax or a mandatory trading scheme, the cost of carbon impacts will be built into the price of the energy source; therefore, the price of burning coal will rise, while the price of solar, wind, and other carbon-lite energy technologies will be reduced.

And yet, something is wrong.

For many, the cost of these externalities does not seem to be reflected in the price of the good or service. Certainly, there is an element of perception and subjectivity in the answer to "what is the accurate price?" and people can argue (and have argued) over the appropriate price for a long time. But increasingly, science is catching up to the debate.

The science on climate change and its economic impact is growing more accurate. The cost of poverty and hunger and pollution are beginning to crystallize. By all indications, the costs of these externalities are not being reflected in the price of goods and services and are largely being borne by local, regional, and national communities.

The Failure of Price in Sustainability

Why is it that basic economic principles are failing us when it comes to the externalities of sustainability? That is the central question.

The theories of appropriate pricing for externalities and marginal damage (for example, environmental or social damages) are well established. On the free market side, we expect scarcity to drive price. And yet, we have not seen the impacts of constrained resources such as water, rare earth minerals, natural areas and functioning ecosystems, carbon emissions, and so on, reflected in the market price.

Outside of the market, governments have a variety of tools that can be used to influence prices. The most common theoretical mechanism is a tax (termed a Pigouvian tax) set at a level to match the cost of the environmental or social externality.[2] There are obvious practical considerations, such as determining the value of the social and environmental externality that would accrue to the company being taxed; but in practice, this has been overcome through trial and iteration, tradable pollution credits, or marketable permits. Nevertheless, we have seen little or no government intervention to influence the price of sustainability impacts except in cases of carbon and environmental pollution.

Take carbon as an example. There is a price on carbon. It is confined to the energy-intensive sectors that operate under one of several mandatory or voluntary carbon trading schemes, such as the European Union Emissions Trading Scheme (EU ETS). So far, the price on carbon has been disappointingly low. The EU ETS price has been hovering around $10–$20 per megaton for the past two years while energy scenarios project that in order to meet the 450 ppm goal set out by the IPCC, the carbon price will need to grow to ~$200/ton by 2050.[3]

2. "Pigou or No Pigou?" 2006. Petrol taxes. *The Economist*. Nov. 11. http://www.economist.com/node/8150198.

3. International Energy Association. 2013. Redrawing the Energy Climate Map: World Energy Outlook Special Report, June 10.

There are few other examples in which a price on the sustainability aspect is even available. Take ecosystems services—a field that is fraught with uncertainty and controversy. Costanza et al. (1997)[4] estimated a minimum global ecosystem services value at $16 to $54 trillion. Compare this to the Gross World Product calculated in 1995 as between $33 and $34 trillion.[5] To date, there are only a handful of companies that attempt to quantify ecosystems value, let alone accrue that value into the price of the product.

The message is: where a price has emerged on these sustainability externalities, the price is moving glacially (pun intended) in comparison to the impact of the externality.

Is this a failure of theory or a failure of application?

While there are probably dozens or even hundreds of theories on the failures of markets, I have focused on three that seem particularly relevant to price failures around aspects of sustainability. These are not intended to be exhaustive or mutually exclusive. In fact, for most cases, it appears that more than one factor may be at play.

Theory 1: Price Anchoring

Price anchoring refers to our tendency to set a price constraint based on our preconceptions. In other words, we expect the price of a product or service to be between $X and $Y, and it is very difficult to reach a "true price" in the face of anchoring. For example, our perception is that new energy technologies and alternative energy technologies should be more expensive.[6] The result is distrust of "cheap" energy technologies, which can only be overcome in time, even if the cost of the technology was low to start.

Price anchoring can be a result of many factors, including social norms (as with energy technologies) or government intervention (such as subsidized products or services). Nothing enrages a commuter like a new toll road, even though the price may be pennies

4. Costanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R. O'Neill, J. Paruelo, R. Raskin, P. Sutton, and M. van den Belt. 1997. "The Value of the World's Ecosystem Services and Natural Capital." *Nature* 387, May 15.

5. Central Intelligence Agency, 1996. *The 1995 CIA World Fact Book.* Posted by the Project Gutenberg eBook, August 3, 2008. https://archive.org/stream/theciaworldfactb00571gut/571.txt.

6. Jacobsson, Staffan, and Anna Johnson. 2000. "The Diffusion of Renewable Energy Technology: An Analytical Framework and Key Issues for Research." *Energy Policy* 28.9: 625–640.

compared to the economic, social, and environmental costs of rush-hour traffic. The reason: roads have historically been free in the United States, thanks to aggressive government subsidization of the transportation infrastructure.

In sustainability, the effect of price anchoring is particularly relevant in natural resource systems. Water, land, and energy have a long history of national significance and have therefore been the subject of intense government subsidy to support infrastructure and development. We, as a society, are firmly anchored to a low or zero cost of these resources reflected in our products and services.

Theory 2: Our Inability to Foresee Positive Feedback Loops

This theory challenges the inherent and assumed ability of the market to respond to sustainability challenges. The basic premise is that markets cannot predict chain reactions effectively and therefore are incapable of ever predicting appropriate price.

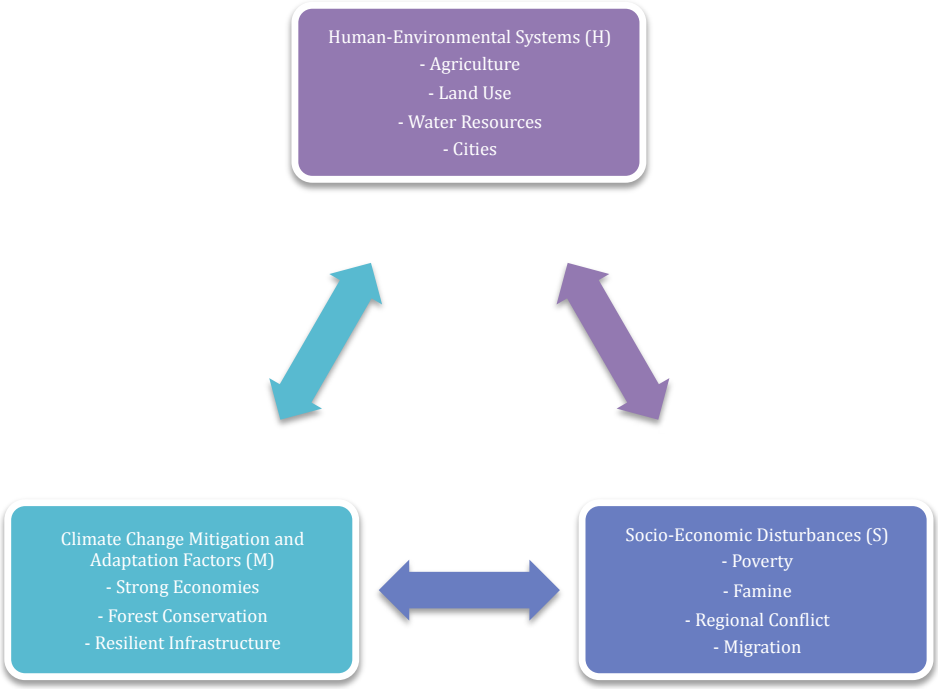
Let's take carbon and climate change as an example. Most of us are familiar with the positive environmental feedback loops of climate change. A "positive feedback loop" is a process in which a small disturbance in a system can amplify through interaction with other aspects of the system. For example, warmer temperatures in the Arctic may lead to thawing of subsurface tundra and the release of large quantities of trapped methane into the atmosphere. Methane is a powerful greenhouse gas, and release of these methane stores could exacerbate climate change and lead to warmer average temperatures.[7] Another possible outcome is the reduction in snow cover, leading to reduced albedo (the reflection of infrared energy) and greater warming.[8]

However, the complexities of environmental feedback loops pale in comparison to the potential scenarios of socioeconomic feedback loops as our climate changes. Communities, nations, and economies stand to see potentially dramatic and costly feedback loops as we struggle to adapt to the perturbations brought on by climate change. These potential feedback loops range from the relatively simple (more severe weather leads to greater energy demand for heating, cooling, and materials production) to the complex. One of the most complex interactions is that of human-environmental systems (H), socioeconomic disturbances (S), and those factors that help us to mitigate or adapt to impacts from the changing climate (M), an interaction that can be termed MSH (Figure 1).

7. Dyupina, Elena, and Andre van Amstel. 2013. "Albedo Arctic Methane." *Journal of Integrative Environmental Sciences* 10.2: 93–105.

8. Déry, Stephen J., and Ross D. Brown. 2007. "Recent Northern Hemisphere Snow Cover Extent Trends and Implications for the Snow—Albedo Feedback." *Geophysical Research Letters* 34.22.

Figure 1: The MSH Interaction



The interaction between agriculture and climate change has been extensively studied. Although the nature of the interaction varies by region, there is growing consensus that climate change will have a negative impact on agriculture on a global level, owing to the increasing frequency of droughts and severe weather, and competition for water resources.[9,10,11] Meanwhile, demand for food is projected to increase primarily from population growth.[12] In the absence of revolutionary changes to demand, the result will be a significant expansion of agricultural land (at the expense of forests and other natural

9. Cline, W.R. 2007. *Global Warming and Agriculture: Impact Estimates by Country*. 2007. Washington, DC: Peterson Institute for International Economics, Volume 17.

10. Nelson, G. C., M. W. Rosegrant, A. Palazzo, I. Gray, C. Ingersoll, R. Robertson, S. Tokgoz, and T. Zhu. 2010. *Food Security, Farming and Climate Change to 2050*. Washington, DC: International Food Policy Research Institute (IFPRI®).

11. Osborne, T., G. Rose, and T. Wheeler. 2013. "Variation in the Global-Scale Impacts of Climate Change on Crop Productivity due to Climate Model Uncertainty and Adaptation." *Agric. For. Meteorol*. 170: 183–194.

12. U.S. Environmental Protection Agency. 2012. Available from http://www.epa.gov/climatechange/EPAactivities/economics/nonco2projections.html (accessed on 23 July 2014).

ecosystems) as well as an intensification of agricultural practices (including more intense use of water and fertilizers).

While there are direct mechanisms for a positive feedback loop between intensification of agriculture and increases in atmospheric carbon dioxide,[13] the potential for additional feedback loops grows exponentially when we consider the socioeconomic disturbances.

Peter Gleick of the Pacific Institute recently wrote on the role of climate-change-induced drought in the eruption of the 2011 Syrian Civil War.[14] Among the myriad political and social impacts of the war, we have seen migration of 0ver four million refugees,[15] multiple regional conflicts, and the rise of extremist factions. Between these various factors and the resulting economic policies of large countries (such as sanctions), there is a growing regional economic crisis.[16,17] Such poverty and instability hinders the ability of societies to mitigate greenhouse gas emissions or to adapt to the environmental impacts of climate change,[18] resulting in potentially disastrous positive feedback loops. This is just one example of the potential of MSH interactions.

Economic stability plays a central role in our ability to respond to climate change. Whether we are considering investments in infrastructure and protection from severe weather or capital investments in alternate-energy development, the actions we take to adapt to and mitigate climate change require stable and productive economies. And yet, our global economy is highly correlated with carbon dioxide emissions (as a proxy for economic growth[19]), and evidence is mounting that climate change will result in more

13. Bajželj, B., and K. Richards. 2014. "The Positive Feedback Loop between the Impacts of Climate Change and Agricultural Expansion and Relocation." *Land 3*(3): 898–916.

14. Gleick, P. "Water, Drought, Climate Change and Conflict in Syria." 2014. *Wea. Climate Soc.* 6: 331–340.

15. United Nations High Commissioner on Refugees. 2015. "Total Number of Syrian Refugees Exceeds Four Million for First Time." Press Release July 9, 2015. http://www.unhcr.org/559d67d46.html.

16. Council on Foreign Relations. http://www.cfr.org/syria/syrias-crisis-global-response/p28402.

17. Pedram, Shiva. 2014. "Syrian Refugee Crisis Threatens Stability in the Middle East." Center for American Progress. https://www.americanprogress.org/issues/security/news/2014/08/12/95595/syrian-refugee-crisis-threatens-stability-in-the-middle-east/.

18. OECD. *Poverty and Climate Change: Reducing the Vulnerability of the Poor through Adaptation*. http://www.oecd.org/env/cc/2502872.pdf.

19 Barker, T., P. Elkins, and N. Johnstone. 1995. Global Warming and Energy Demand. London, UK: Routledge.

severe oscillations in economic boom-bust cycles, resulting in overall destabilization of the global economy.[20]

Of course, potential negative feedback loops also exist. Of particular note, migration trends have resulted in increased urbanization, and some evidence exists that cities, in comparison to expanding rural areas, are more capable of adapting to climate impacts and mitigating inputs to climate change.[21]

In the face of these complexities and the potential magnifications, it is highly unlikely that markets will be successful in predicting the appropriate price placed on carbon.

Theory 3: The "Not-Free" Market

This final theory speaks to one of my main concerns. That is, we are not operating in a free-market environment. Rather, the political playing field is heavily skewed toward private interests, and these private interests have significant incentives *not* to account for the externalities of sustainability impacts.

By many accounts, and based on the evidence of multiple laws and court rulings, lobbying in the United States has reached unprecedented levels, and its influence on lawmakers is at an all time high.[22] The amount of money spent by private interests to influence lawmakers continues to rise, thanks in part to the Supreme Court decision in Citizens United v. Federal Election Commission.[23] It's difficult to put a number on the amount, as much of this money is now "dark" or untraceable. A recent article reported $6 billion was spent on lobbying during the 2012 election campaigns and ~$600 million in dark money has been contributed between 2010 and early 2015.[24] Lest you think this money is from objective

20. Kellie-Smith, O., and P. Cox. 2011. "Emergent Dynamics of the Climate-Economy System in the Anthropocene." *Phil. Trans. R. Soc.*: 369, 868–886.

21. Seto, K., and D. Satterthwaite. 2010. "Interactions Between Urbanization and Global Environmental Change." *Current Opinion in Environmental Sustainability* 2(3): 127–128.

22. Schouten, Fredreka. 2010. "Lobbying Industry Booms." *USA Today* (Arlington, Va.) 05 Feb: A.4. Gannett Co. 03 Apr 2015.

23. Burns, Natasha, and Jan Jindra. 2014. "Political Spending and Shareholder Wealth: The Effect of the U.S. Supreme Court Ruling in Citizens United." *American Politics Research*. 42.4: 579–99.

24. Torres-Spelliscy, Ciara. 2015. "Court Ruling Drowned Politics in Dark Money: The Front Burner." *Orlando Sentinel.* March 13. http://www.orlandosentinel.com/opinion/os-ed-citizens-united-front-burner-con-20150312-story.html.

sources, consider that U.S. corporations and individuals spent about $3.2 billion in 2015 on lobbying,[25] and this money has resulted in some fairly substantial economic benefits.[26]

Beyond the money, there is the question of time and people. We hear more and more about laws written by the very companies to be regulated[27,28] because congressional staffers are few and far between, underpaid, temporary, and relatively inexperienced. Compared to the efficiency and expertise offered by lobbyists and the companies they represent, it is simply a judicious decision for congressional staffers to ask for outside help, or to fail to read the proposed laws when they are submitted.[29]

Under these circumstances, it is easy to imagine that the balance of power and negotiation in government is not equal and the significant influence advantage goes to large corporations over the small organizations and individuals represented. Combine this with the economic driver of these corporations to ignore or minimize accrual of costs from externalities, and we are not operating in a free market where prices can evolve to reflect sustainability costs. Under this scenario, it seems naïve to think that there will be any momentum toward a more realistic price in issues of sustainability. In fact, we appear to be in the opposite situation, where government is pushing against realistic pricing and is instead incentivizing artificially low prices in response to significant private-interest pressure.

Evolution or Revolution

In the face of such intractable hurdles, it is easy to give up, run for the hills, and build an underground bomb shelter. But of course, we as a society have not given up. What we have done is to settle in on a persistent evolution of progress. I would characterize this

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25. Center for Responsible Politics. 2015. Lobbying Database, downloaded on January 29, 2016. https://www.opensecrets.org/lobby/index.php.

26. Strauss, Steven. 2012. "Actually, Corporations That Lobby and Make Campaign Contributions Get Special Benefits." *Huffington Post*. February 11. http://www.huffingtonpost.com/steven-strauss/actually-corporations-tha_b_1144789.html.

27. Lipton, Eric, and Ben Protess. 2013. "Banks' Lobbyists Help in Drafting Financial Bills." *New York Times Dealbook*. May 23. http://dealbook.nytimes.com/2013/05/23/banks-lobbyists-help-in-drafting-financial-bills/?_r=0.

28. Grim, Ryan, and Lucia Graves. 2013. "'Monsanto Protection Act' Defended By Roy Blunt, Farm State Senator (UPDATE)." *Huffington Post*. May 23. http://www.huffingtonpost.com/2013/05/23/monsanto-protection-act_n_3322180.html.

29. Fabian, Jordan. 2010. "Key Senate Democrat Suggests that He Didn't Read Entire Healthcare Reform Bill." *The Hill.* http://thehill.com/blogs/blog-briefing-room/news/115749-sen-baucus-suggests-he-did-not-read-entire-health-bill.

approach as one that looks at the challenges we face for aspects that we can control or influence and then slowly changes them, achieving incremental improvements. Multiplied by thousands and millions of actors, the net improvement can, theoretically, be massive.

This approach can be seen in many of our closest held ideals for progress:

- For individuals, we should *think globally, act locally*—meaning we should consider the global challenges and then recycle that glass bottle as one small part of the bigger picture.

- For companies, we should *set performance targets*—meaning that "progressive" companies set targets to achieve year-over-year improvements in aspects of sustainability that the company controls or influences. The typical example sounds something like "we will reduce our direct greenhouse gas emissions by 20% in the next 5 years."

- For governments, we should *regulate*—meaning we should force companies and individuals within our purview to consider and account for the externalities of their action.

While progress in these forms is noteworthy and even beneficial, it likely will not be enough. The effects of systemic, global sustainability impacts are already upon us despite our persistent approach, and we may already be driving ourselves over the proverbial cliff.

Johan Rockström and colleagues, when describing a model for assessing planetary boundaries, began their discussion with this note: "Anthropogenic pressures on the Earth System have reached a scale where abrupt global environmental change can no longer be excluded."[30] The model was extended by Kate Raworth of Oxfam to account for socioeconomic sustainability as well.[31] The take-away message: that as we place more strain on human and natural systems, we drive toward potential tipping points, over which the impacts can cascade and magnify.

Even when we look forward and project our improvements, the world that our children will have to endure looks much more bleak than any we have enjoyed. Energy and climate

30. Rockström, J., W. Steffen, K. Noone, Å. Persson, F. S. Chapin III, E. Lambin, T. M. Lenton, M. Scheffer, C. Folke, H. Schellnhuber, B. Nykvist, C. A. De Wit, T. Hughes, S. van der Leeuw, H. Rodhe, S. Sörlin, P. K. Snyder, R. Costanza, U. Svedin, M. Falkenmark, L. Karlberg, R. W. Corell, V. J. Fabry, J. Hansen, B. Walker, D. Liverman, K. Richardson, P. Crutzen, and J. Foley. 2009. "Planetary Boundaries: Exploring the Safe Operating Space for Humanity. *Ecology and Society* 14(2): 32.

31. Raworth, Kate. N.d. "The Doughnut." *Exploring Doughnut Economics.* http://www.kateraworth.com/doughnut/.

projections predict that we will blow through the 350 ppm, and likely the 450 ppm carbon dioxide concentration in the atmosphere that the IPCC marked as necessary to constrain global warming to 2°C (a value that is seen as "less than catastrophic").[32] These projections include all the incremental improvements in energy efficiency and new, cleaner energy technologies.

The message seems clear—that incremental improvement, no matter how deliberate or widespread, won't be sufficient for many of the sustainability challenges we now face; that is, our evolution is not keeping pace with our ecology.

What if we changed the approach? What if we gave up control in the interests of transformative change? Perhaps our best chance at this point is to set the wheels of revolution in motion without knowing which direction that revolution might take.

Such a leap of faith requires several things. It requires a slight sense of desperation, which admittedly not everyone feels. It also requires a trust in the power of institutions and ingenuity. Because radical change requires innovation on an extraordinary level: invention, communication, dissemination, adoption, and scaling. Positive change requires that we act according to the norms and informal rules that institutions provide. For example, we trust that private enterprises are efficient, but do we trust that they will act in our best interests so long as the economic circumstances align with those interests (or do you believe corporations are inherently evil)?

If revolution and transformative change are the way forward, then our goal should not be to stabilize markets and control externalities under the status quo. Our goal should be to destabilize markets in order to force new models of enterprise. Throw out the current, comfortable incentives structures for investors based on short-term profit. Abandon our anchored perception of what is 'acceptable growth'. Challenge the distinction between public and private enterprises with new models of business.

Of course, for many, revolution is not a choice and in the case of sustainability, the revolution may already be upon us. For me, the writing is on the wall. I can point to three movements that I think have the power to transform our economy and our existing perception of what is and is not a legitimate externality:

First is the potential revaluation of companies that rely on fossil fuel reserves. Frequently discussed under the banner of stranded assets, this argument is couched in moral terms

32. Lieberman, Bruce. 2012. "Forget about That 2-Degree Future." *Yale Climate Connections.* http://www.yaleclimateconnections.org/2012/12/forget-about-that-2-degree-future/.

(that is, there is a moral imperative to leave assets unburned in order to address climate change and the future of society).

There are economic arguments as well. For example, the need to utilize these resources is underpinned by projections on economic growth over the next 30 years—energy companies argue that meeting energy demand to fuel growth is the greatest challenge and that all existing assets, plus more, will be required to meet this demand. But these arguments rely on a few very large assumptions—in particular the growth of the middle class in China with concomitant growth in consumerism and energy use. Indeed China's middle class has grown at an astonishing rate over the past 10 years.[33] But there may be cracks in the façade. Some are arguing that such growth is unsustainable as the overall economic growth of China slows and that the Chinese government has not supported the shift to a more innovative economy that will be necessary to support the higher incomes of a large middle class.[34]

If our projections of economic growth are overly optimistic, or if efficiencies in energy consumption allow us to increasingly decouple economic growth from fossil fuel consumption, then the projections on energy use may well be too high. In economic terms, this would result in downward adjustments in the value of fossil fuel reserves—effectively stranding assets that are more difficult to access, creating a shift in the valuation of energy companies, and creating a tipping point away from traditional sources toward alternative energy.

The second revolutionary factor is the emergence of regulations. Regulations in sustainability are nothing new and continue to evolve. But there are signs that our incremental approach to regulating sustainability externalities may be shifting. Aggressive and sweeping regulations are emerging in which the policymakers are opening the door to potentially enormous shifts.

For example, California has issued an Executive Order to reduce emissions by 80% below 1990 levels by 2050.[35] On face value, this appears to be another in a long list of political commitments. There are, however, key differences with incremental examples of cap-and-trade mechanisms. In particular, the commitment is to an end state, not a market mechanism. Calculations of what this target will entail indicate that California will essentially need to eliminate fossil-fuel-use in automobiles and radically shift electricity

33. Barton, D., Y. Chen, and A. Jin. 2013. "Mapping China's Middle Class." June. *McKinsey Quarterly*.

34 . Carlson, B. 2012. "Why China's Middle Class is Nervous." September 10. *Global Post.*

35. California Executive Order S-3-05.

generation away from fossil fuels.[36] Focusing on the end-state goal rather than the mechanism of change is an example of a transformative policy commitment that can revolutionize the energy industry in California.

The final, and most powerful revolutionary force is the generational change that is already underway. The so-called millennial generation is now entering its economic growth phase—peak earning years combined with an intergenerational wealth transfer as their parents move wealth to the millennials. This is not a linear transition and the movement of wealth into the hands of the millennials is accelerating rapidly. Combine this wealth transfer with a strong sense of global connection and greater environmental awareness, and the emergence of the millennial generation has the potential to radically alter the economic landscape with regard to sustainability externalities.

Combined, these forces (revaluation of fossil fuel assets, broad regulations, and generational transfer) have the potential to destabilize our current approach to sustainability. The outcomes of such a destabilization are far from clear. Would the result be another failed socialism—another blip on the long list of human failures? Undoubtedly. In fact, I would venture to guess that there would be many more failures than successes. That is the nature of disruptive innovation. But there remains the possibility, perhaps even the likelihood, that something great will emerge.

Biographies

Todd Cort is a faculty member at the Yale School of Management and Yale School of Forestry and Environmental Studies. He also serves as the faculty co-director for the Yale Center for Business and the Environment (CBEY) and adjunct faculty member with the Columbia University Earth Institute. He holds a PhD in civil and environmental engineering, master's and bachelor's degrees in biochemistry, and a professional engineer's license in California. Dr. Cort previously served as director of Sustainability Advisory services for TUV Rheinland and Det Norske Veritas, where he consulted on sustainability matters including metrics, risk management, and auditing practices.

Juan-Victor Seminario currently works at WaterAid America as program development officer for Latin America and the Caribbean. He joined WaterAid in the summer of 2015 following the completion of his master's degree in advanced management at the Yale School of Management. With more than seven years of extensive experience working with

36. California Council on Science and Technology. 2011. "California's Energy Future: The View to 2050, Summary Report." June.

civil society organizations, media, and government in Peru, Juan-Victor brings his accumulated skills and knowledge to support WaterAid's growth initiative in Latin America. He studied International Relations at Claremont McKenna College and earned an MBA in EGADE Business School. He has written articles on Peru's politics and co-edited a book on Peru's National Congress.

Pollution: The Next Environmental Issue on the Global Agenda After Climate Change
And
The Positive Health Impacts of Environmental Investing

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Abstract

The purpose of this commentary is to describe how environmental investors can generate significant healthcare benefits and reductions in the cost of healthcare. It is possible to produce significant health benefits that have been overlooked until now by investing in renewable energies; energy-efficiency solutions; companies that consider their environmental impacts across operations and product lifecycles as well as from the products themselves; and technologies and processes that reduce pollution. Indeed, the most important causes of pollution-related health effects can be addressed by reducing the use and production of certain pollutants, including those related to the use of fossil energies. This commentary argues that there are both good social impacts and good

business/investment opportunities for such actions. Further, this commentary stresses that collaborations between investors, businesses, nonprofit organizations, and governments can lead to greater positive environmental and health impacts.

This commentary also introduces the work of the *Lancet,* the Global Alliance on Health and Pollution (GAHP) and the Icahn School of Medicine at Mount Sinai in their initiative, the Global Commission on Pollution, Health, and Development, which aims to become for pollution what the Intergovernmental Panel on Climate Change is for climate change.

The Overlooked Effects of Pollution on Health

While the spotlight of both international and domestic attention in recent years has focused mainly on the Climate Change Agenda and is now focused on the aftermath of the 2015 Paris Climate Conference (COP21), another critical environmental issue is the impact of pollution on health and healthcare costs.

The science about environmental impacts on health is still in a nascent phase with many unknowns in terms of the attribution of causes, effects on health and healthcare costs, effective forms of prevention and attenuating actions, and means of redress. Specifically, there is a general lack of public awareness among both the lay population and professionals about the impacts of pollution on health. For many decades, environmental and health departments have been working in silos. Recently, this situation has started to change with the emergence of several new holistic and cross-disciplinary initiatives in this area.

A Department of Public Health, Environmental and Social Determinants of Health (PHE) has recently been created in the World Health Organization (WHO) to address the root causes of environmental and social threats to health. In 2006, WHO made a first attempt to estimate how health is affected by exposure to physical, chemical, and biological risk factors. Within this context, the organization assessed how environmental risk factors affect 85 diseases. To do this, WHO used available scientific evidence along with focus group consultations with over 100 experts. The organization's study suggested that environmental risk factors play a role in more than 80% of the diseases regularly reported by WHO. The results from this study highlight the major impact that the environment and pollution have on cardiovascular diseases, cancer, and asthma in the developed world and the impact they have on lower respiratory diseases and diarrhea across all income groups (Prüss-Üstün and Corvalán 2006). Indeed, the study stresses that, worldwide, about 19% of all cancers were estimated as attributable to the environment, resulting in 1.3 million deaths each year. Researchers also estimated that 16% of the total burden of cardiovascular disease was attributed to the environment, resulting in 2.5 million deaths per year. Regarding asthma, total environmental exposures were estimated to account for 44% of its development or aggravation.

The World Health Organization has also recently published a report about the impact of climate change on health. The results highlight the health benefits that ensue from reducing climate pollutants such as black carbon, methane, ozone, and hydrofluorocarbons (Scovronick 2015). The reduction of black-carbon emission is expected to have the greatest health impact because it is the air pollutant most associated with premature death and morbidity. Most black-carbon emissions are fine particulate (PM 2.5) due to fuel combustion in transport and the production of building materials, which contribute to over

80% of the black-carbon emitted by humans. These fine particles penetrate deeply into the lungs, and evidence shows that they correlate highly with both cardiovascular and respiratory diseases: "Chronic exposure to particulate matter leads to increased risks of pre-mature mortality from heart attack, stroke, respiratory infections, and lung cancer" (WHO 2015).

Ozone is the second climate pollutant associated with the most significant health effects. There is strong evidence showing the link between ozone and respiratory diseases such as asthma and cardiovascular diseases. There is also some evidence of links between ozone, central nervous system diseases, reproductive diseases, and early childhood development. Since ozone is not emitted directly, there is a need to focus on the precursor emissions, including oxides of nitrogen (NO_x), methane, carbon monoxide, and volatile organic compounds. Nitrogen dioxide (NO_2), which is one of the major components of NO_x, is a product of combustion processes, including vehicle combustion (particularly diesel vehicles), as well as power plants. This deserves particular attention because NO_2 also produces adverse respiratory and cardiovascular effects on its own.

The report concludes that decreasing the emission of climate pollutants would not only significantly reduce the burden of disease (which includes both the effects on disease occurrence and related deaths) attributed to air pollution but would also have both direct and indirect positive impacts on health by mitigating the effects of climate change on weather, food production, and access to potable water.

The Lancet, GAHP, and Mount Sinai Global Commission on Pollution, Health, and Development

Yet, pollution related to climate change is just the tip of the iceberg. While a third of the total deaths caused by pollution are attributed to ambient air pollution, which is a broader concept that includes climate change pollution, there is a need to focus much more attention on the overall impact of the different types of pollution—air, water, and soil—on health, mortality, and healthcare costs (Landrigan and Fuller 2014). There is currently a gap in the study of pollution's full impact on health because most of the research tends to focus on specific correlations rather than on providing the full picture of this critical issue.

Attention is drawn to the work of the Global Commission on Pollution, Health, and Development, which has the ambitious goal of becoming for pollution what the Intergovernmental Panel on Climate Change is for climate change. The commission stresses that pollution is the first cause of worldwide death and that more than one death out of seven is the consequence of environmental pollution (Global Commission 2015). Indeed, 8.9 million deaths were attributed to air, water, and soil pollution in 2012, according to WHO, while only US$100 million in international aid was allocated to this

issue in 2013. That same year, in comparison, over US$28 billion in international aid went to the control of infectious diseases, including HIV/AIDS, malaria, and tuberculosis, even though these diseases account for 2.5 million deaths combined. This means that pollution control received almost 300 times fewer resources, even though it contributes to over three times as many deaths. Pollution-attributed diseases increasingly include chronic, non-communicable diseases (NCDs) such as heart disease, stroke, and cancer, in addition to diarrhea and pulmonary diseases that have been historically correlated with pollution.

These striking observations of the issues related to pollution led to the creation of the commission, which aims to overcome this situation and put pollution on the global development agenda. The commission is an initiative of the *Lancet,* the GAHP (the first coordinated international effort to tackle pollution on a global scale [(GAHP 2015]), and the Icahn School of Medicine at Mount Sinai. The United Nations Environment Programme and the World Bank provided additional coordination and input support. Distinguished leaders from countries around the world have been mobilized in this endeavor. Indeed, the commission is made up of former heads of state; leaders of UN agencies; ministers of health and the environment; members of the European Commission, the World Bank, and the Asian Development Bank; representatives of civil society organizations; leaders in public health and environmental science; economists; and other public figures. The non-profit organization Pure Earth (formerly Blacksmith Institute) is the Secretariat of GAHP and coordinates the work of the Commission. The commission will assess the full health impacts and economic costs of air, water, and soil pollution globally in order raise awareness about the issues and provide actionable solutions to policy-makers. It will comprehensively study pollution-related topics that are usually analyzed separately, such as urban air, chemicals, hazardous waste, toxic chemicals, cook stoves, sanitation, and so on. It will also compare the costs of inaction to the costs of solutions to the problem. It will inform key decision makers around the world about the burden that pollution places on health and economic development. It will also provide cost-effective pollution-control solutions and strategies by using robust and scientifically credible analyses that set out the full magnitude of pollution's effects. The main report from the commission will be published in December 2016 in the *Lancet*, one of the most renowned scientific journals in the field of health, ranked second out of 150 scientific journals in terms of impact in the field of medicine, according to Thomson Reuters.

The impacts of environmental pollution are especially important in low- and middle-income countries (LMICs), where it has become the leading risk factor for death. Yet, while seemingly far away, those polluting emissions directly affect wealthy countries as well. Pollution does not stop at borders, and we live in a global economy with consumer goods coming from every part of the world. Indeed, evidence shows that contaminated air from China travels across the Pacific and can be measured in countries around the Pacific, including the United States. In addition, mercury from gold mining and coal plants can be

found in global stocks of fish, and arsenic has been found in imported rice. Furthermore, environmental and health issues caused by pollution in poor countries can catalyze war and massive forced immigration. Indeed, pollution threatens societal development and social cohesion and condemns future generations to continuing poverty and poor health, thereby fostering social unrest. An additional argument for prioritizing the prevention and cleanup of toxic pollution is that pollution control helps tackle climate change and reduce threats to biodiversity. (Landrigan and Fuller 2014.)

The Positive Health Impacts of Environmental Investing and the Opportunities Related to Pollution Remediation

Based on these observations, one can conclude that investors who finance clean energy and resources-efficiency solutions and companies that consider environmental impacts across their operations and products lifecycle have a positive impact not just on the environment but also on health and healthcare costs. This is especially true when considering a reduction in the use of coal and oil, which by limiting the amount of harmful particles, ozone, and nitrogen dioxide released into the environment, has an immediate impact on air quality and associated health conditions such as cardiovascular and respiratory diseases. These health benefits, in turn, should be added to the other already known benefits that can help encourage investors and limited partners to invest in more environmentally friendly products and fewer polluting financial instruments. Positive outcomes like these can result either from incremental changes in large organizations, disruptive innovation in early stages companies, or the catalyzing effects of philanthropy while simultaneously reducing tax.

However, pollution remediation, like environmental and sustainability investing, suffers from investors' lack of understanding of the business opportunities and threats related to it. Indeed, it has a reputation mainly for reducing acute risks while increasing companies' operating costs as well as passing costs on to the end consumers. However, it can also lead to new profitable opportunities through the development of novel products in new markets or innovative and cost-effective methods of production. Indeed, sustainable initiatives effectively embedded in companies' strategies can lead to increased revenues, improved productivity, and enhanced risk management like that stressed in the UN Compact Value Driver Model (UN Global Compact 2013). The perspectives of positives outcomes are also driven by the increasing number of responsible and ideologically driven millennial consumers, as well as by large corporations' willingness to improve their corporate social responsibility (CSR) image and demand for resource-efficiency solutions that allow them to reduce their operating costs.

NewWorld Capital underlines several positive macro-trends in the environmental markets in the United States. First, the firm stresses that, according to its estimates, "environmental

opportunities already constitute a large domestic market sector, representing approximately $382 billion in annual turnover in the U.S. market" in 2014, which will grow to $580 billion by 2020 (NewWorld 2014). Within this sector, the firm has identified "high economic opportunity market segments," such as energy efficiency, clean energy, and water and waste management (NewWorld 2015). Further, the high rate of innovations occurring in the sector presages more growth opportunities (NewWorld 2014). Nonprofit organizations can also play a new role in developing business opportunities. Pure Earth is an interesting example. Among its different projects, the organization has developed some interesting processes, such as a new technique for filtering gold without using mercury in Indonesia or the production of lead-free pottery in Mexico, that could be used by local businesses and social entrepreneurs. These processes could present novel investment opportunities for impact investors. However, environmental investing possesses structural risks that should first be minimized to improve the prospects of success. Indeed, particular attention has to be given to reducing technology risk, regulatory and subsidy risk, hydrocarbon pricing risk, foreign competition, and scaling risk (both for the business and capital, especially when investing in early stages companies). (NewWorld 2014.)

The financial threats related to pollution crisis tend to be more frequently discerned by investors than the upsides do. Indeed, it is commonly understood that pollution-related risks can have a considerable impact on company brand image and market value, as exemplified when BP's stock price plummeted after the Gulf of Mexico oil spill. Indeed, pollution involves material financial risks for companies and should be taken seriously by any investor. In particular, focus has to be given to pollution by investors while they are performing any investment due diligence, in the same way it is commonly done in real estate. Indeed, in real estate, pollution-related risks could imply regulatory sanctions and a considerable decrease in asset value. According to Dr. Robert Pojasek, an expert in risk management and sustainability and an instructor at the Harvard Extension School, the inclusion "of an international management system standard such as the recently revised ISO 14001 (which includes risk management with its opportunities and threats) is evidence of good environmental management together with a positive predictive value for potential investment." Understanding the impact of environmental matters on intangible assets is especially crucial for companies because of the increasing weight of intangible assets in the company's market valuation. This increase can be observed in the declining ratio of net assets to enterprise value. James E. Malackowski, Ocean Tomo's Chairman, explains that "within the last quarter century, the market value of the S&P 500 companies has deviated greatly from their book value. This 'value gap' indicates that physical and financial accountable assets reflected on a company's balance sheet comprises less than 20% of the true value of the average firm"(Ocean Tomo 2010).

However, the current market is imperfect, and the environmental and health externalities are not correlated to the market. For this reason, the economic, financial, and legal

environments still have to be improved to ensure that businesses that are polluting the environment and harming health have an incentive to change the way they do business. In this respect policy prescriptions, including regulation, tax incentives, fines, and goals-aligned subsidies allocation, constitute tools that can create a good environment for responsible companies and business models. Still, it is not enough. Real commercial incentives are necessary, including tangible economic gains for groups that shift to non-polluting forms of production, distribution, and disposal of waste. Indeed "it is the promise of attractive economic returns—not societal co-benefits—that will draw sufficient amounts of private capital into" environmental markets (NewWorld 2015). It is this that will allow the environmental and health problems to be overcome; governments and philanthropic capital are not sufficient alone. For this reason, governments, NGOs, and the private sector have to work hand-in-hand to tackle these life-threatening environmental and health issues.

Conclusion

To conclude, even though it may initially be difficult for environmental investors to identify the financial benefits of a particular investment, they can nonetheless promote significant healthcare benefits by investing in private companies, the public market, and philanthropic initiatives that make smart environmental decisions. The health impacts of pollution, as identified by the Global Commission on Pollution, Health, and Development, constitute another good reason to invest in financial instruments that take environmental impacts into consideration, along with renewable energies and energy-efficiencies solutions. Yet, not only do the environmental markets lead to high social benefits, but they also present considerable opportunities for attractive returns driven by macro trends, especially in the areas of energy efficiency, clean energy, and water and waste management (NewWorld 2015). Indeed, these already large subsectors are growing and are innovative. Further, they match the demands of both increasingly ideologically driven consumers and large corporations that are aware of the opportunities the areas represent, in terms of cost reductions and reputational impact. However, some policy initiatives are still required to overcome the market inefficiencies and externalities. As a result, the Global Commission on Pollution, Health, and Development will propose a set of actionable measures to be implemented by policymakers in its final report to be published in the *Lancet* in December 2016.

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Biographies

Richard Fuller is leading the Global Commission on Pollution, Health, and Development with Philip Landrigan (Dean for Global Health and professor of preventive medicine and pediatrics, Icahn School of Medicine at Mount Sinai). Richard is the founder and president of Great Forest, Inc., a leading sustainability consultancy in the United States, and is an environmentalist best known for his work in global pollution remediation. He led the formation of the Global Alliance on Health and Pollution and is also the founder and president of Pure Earth (formerly the Blacksmith Institute), which is considered one of the world's leading experts on toxic issues. To date, Pure Earth has remediated more than 75 toxic sites worldwide, changing the lives of over four million people, including one million children. In 2011, he received the UN-backed Green Star Award on behalf of the NGO. In 2014, the UN Dispatch stressed Fuller's work in helping to shape the Sustainable Development Goals and broaden the scope of toxic pollution recognized by the goals. He recently published *The Brown Agenda,* in which he details the importance of the overlooked problem of pollution, his journey to the creation of Pure Earth, and specific ways in which anyone can help combat brown sites all over the world. Fuller created a number of initiatives that established a model for global pollution cleanup.

Alexander Preker is the president and CEO of the Health Investment & Financing Corporation in New York. Mr. Preker is one of the commissioners for the Global Commission on Pollution, Health, and Development and is the chair of the External Advisory Committee for the WHHSJ of the International Hospital Federation. From 2007 to 2012, Mr. Preker was head of the Health Industry Group and Investment Policy for the International Finance Corporation. Previously, he was chief economist for the health sector in the World Bank Group. Mr. Preker has published extensively, having written many scientific articles and over 15 books. Mr. Preker is an executive scholar and adjunct associate professor at the Icahn School of Medicine at Mount Sinai in New York, an adjunct associate professor of public policy at New York University's Robert F. Wagner Graduate School of Public Service, and an adjunct associate professor for Health Care Management at the Mailman School of Public Health at Columbia University. His training includes a PhD in economics from the London School of Economics and Political Science, a fellowship in medicine from University College London, a diploma in medical law and ethics from King's College London, and an MD from University of British Columbia/McGill.

Diane-Charlotte Simon is an associate investment analyst with a particular expertise in the environmental and health sectors at a firm investing in private companies in New York. She gained an extensive understanding of the various concepts related to sustainability and their related financial opportunities and threats while preparing for the certification on the Fundamentals of Sustainability Accounting, (FSA level 1), developed by the Sustainable

Accounting Standards Board (SASB), and while writing her thesis. In this context, she interviewed 15 sustainability experts, including nine senior executives of Fortune 500 companies in the United States, France, and India. She is an advocate for impact investing, and contributed to the organization of the Conscious Investor Summit. She has also developed a good knowledge of the dynamics of both advanced economies and emerging countries, having worked in finance and for start-ups in the United States, Europe, and Asia. Simon graduated summa cum laude from two Master's in Business Management programs, one in the United States (City University of New York) and one in France (Ipag Business School). She is a teaching assistant in economics, competition, and emerging markets at Columbia University and is part of the research team involved in the Global Commission on Pollution, Health, and Development.

Balancing Corporate Values with Investor Demands:
The Challenges of Industry-Led Scaling of a Low-Carbon Power Supply

Parker Liautaud

Abstract

The private sector is under increasing pressure to address the financial risks of climate change. At the same time, opportunities for low-carbon economic growth are becoming more attractive to potential investors, especially in scaling up renewable energy (in particular, solar and wind power), retrofitting coal power plants to burn natural gas, and improving the energy efficiency of buildings and industrial processes. Many of these opportunities could provide substantial economic benefits while decreasing greenhouse gas emissions. However, the economy-wide emergence of opportunities clouds the challenges faced by individual actors. The case of NRG Energy and its attempts to scale up its use of renewable energy illustrates how investors can hold CEOs back even when the economic incentives exist. Government policy could help the private sector to invest in low-carbon opportunities without being penalized by stakeholders.

Balancing Corporate Values with Investor Demands: The Challenges of Industry-Led Scaling of a Low-Carbon Power Supply

An increasingly popular assertion of the environmental movement today is that companies no longer have to choose between doing what's good for their business and what's right for the planet and its people. It seems that a confluence of circumstances has led to "sustainability" being promoted as good business sense. It isn't just the campaigners—companies themselves are jumping on board too. Indeed, many companies that have overhauled their practices to be more responsible have saved money and improved their performance. From Unilever to IKEA, a generation of enlightened CEOs seems to be stepping out of the shadows and asserting that doing well and doing good are not mutually exclusive.

"There is overwhelming evidence that the way in which companies go about their business is becoming more important than ever,"[1] writes David Jones in his 2011 book *Who Cares Wins,* which argues that companies need to behave ethically in order to be successful. His book is one example in a crusade to transform business into a force for good in the world. Increasingly, companies have made efforts to integrate sustainability practices and ethical behavior into the fabric of their corporate identity, rather than to treat them as separate CSR initiatives whose purpose is to serve as counterweights against the transgressions of traditional business models.

NRG's Clean Energy Ambitions

Among all the success stories, one company provides a lesson in caution: NRG Energy—a Fortune 200 energy provider that arguably ranks among the most environmentally progressive energy companies in the world. It features a purpose-driven CEO who sees climate change as the most important threat that the world faces today and in the future.

NRG has invested heavily in growing low-carbon alternatives to fossil fuels, especially solar, wind, and natural gas[2] (which, despite being high-carbon in comparison with renewables, is still preferable to coal). It has been six years since NRG launched its flagship sustainability initiative, and the results are beginning to show.[3] But recently,

1. David Jones. 2011. *Who Cares Wins: Why Good Business is Better Business.* Financial Times Press.

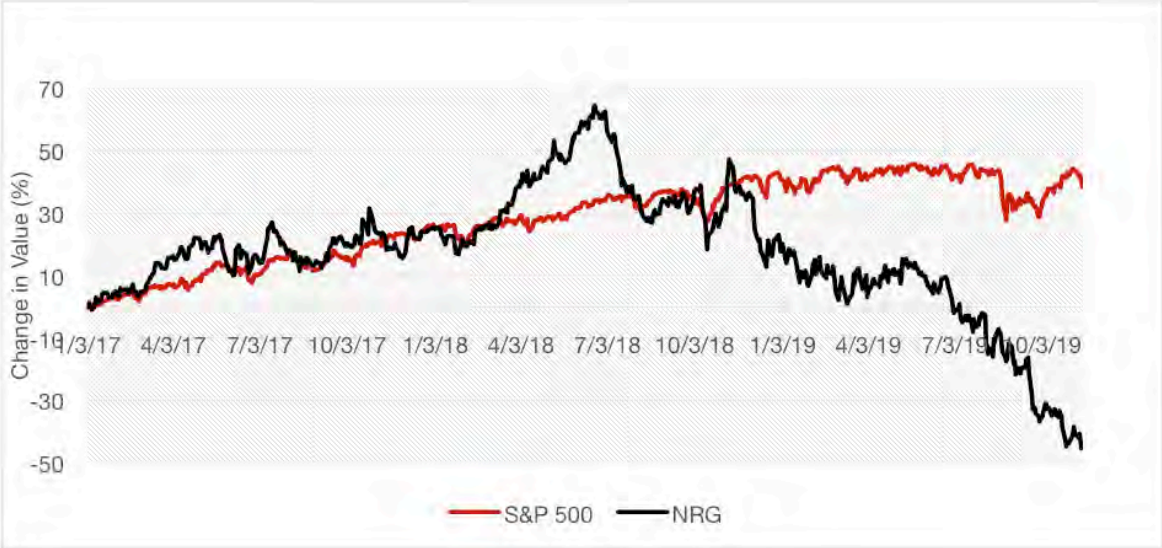
2. NRG Energy. 2015. *2014 Annual Report.* Retrieved from http://investors.nrg.com/phoenix.zhtml?c=121544&p=irol-reportsannual.

3. Rebecca Smith. November 2015. "NRG Chief's Green Ambitions Are Put on Back Burner." *Wall Street Journal.* Retrieved from http://www.wsj.com/articles/nrg-energy-ceos-green-ambitions-are-put-on-back-burner-1446592145?ru=yahoo?mod=yahoo_itp&cb=logged0.34269569255411625.

NRG's performance has suffered. In the past five years, its stock has mostly tracked the performance of the S&P 500 (of which it is a component) with the exception of a

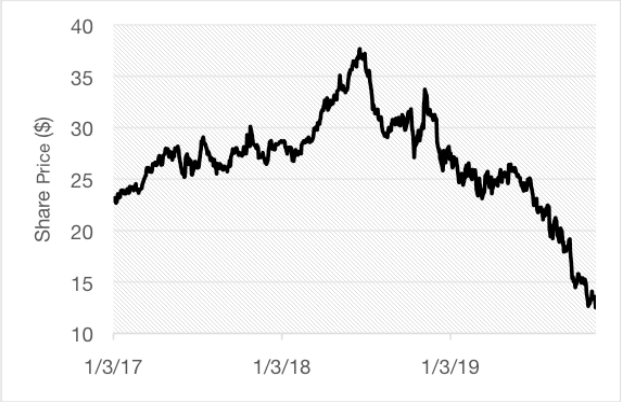
disappointing period in 2012, from which it recovered by the end of the year. In the past two years, though, its share price has decoupled from indices, plummeting from a 5-year high in June 2014 to lose around two-thirds of its value [4] (Figures 1[5] and 2[6]).

Figure 1: S&P 500, NRG



Source: Author's chart with data from Yahoo! Finance 2015.

Figure 2: NRG



Source: Author's chart with data from Yahoo! Finance 2015.

4. *Yahoo Finance.* 2015. NRG Energy, Inc. (NRG) Stock Tracker. Retrieved from http://finance.yahoo.com.

5. *Yahoo Finance*. 2015. NRG Energy, Inc. (NRG) and S&P 500 Stock Trackers. Retrieved from http://finance.yahoo.com.

6. *Yahoo Finance.* 2015. NRG Energy, Inc. (NRG) Stock Tracker.

The key question in this case is whether Mr. Crane's push to decarbonize his company is related to NRG's lagging performance. Superficially, it would seem unnecessary that NRG's performance would suffer as a result of the transition. The consumer mostly doesn't see what Mr. Crane and Sicily Dickenson, NRG's CMO, call "the power behind the plug," [7] so as long as prices aren't affected, nothing about NRG's power sources would affect the behavior of consumers (leaving out the effects of marketing). In order to understand NRG's rationale for overhauling its energy sources and the effects of its sustainability plans on performance, we must analyze several deeply embedded factors, including the culture of the company, the values promoted by its leadership, and a fragmented and unreliable policy environment, as well as the broader sentiment of investors and whether they're ready for an activist-CEO in the energy space.

How NRG Took Advantage of Changing Energy Policy

Despite being relatively young (only 26 years old[8]), NRG is one of the largest companies in its industry, supplying energy to around forty million homes across the United States and operating in all fifty states and the District of Columbia.[9] It does so with just under ten thousand employees. In 2006, the proportion of its product coming from renewables was effectively none. The company had started investing in new wind projects, but had only about 300 MW of generating capacity.[10] By comparison, it was generating 1,100 MW of nuclear power, 3,555 MW from oil, 7,815 MW from coal, and 10,470 MW from natural gas, for a total of 22,940 MW nationwide.[11] Renewables formed a negligible component of the power it generated.

That was in 2006—when NRG produced less than half the power it does today. When the Obama administration began a few years later, the policy environment changed significantly. Federal subsidies for renewables nearly tripled, from $5.1 billion to $14.7 billion between 2007 and 2010. [12] Of those subsidies, federal tax credits accounted for

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7. NRG Energy. 2015. "Have You Ever Thought about the Power behind the Plug?" Retrieved from http://revolution.nrg.com/.

8. Smith. "NRG Chief's Green Ambitions."

9. NRG Energy. 2015. *2014 Year in Review.* Retrieved from http://investors.nrg.com/phoenix.zhtml?c=121544&p=irol-reportsannual.

10. NRG Energy. 2007. *2006 Annual Report.* Retrieved from http://investors.nrg.com/phoenix.zhtml?c=121544&p=irol-reportsannual.

11. Ibid.

12. U.S. Energy Information Administration. 2010. *Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2010.* Retrieved from http://www.eia.gov/analysis/requests/subsidy/archive/2010/pdf/subsidy.pdf.

$4.13 billion in 2007 and $8.17 billion in 2010, [13] approximately doubling during those three years. By 2011, NRG was ramping up its efforts and fully committed to renewables, with David Crane asserting in the *New York Times* that "we intend to do as much of this business as we can get our hands on." [14] Along with partners, NRG was able to acquire more than $5.2 billion in federal subsidies and loans for utility-scale solar power[15]—and that's just one example.

It isn't particularly surprising that NRG effectively had no renewable power generation in 2006. Most sources were underdeveloped. The cost of solar power was around $5/watt,[16] far higher than it is today. Solar power was getting cheaper, but the cost didn't start to fall rapidly until around 2008. (By 2013, the price of solar power had decreased to $0.74/watt.[17]) At the time, module prices were also on the rise due to a short-term silicon shortage.[18] The rapid global rise in solar power that we can see today wasn't especially easy to predict back then.

Around the time that the cost of renewables began to change rapidly, NRG began heavily investing in its renewable energy assets. The company created NRG Renew, a subsidiary created to develop renewable energy, which now exclusively features wind and solar projects (mostly wind), and generates 2,808 MW of power.[19] The company also formed NRG Residential Solar Solutions LLC, a wholly owned subsidiary of NRG that is dedicated exclusively to installing solar power on homes. (It generates only 50 MW of power. [20])

In 2012, it established NRG Yield, a separate public company created by NRG and designed as a growth vehicle. It was part of a new generation of companies called Yieldcos, which supply cash to a parent company through contracted assets it owns. NRG Yield provided dividends for NRG to invest in new projects, many of them renewable.[21]

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13. Ibid.

14. Eric Lipton and Clifford Krauss. November 2011. "A Gold Rush of Subsidies in Clean Energy Search." *The New York Times.* Retrieved from http://www.nytimes.com/2011/11/12/business/energy-environment/a-cornucopia-of-help-for-renewable-energy.html?_r=0.

15. Ibid.

16. Zachary Shahan. September 2014. "13 Charts on Solar Panel Cost & Growth Trends." *CleanTechnica.* Retrieved from http://cleantechnica.com/2014/09/04/solar-panel-cost-trends-10-charts/.

17. Ibid.

18. Ibid.

19. NRG Energy. *2014 Annual Report*.

20. Ibid.

21. Ibid.

Lastly, NRG also recently formed NRG Carbon 360, an arm of the company that produces carbon-capture and storage solutions. [22]

A partial goal of these projects was to force a transition from carbon-intensive fossil fuels to renewables, nuclear power, and natural gas. One of NRG's main sustainability goals is to reduce its company-wide emissions by half by 2030, and by 90% by 2050.[23] A company less interested in the effects of climate change would perhaps have been satisfied with maintaining varying proportions of coal, oil, natural gas, and nuclear power without taking on the substantial risk of investing in and scaling up solar and wind projects in an unreliable policy environment. Capital-intensive energy infrastructure projects are expensive and it takes time to see results. In other words, NRG's renewable projects come at a significant risk to performance in the short-term, and the company was taking a bet on the long-term results outweighing those risks.

As far as generating capacity goes, the results have put NRG on target to achieve its long-term renewable energy goals. The company has increased its production from wind power by five times, and grown to become the third-largest generator of renewable power in the United States.[24] It has also invested in deploying a network of electric car chargers called "eVgo" that has grown in customer acquisition by 20 times, and it plans on deploying eVgo to 25 more major cities by 2018.[25] Perhaps most importantly, renewable power now accounts for 4,259 MW of generation, or 8% of its total—compared to effectively none less than a decade ago—the overwhelming majority of which comes from wind and utility-scale solar.[26]

The Role of Management Values

When NRG started to expand its investments into renewable energy, it was only because the policy environment and resource prices allowed for it. It's worth noting that this is the fundamental pillar of any corporate sustainability effort that goes beyond old-style CSR and truly integrates across the whole company. Business can only be a sincere force for good in the world as long as regulations, economics, and business incentives align. It may be morally unsatisfying (even if predictable) that a company would only invest in socially beneficial measures if it suits its business agenda, but the flipside of that is that any measures that aren't financially sustainable are nothing more than charitable extensions that aren't connected to the core of the business, and thus are impossible to reliably scale.

22. NRG Energy. "Our Companies." http://www.nrg.com/about/who-we-are/our-companies/.

23. NRG Energy *2014 Year in Review*.

24. Ibid.

25. Ibid.

26. Ibid.

Therefore, a corollary is that when the business incentives do align with the opportunity to integrate environmental sustainability into the fabric of the company's work, it could have a much bigger impact. In NRG's case, millions of homes could become powered by clean energy.

NRG is not the first energy company to diversify its mix, but an important question that should be asked when a company takes such drastic measures is why it is doing it. Mr. Crane is a long-serving and competent CEO who had already been running NRG for six years before his sustainability platform was launched. Over his tenure, Mr. Crane has made climate change his highest priority second to the performance of the company. He regularly takes part in climate activism, including walking with the People's Climate March in New York City in 2014. He writes articles in liberal outlets such as the *Huffington Post,* encouraging young people to take a stand on climate issues and take responsibility for their future. His biography on the NRG website trumpets how he was "one of the first U.S. power industry CEOs to publicly call for mandatory climate change measures,"[27] and *Forbes Magazine* describes him as the executive striving to be the "emperor of alternative energy."[28]

His leadership in a particularly obstinate industry is laudable, but NRG still has to reconcile a purpose-driven mission with the realities of running an energy company. That means producing and transmitting electricity at the lowest cost and keeping capital expenditures under control, among a host of other complexities. In aggressively growing its renewables portfolio, NRG had subjected itself to a constantly changing policy environment, a situation that makes it hard to foresee future costs, and this instability left the company potentially more exposed to unforeseeable risks than its competitors. Investors noticed.

The Effect of Fragmented and Unpredictable Energy Policy

While renewables have benefited from growing subsidy support in the United States,[29] federal climate and energy policy is fragile. Many of the substantial policy changes supporting the long-term future of renewables are based on executive authority, and therefore tied to domestic politics.

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27. NRG Energy. 2015. "David Crane: President and Chief Executive Officer." Retrieved from http://www.nrg.com/about/our-management/david-crane/.

28. Christopher Helman. July 2014. "David Crane's Green Vision for Carbon-Belching NRG Energy." *Forbes.* Retrieved from http://www.forbes.com/sites/christopherhelman/2014/07/02/david-cranes-green-vision-for-carbon-belching-nrg-energy/.

29. U.S. Energy Information Administration *Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2010*.

Consequently, the United States has generally struggled to keep up with global investment flows into the sector. Annual new investment into renewable power and fuels in the United States has varied between $29.1 and $50 billion since 2006,[30] but there hasn't been reliable growth in these investments in the last eight years. The rest of the world has left the United States behind. In 2006, U.S. investment into the sector accounted for around 26% of the global total—by 2014, this share had decreased to 14.2%.[31] In the same time period, China's investment into renewable power and fuels increased from just over one third of what the United States was spending ($11.1 billion vs. $29.1 billion) to more than double ($83.3 billion vs. $38.3 billion). These numbers reflect the fragility of American energy policy and reveal a rift between NRG's tactic of aggressive growth in renewables, and the wider sentiment on their potential in the United States in the short term.

The unpredictable nature of American energy policy makes it hard to tell whether R&D and other investments into renewables will increase substantially and reliably in the near future. While tens of billions of dollars are nonetheless flowing into the sector each year, NRG remains relatively isolated in its moral compass, at least among established energy companies. The fact that American energy policy seems anchored in traditionally unwavering support for fossil fuels (the U.S. government has not begun to phase out its fossil fuel production subsidies[32]) makes it difficult for a company like NRG to depart drastically from conventional fuels without signaling a significant risk to investors—who tend to dislike uncertainty.

When all of these factors are taken into consideration, can NRG's efforts be considered successful?

Stakeholder Responses

Investors didn't think so. They were worried that the company was overspending on renewable energy projects without much to show for them in terms of results[33]—in other words, the aforementioned risks of heavy short-term investment into new projects on the

30. Renewable Energy Policy Network for the 21st Century (REN21). .2015. *Renewables 2015 Global Status Report.* Retrieved from http://www.ren21.net/wp-content/uploads/2015/07/REN12-GSR2015_Onlinebook_low1.pdf.

31. Ibid.

32. U.S. Treasury Department. 2014. "United States—Progress Report on Fossil Fuel Subsidies." Retrieved from http://www.treasury.gov/open/Documents/USA%20FFSR%20progress%20report%20to%20G20%202014%20Final.pdf.

33. Stephen Lacey. 2015. "NRG Will Spin Off Its Clean Energy Business: Investor Pressure, or a Bet on a Green Premium?" Greentech Media. Retrieved from http://www.greentechmedia.com/articles/read/under-pressure-from-investors-nrg-restructures-clean-energy-business.

ground harmed them. As a result, the stock price has plummeted. Earlier this year, David Crane commented in the *Wall Street Journal* that "There was a mismatch between what investors wanted us to do with our cash—which was give it back—and what we wanted to do, which was put it in growth businesses."[34]

NRG Yield has also failed, as far as investors are concerned. Designed as a growth engine for the company, investors began to doubt the possibility that it could continue to sustainably fuel an acceptable level of dividend growth.[35] Consequently, NRG Yield's own stock price (NYLD) has decreased precipitously, to less than a third of what it was at the beginning of the year.[36] Broader fears around the risk profile of Yieldcos have also risen,[37] so NRG Yield isn't especially unique in facing this problem, but NYLD has even significantly underperformed compared to the Global X YieldCo ETF Index (an index made up entirely of yieldcos, including NYLD) (Figure 3[38]).

Figure 3: Yieldco Index Performance versus NYLD

Source: Author's chart with data from Yahoo! Finance 2015.

34. Smith. "NRG Chief's Green Ambitions."

35. Ibid.

36. *Yahoo Finance.* 2015. NRG Yield, Inc. (NYLD) Stock Tracker. Retrieved from http://finance.yahoo.com.

37. Mercatus Analytics. 2015. Distributed Energy Insight Report. Retrieved from http://pages.gomercatus.com/rs/432-MVH-269/images/Insight%20Report%20%28Final%29.pdf?aliId=479714.

38. *Yahoo Finance.* 2015. NRG Yield, Inc. (NYLD) and YieldCo Index ETF (YLCO) Stock Trackers. Retrieved from http://finance.yahoo.com/.

Regardless of the financials, questions of the wider societal impact of NRG's projects still remain. Renewable power generation of 4,259 MW sounds like a lot, especially when compared with almost none only a few years ago. But 8% of NRG's generating capacity coming from renewables also means that 90% still comes from high-carbon conventional fuels (the other 2% coming from nuclear). And the increase in NRG's generating capacity from 22,940 MW in 2006 to 53,470 MW today[39] indicates that there's a whole other story that isn't being told about the side of the company that generates high-carbon power.

While nuclear power has negligibly increased in capacity (1,100 to 1,176 MW), capacity from oil has nearly doubled (3,555 to 6,008 MW), natural gas has increased by more than 2.5 times (10,470 to 25,301 MW), and even coal has more than doubled (7,815 to 16,734 MW). [40] To put that into perspective, NRG's absolute increase in fossil-fuel-generating capacity is more than five times its increase in generating capacity from renewables.

Mr. Crane believed that investors would tolerate his purpose-driven renewables strategy partly because he had also invested so heavily in conventional capacity increases.[41] Not only was he wrong (they didn't tolerate his strategy), but he also faced pressure to take action to satisfy shareholders, leading NRG to make the decision to spin off its renewables arm, while limiting investment in clean energy projects to a restrictive $125 million.[42]

This raises the important question: What do investors see as a success, compared to NRG? It comes down to a clash of values. As a corporate leader, Mr. Crane has two separate missions: one related to the operation of the business, and another related to the influence that his business could have on society. The potential for a large energy company to exert this influence is huge—it could choose how it generates electricity and in turn remove the burden of responsibility from the consumer. However, since energy is the core of its business, its social mission must also align with the realities of operating a public company. Markets respond brutally to short-term failures. In NRG's case, its spending didn't match with results, and it has been punished harshly by stakeholders.

In fairness to Mr. Crane and the NRG management, there are many factors out of their control when they invest for growth in renewables. However, integrating a social mission into the core business of a company is different from rendering a large corporation more sustainable. The challenge is harder for an energy company. For many organizations, integrating sustainability, while a difficult and complex task, is usually somewhat peripheral to the product it sells. NRG was trying to address the risks of climate change by

39. NRG Energy. *2014 Annual Report,* and *2006 Annual Report*.

40. Ibid.

41. Smith. "NRG Chief's Green Ambitions."

42. Ibid.

substituting the product it sells, and in doing so had to take a significant gamble with investors, on which there was no safety net.

Wider Implications

The case of NRG may present a valuable lesson. Its stock performance issues raise questions about whether the private sector is ready for an investor with socially oriented values, and while Mr. Crane is a veteran executive and has been leading NRG for over a decade, he was eventually forced to drastically scale back his ambitions for renewable generation in order to save the performance of his company.

It's fair to say that NRG is a good example of how a company can be punished and limited even when its senior management is dedicated to using their resources to solving a particular problem. And while the use of renewables is growing rapidly around the world, the U.S. power sector hasn't addressed important questions of storage and transmission, as well as other complexities that are involved in moving the United States to a low-carbon power supply.

Furthermore, the case of NRG demonstrates the challenges individual actors in the energy industry face, despite the improving prospects for an economy-wide transition to low-carbon power.

Measures that both reduce carbon emissions and boost economic growth are becoming increasingly available and attractive to investors. The *2015 New Climate Economy Report* (a study of the Global Commission on the Economy and Climate) showed that action in 10 "areas of opportunity"[43] that would deliver economic benefits (in other words, investments that would be defensible regardless of the effect of climate change) could account for 96% of the emissions reductions necessary to keep global warming below the 2°C threshold agreed upon at the UN climate summit in 2009.

However, this seemingly serendipitous alignment of interests clouds the challenges faced by executives in individual firms. CEOs in the energy industry that rush the transition in order to align with the urgency of the threat of climate change stand to be punished by stakeholders who place less value on those solutions. In NRG's case, redirecting revenue into growth businesses was a risky move, and when the results underwhelmed stakeholders, the business suffered.

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43. The Global Commission on the Economy and Climate. 2015. "Executive Summary." *Seizing the Global Opportunity: Partnerships for Better Growth and a Better Climate: The 2015 New Climate Economy Report.* Retrieved from http://2015.newclimateeconomy.report/wp-content/uploads/2014/08/NCE-2015_Exec_summary_web.pdf.

In the broader context of the climate change issue, this case can help illustrate the pitfalls of expecting that a cost-benefit assessment alone will be enough to accelerate the scaling of low-carbon power. While it's true that the aggregate cost of inaction is widely agreed to exceed the cost of action,[44, 45] and that there are opportunities to make money in low-carbon growth, many institutional investors and individual shareholders remain unsympathetic to the long-term view and respond unkindly to short-term performance failures. This exposes a fundamental challenge that has yet to be adequately addressed: the power of the private sector's short-term bias.

While an in-depth analysis of the effects of this problem is beyond the scope of this paper, the experience of NRG does have significant implications for even the most socially responsible companies. There remains a serious disincentive for companies to invest in the measures that could produce financial benefits in the long term, simply because shareholders hold power in the company's decision making (as evidenced by NRG's decisions to cap internal spending on growth projects and spin off their renewables arm).

This problem is not limited to the scaling of a low-carbon power supply. The broader reluctance to undertake measures that involve up-front costs has been a serious challenge to the development of any industry-led projects that could reduce carbon emissions. Improvements in energy efficiency could account for a decrease in greenhouse gas emissions of 5.7 GtCO2e per year by 2030[46] (the study cited provides a range, of 4.5 to 6.9 GtCO2e), and these measures have the added benefits of being universally desired and avoiding the difficulties involved in facing a powerful fossil fuel industry. However, improving the efficiency of buildings and industrial processes requires significant upfront investment, which could be penalized by corporate stakeholders with a shorter-term view than the company's management, similar to the way in which NRG was punished. As such, even organizations interested in the long-term savings that come with better energy efficiency may not be able to justify to their stakeholders the investment required, especially when supporting government policy is underdeveloped and unpredictable.

Given the context, therefore, an important question is how the private sector can be incentivized to participate on a larger scale in developing solutions that address climate disruption. Here, there may be a role for intelligently designed government policy. Regulations can help to level the playing field for whole industries (in this case, energy)

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44. DARA. 2012. Climate Vulnerability Monitor, Complete Report. Retrieved from http://www.daraint.org/wp-content/uploads/2012/10/CVM2-Low.pdf.

45. Economist Intelligence Unit. 2015. *The Cost of Inaction: Recognizing theValue at Risk from Climate Change.* Retrieved from http://www.economistinsights.com/sites/default/files/The%20cost%20of%20inaction.pdf.

46. Ibid.

so that stakeholders don't penalize CEOs who take advantage of opportunities for long-term growth. While the purpose of this paper is not to advocate specific policy measures (the requisite analysis has not been performed), numerous proposed solutions could be effective. Carbon pricing has gained momentum as a potentially powerful mechanism for accelerating the transition to a low-carbon world, and has been embraced by experts.[47] The current landscape of carbon pricing initiatives is fragmented and many existing policies are weak,[48] but this may change. The world has learned from the problems that plagued the launch of Europe's emissions trading system (ETS) in 2005. Some regional programs have proven successful: A study from the Analysis Group calculating that the Regional Greenhouse Gas Initiative (U.S. Northeast) had produced $1.3 billion in net added economic value while saving consumers around $460 million in heating and power costs over three years.[49] On a national level, Korea established a nationwide ETS in 2015,[50] and China will launch its own in 2017.[51]

In the end, NRG's challenges demonstrate that even when the criteria are met for a company to invest in solutions to issues like climate change, it can run into resistance. A range of factors allowed NRG to make significant investments in renewables, but one CEO taking a moral stand is not sufficient if the rest of the industry remains obstinate and if shareholders are resistant.

As for its current predicament, the company must now decide between limited options. NRG's stock price continued to decline after Crane announced its new strategic direction[52]; at the end of 2015, David Crane stepped down from his position as CEO of

47. Partnership for Market Readiness. 2013. "Carbon Pricing to Achieve Mitigation: Remarks from Rachel Kyte." Retrieved from https://www.thepmr.org/content/carbon-pricing-achieve-mitigation-remarks-rachel-kyte.

48. World Bank Group. 2015. *State and Trends of Carbon Pricing.* Retrieved from http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2015/09/21/090224b0830f0f31/2_0/Rendered/PDF/State0and0trends0of0carbon0pricing02015.pdf.

49. Analysis Group. 2015. *The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States.* Retrieved from http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_rggi_report_july_2015.pdf.

50. International Carbon Action Partnership. 2012; updated 10 September 2015. "Korea Emissions Trading Scheme." Retrieved from https://icapcarbonaction.com/index.php?option=com_etsmap&task=export&format=pdf&layout=list&systems%5B%5D=47.

51. International Carbon Action Partnership. 2015. "China to Cap Emissions from Six Sectors, ETS to Launch 2016." Retrieved from https://icapcarbonaction.com/en/news-archive/268-china-to-cap-emissions-from-six-sectors-ets-to-launch-2016.

52. *Yahoo Finance*. 2015. NRG Energy, Inc. (NRG) and S&P 500 Stock Trackers. Retrieved from http://finance.yahoo.com.

NRG, and was replaced by Mauricio Gutierrez. His departure from NRG reflects the rift in values that may prevent progress on the evolution of clean energy, even when executives make ambitious efforts in that direction.

Nonetheless, the company's revised strategy of spinning off the renewables arm should not be dismissed. Separating the renewables arm of the business allows institutional investors and others that don't care as much about the moral implications of their investment to keep their stake in the part of the company that better suits their interests. Furthermore, a rising number of investors are interested in investments that are exclusively socially beneficial, and a newly formed renewables spin-off can appeal to those that were previously hesitant to invest in a provider that earned the overwhelming majority of its revenue from burning fossil fuels.

Biography

Parker Liautaud studies geology and geophysics at Yale University. His work focuses on exploring policy solutions to climate change. From April 2014 to October 2015, he was a fellow and member of the directorate at the Yale Climate & Energy Institute. He has been invited to speak on climate issues at a range of institutions, including the World Economic Forum (2015), the World Bank (2015), the White House (2014), and the Clinton Global Initiative (2014 Annual Meeting). In December 2013, he was named to *Time* Magazine's 30 Under 30 list of people changing the world.

Introducing the Carbon Impact Factor

A Family of Financial Instruments to Differentiate and Reward Carbon Efficiency in Commodity Production

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Introducing the Carbon Impact Factor: A Family of Financial Instruments to Differentiate and Reward Carbon Efficiency in Commodity Production

The production of commodities contributes a significant portion of anthropogenic greenhouse gas (GHG) emissions globally and presents a particularly difficult challenge for policy makers and multinational companies working to address emissions within the global supply chain. A simple mechanism is needed that enables commodity producers to benefit financially from taking action to reduce emissions, while it also enables market participants to demand carbon efficient commodities at the base of the supply chain. Rather than create an entirely new approach, we have designed a system that leverages technology to integrate standards, audits, and financial flows to enable the existing global market infrastructure to differentiate and value low-impact commodities.

Of the numerous environmental externalities associated with commodity generation, carbon risk has emerged as a driver in capital markets. This concept paper introduces the Carbon Impact Factor (CIF): a family of financial instruments that allows market participants to incorporate the carbon efficiency of a commodity into purchasing decisions and communicate associated carbon mitigation to stakeholders. While the focus of this

effort is carbon, the principles can be applied to other externalities, such as water depletion, social and land use impacts, and beyond markets to include policy and regulatory mechanisms.

Taking a systems perspective, we can apply proven technologies with established precedents in environmental standards and commodities and address the capital markets' drive to quantify and minimize carbon risk in global markets. We have conceptually designed a family of low-carbon financial instruments that is apolitical, cost efficient, scalable, extensible, and relevant and that possesses market-worthy integrity. The solution allows buyers of commodities to invest in low-carbon production practices and rewards the producers that implement those low-carbon practices.

The Carbon Impact Factor (CIF): a family of quantified, serialized, cryptographic, blockchain-enabled financial instruments to quantify and value the carbon efficiency associated with the sourcing and production of various commodities. The CIF combines components of RECs, carbon offsets, carbon insets, and sustainability certificates to create a new form of efficiency currency that can be quantitatively valued in commodity sourcing decisions. Further, CIFs can be purchased by multinationals to demonstrate and communicate their efforts to reduce carbon intensity (risk) within their supply chain. CIF is not a carbon offset, nor a carbon inset. It is a measure of carbon efficiency. The unit not only incentivizes the production of each commodity with carbon efficiency as a consideration, but it also incentivizes the selection of commodities with higher carbon efficiency. The team contributors have expertise in standards development and quality assurance; GHG emissions reduction quantification; GHG measurement, monitoring, reporting, and verification methodology development; environmental commodities; commodity markets and trading; and supply chain data, blockchain technology, and cryptocurrency. Through collaboration and the application of systems thinking, the team has developed the conceptual solution presented in this paper.

Background

Scientific consensus is that the global climate system is on the verge of change unprecedented in human history due to the increasing concentration of greenhouse gases (GHGs) generated from human activities.[1] Global temperatures have steadily increased from pre-industrial levels, already reaching the halfway point towards the "danger

1. Carbon Tracker. 2013. "Things to look out for when using carbon budgets!" Carbon Tracker Initiative (October). Available from http://www.carbontracker.org/wp-content/uploads/2014/08/Carbon-budget-checklist-FINAL-1.pdf.

threshold" of a 2°C rise.[2] The global community—governments, businesses, nongovernmental organizations, and citizens—are aligned in the understanding that GHG emissions must be significantly reduced to stay within a carbon budget.[3] There is also widespread agreement that any effective strategy will involve a market-based mechanism that puts a price on GHG emissions.[4] Since initial publication of this concept paper, both the carbon budget and the use of market-based solutions were supported in the Paris Agreement. Specifically, governments reaffirmed their commitment to keeping the increase in the average global temperature to below 2°C above pre-industrial levels, while pursuing efforts to limit temperature increase to 1.5°C. Article 6 of the Agreement included provisions for approaches on international cooperation and transfer of GHG emission reductions, such as those provided by market mechanisms.[5]

To date, international climate negotiations have focused on commitments by national and subnational governments to gradually reduce emissions, primarily from direct downstream sources (for example, power plants, energy-intensive manufacturing, and motor vehicles). These types of top-down government regulations and policy measures, however, will typically not be able to effectively address upstream GHG emissions (for example, from the extraction of raw materials and subsequent transformation into products) because supply chain emissions are indirect and often associated with activities beyond national and subnational borders. Multinational corporations working to manage their GHG emissions face a similar challenge with indirect upstream emissions from supply chains. CDP (formerly the Carbon Disclosure Project) provides a global system for companies and cities to measure, disclose, manage, and share vital environmental risk information. CDP incorporates three categories of GHG emissions as defined by the World Resources Institute (WRI) and World Business Council on Sustainable Development (WBCSD). The majority of companies report only their direct emissions (Scope 1) and those from the generation of purchased electricity (Scope 2), with a much smaller percentage reporting

2. United Nations. 2009. Copenhagen Accord. *UN Framework Convention on Climate Change* (PDF: 18 December). Accessed 14 October 2015. Available from http://unfccc.int/resource/docs/2009/cop15/eng/l07.pdf.

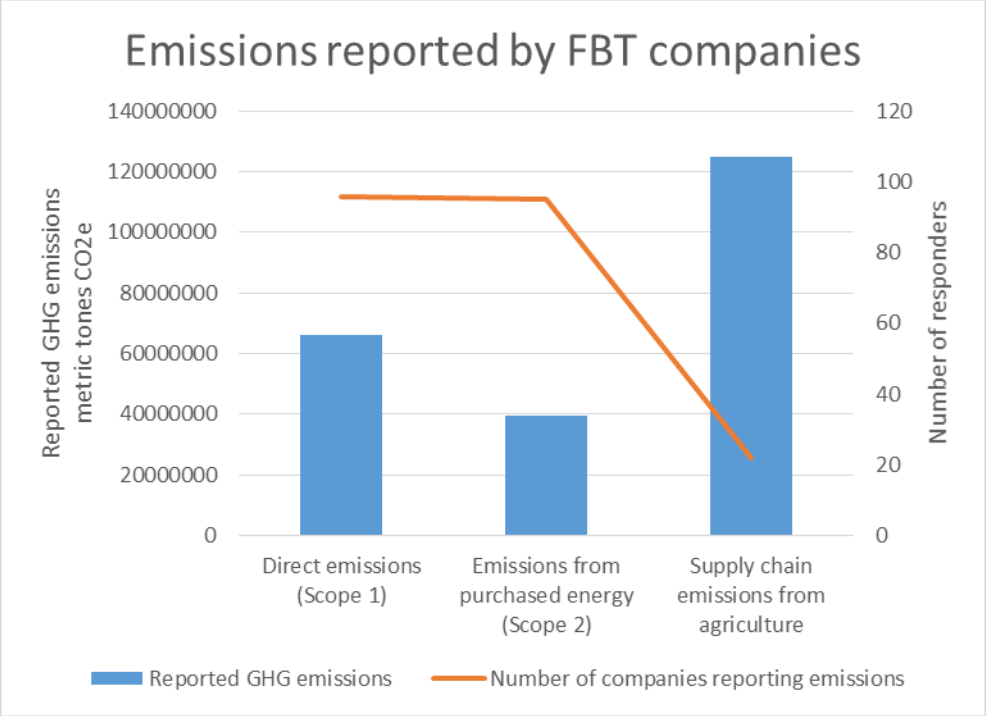
3. Leaton, James (on behalf of Investor Watch). 2011. "Unburnable Carbon: Are the world's financial markets carrying a carbon bubble?" Carbon Tracker Initiative. PDF. Available from http://www.carbontracker.org/wp-content/uploads/2014/09/Unburnable-Carbon-Full-rev2-1.pdf.

4. For example, see: http://www.wri.org/our-work/topics/indcs and http://www.wemeanbusinesscoalition.org/about.

5. The Paris Agreement under United Nations Framework Convention on Climate Change. December 12, 2015. "Adoption of the Paris Agreement." Draft decision-/CP.21. http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf

indirect emissions that occur in the supply chain (Scope 3). For the Agricultural sector, the number of entities reporting scope 1 and 2 emissions is inversely proportional to the Scope 3 emissions[6] (highlighted in Figure 1). This reporting profile is typical across numerous commercial sectors.

Figure 1: CDP Data from Responses of Food, Beverages, and Tobacco Companies Showing Inverse Relationship between Number of Companies Reporting Emissions and the Location of the Emissions



Note on the "Supply chain emissions from agriculture": Reported agricultural GHG emissions are in the range of 108,755,112- 125,060,047 metric tons CO2e based on extrapolations from CDP data.

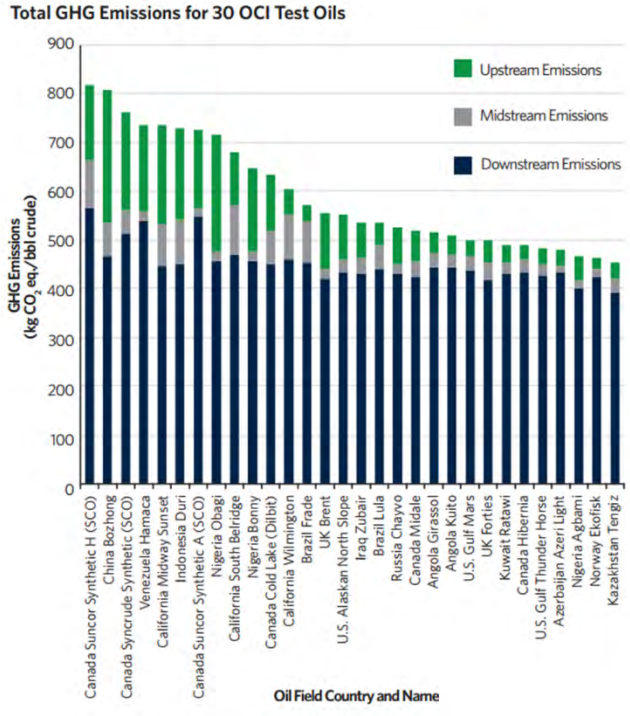
Source: *The forgotten 10%: Climate mitigation in agricultural supply chains; Maia Kutner, Director of Technical Reporting, CDP, September 2015; original p .23; PDF p. 10.*

The challenges in Scope 3 reporting are in part due to variability across supply chains. For example, a recent analysis of different petroleum oils from around the world found more

6. Scott, Mike (for CDP). 2015. "The Forgotten 10%: Climate Mitigation in Agricultural Supply Chains." CDP (September). Accessed Oct. 14, 2015. Available from https://www.cdp.net/Documents/climate-mitigation-in-agricultural-supply-chains.pdf.

than an 80 percent difference in their lifecycle GHG emissions per barrel (Figure 2).[7] Similar variances in total GHG impact are seen in agricultural and industrial sectors as well.

Figure 2: Lifecycle of GHG Emissions of Different Oils, with the most Significant Differences Attributable to "Upstream" Factors (that is, crude oil extraction at the source)



Note: Unlike the other OCI test oils, Cold Lake dilbit is not comprised of a full barrel of oil. It is about 75 percent bitumen mixed with diluent to allow it to flow.

Source: *Graph and authors' calculations from Figure 12 "Total GHG Emissions for 30 Phase 1 OCI Test Oils" from* Know Your Oil: Creating a Global Oil-Climate Index *by Deborah Gordon, Adam Brandt, Joule Bergerson, and Jonathan Koomey; Washington, DC: Carnegie Endowment for International Peace; March 2015; p. 36. http://carnegieendowment.org/files/know_your_oil.pdf.*

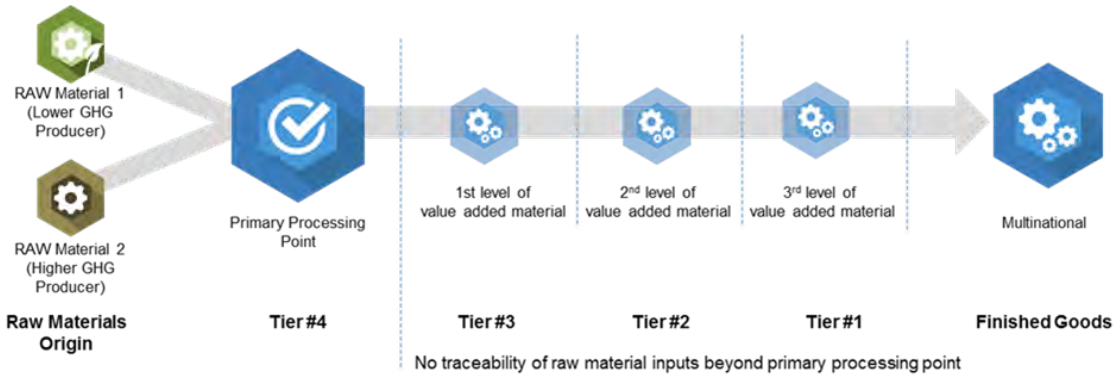
Furthermore, the supply chain itself is generally divided into multiple Tiers (see Figure 3). In this example, Tier 4 is both the furthest from corporate operations and has the highest environmental impact.[8] The lack of Scope 3 reporting reflects that the complexity of

7. Gordon, Deborah, Adam Brandt, Joule Bergerson, and Jonathan Koomey. 2015. *Know Your Oil: Creating a Global Oil-Climate Index.* Washington, DC: Carnegie Endowment for International Peace. Accessed PDF November 4, 2015. Available from http://carnegieendowment.org/2015/03/11/know-your-oil-creating-global-oil-climate-index.

8. McGill, Alan. 2011. "Puma's Reporting Highlights Global Business Challenges." *PwC World Watch* 3. Accessed November 4, 2015. Available from http://www.pwc.com/gx/en/audit-

accurately quantifying, managing, and reporting GHG emissions increases with distance from corporate operations. For raw material inputs, which occur in Tier 4, this difficulty is compounded by the fact that, in almost every instance, raw materials from multiple origins are aggregated and co-mingled at a primary processing point, after which they move undifferentiated in the value chain.

Figure 3: Simplified Commodity Supply Chain, Showing Raw Material Producers and the Tiered Supply Chain



These same challenges, however, present an important opportunity. While undifferentiated in global commodity markets*, raw materials are not created equal when it comes to overall impact.* This includes both the GHG emissions associated with the actual raw materials and those associated with their extraction, production, and processing.

Although efforts are being made to create one, currently no scalable mechanism exists for multinationals or commodity market participants to effectively manage GHG emissions at the base of the supply chains. For perspective, if we look at just six "commodified goods" (concrete, natural gas, refrigerants, palm oil, motor oil/lubricants, and iron and steel), GHG emissions are projected to be in the tens of billions of $mtCO_2e$ between 2015 and 2040.[9, 10, 11, 12] In each case, there is variability in GHG impacts relating to the sourcing or

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services/corporate-reporting/sustainability-reporting/assets/pumas-reporting-highlights-global-business-challenges.pdf.

9. Velders, G. J. M., S. Solomon, and J. S. Daniel. 2014. "Growth of climate change commitments from HFC banks and emissions." *Atmos. Chem. Phys.* 14: 4563–4572.

10. U.S. Energy Information System. International Energy Statistics. Available from http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=3&pid=3&aid=8.

11. World Steel Association. "Steel's contribution to a low carbon future and climate resilient societies**."** Available from http://www.worldsteel.org/publications/position-papers/Steel-s-contribution-to-a-low-carbon-future.html.

processing or both. If the respective markets were enabled to value and select for carbon efficiency associated with sourcing and processing with *no changes to actual material use*, the resulting GHG reductions would be massive and would exceed the GHG emissions of many countries today.

Opportunity Drivers

Two events—the recognition of carbon emissions as a risk by capital markets and the technology revolution—present significant opportunities to address emissions at the base of the supply chain.

Carbon Emissions Recognized as a Risk by Capital Markets

GHG emissions are now being viewed in capital markets as a material risk for businesses, which presents a scalable and apolitical framework to address GHG externalities.

For example, the Carbon Tracker Initiative[13] estimates that the amount of CO_2 contained in *proven* fossil fuel reserves exceeds the total allowable amount of CO_2 that can be released into the atmosphere by roughly a factor five by 2050.[14] Since fossil-fuel-based companies' value is derived in large part from their *proven* reserves, this implies that capital markets are carrying a substantial risk of overvaluation. In conjunction with this correlation, divestment campaigns targeting fossil fuels have led over 400 institutions, representing over $2 trillion in investment, to commit to divestment.[15] While divestment has gained attention and is indicative of the larger issue of carbon risk, questions arise regarding the redeployment of this capital in an efficient and high-impact manner. The emergence of low-carbon ETFs,[16] Green Bonds, and Indices[17] provide additional evidence

12. World Business Council for Sustainable Development and International Energy Agency. 2009 (U.S.2012). "Cement Technology Roadmap; Carbon emissions reductions up to 2050." GHG Inventory.

13. Smart, Lauren. 2015. "Carbon Risk: How do we measure and manage it?" *The Actuary* (June). Available from http://www.theactuary.com/features/2015/06/carbon-risk-how-do-we-measure-and-manage-it/.

14. Leaton, "Unburnable Carbon." Accessed Oct. 8, 2015 from http://www.carbontracker.org/wp-content/uploads/2014/09/Unburnable-Carbon-Full-rev2-1.pdf.

15. Carrington, Damien, and Emma Howard. 2015. "Institutions Worth $2.6 Trillion Have Now Pulled Investments Out of Fossil Fuels." *The Guardian* (September 22). Available from http://www.theguardian.com/environment/2015/sep/22/leonardo-dicaprio-joins-26tn-fossil-fuel-divestment-movement.

16. BlackRock. 2015. "iShares MSCI ACWI Low Carbon Target ETF." Available from https://www.ishares.com/us/products/271054/ishares-msci-acwi-low-carbon-target-etf.

17. FTSE. FTSE CDP Carbon Strategy Index Series. Available from https://www.cdp.net/en-US/Respond/Documents/FTSE%20CDP%20Methodology%202-sider.pdf.

of the trend. Further, the Norwegian Pension Fund's move to divest holdings associated with palm oil suggests that institutional investors are now acting to reduce carbon exposure beyond fossil fuel holdings.[18]

If capital markets are both deploying advanced analytics and developing products in relation to carbon risk, then an opportunity exists for a mechanism to be introduced enabling the efficient allocation of capital in relation to carbon risk at the base of the global markets.

Technology Revolution Brings Cost-Effective Data Acquisition and Integrity

Technological innovation in the past decade offers solutions for designing a system to manage and reduce commodity carbon emissions, primarily through *cost-effective* data capture and validation. Four particularly relevant technological innovations are

- **Mobile Technology:** Mobile technology has emerged as a primary engine of economic growth, enabling data to be collected everywhere and shared globally, stimulating enormous private-sector spending in both R&D and infrastructure, and profoundly changing individual lives and transforming commerce on a global scale.[19] In the case of the developing world, mobile technology is a pathway to democratizing communication and services such as banking.
- **Blockchain:** Blockchain technology, enabling cryptocurrencies such as Bitcoin, creates the possibility of an apolitical global platform for trading and exchanging currencies and commodities.[20] Low transaction costs, financial innovation, and mobile wallets can bring financial tools to the unbanked—including the producers of raw materials who can be financially compensated for adopting sustainable practices. In addition, blockchain technology can incorporate a notary function for immutable and easily auditable record keeping that is critical for our application.

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18. An example can be can be seen in the Norwegian Pension Fund's recent decision to divest its holdings in both Posco, the Korean conglomerate that owns Daewoo, and Daewoo, which owns the Indonesian company, PT Bio Inti Agrindo, a palm oil producer associated with deforestation. See "Norway Fund excludes Four Asian Groups." 2015. *The Financial Times.* Available from http://www.ft.com/intl/cms/s/0/b8305bbe-44c7-11e5-b3b2-1672f710807b.html#axzz3r7DAXB5B.

19. Bezerra, Julio, W. Bock, F. Candelon, S. Chai, E. Choi, J. Corwin, S. DiGrande, R. Gulshan, D. C. Michael, and A. Varas. 2015 "The Mobile Revolution: How Mobile Technologies Drive a Trillion-Dollar Impact." *bcg Perspectives.* Available from https://www.bcgperspectives.com/content/articles/telecommunications_technology_business_transformation_mobile_revolution/.

20. Investopedia. "Cryptocurrency." Available from http://www.investopedia.com/terms/c/cryptocurrency.asp?optm=sa_v2.

The *Economist* calls it a "Trust Machine," and the technology is expected to have impacts on par with that of the Internet.[21]

- **Big Data Analytics:** Big data is a popular term used to describe the exponential growth and availability of data, both structured and unstructured. Big data analytics is the process of examining, or "mining," large data sets containing a variety of data types to uncover hidden patterns, unknown correlations, market trends, anomalies, and other useful business information.[22]
- **Global Solution Networks:** Emerging networks of civil society organizations, private companies, governments, and individuals enabled by digital technology are achieving new forms of social innovation—advocating for and delivering solutions for global problems.[23] Enabled by the digital revolution, multi-stakeholder, self-governing networks are transforming how we solve global problems—including the development, application, and modification of global standards.

Existing Mechanisms: Environmental Commodities and Sustainability Initiatives

Over the previous two decades, numerous instruments have evolved to quantify externalities related to environmental and other impacts. We'll review the most prominent here.

Environmental Commodities: Renewable Energy Certificates (RECs)

RECs are unitized, serialized environmental commodities representing the generation of one MWh of electricity from renewable energy sources such as wind and solar. RECs are decoupled from electricity at the point of generation and bundled with power purchases or transacted separately. The indirect crediting of RECs is an efficient way to enable the differentiation and pricing of renewable energy without disrupting existing markets or infrastructure. RECs are well-established, cost-effective environmental commodities that are broadly utilized in both compliance and voluntary regimes, but the market for them is limited to electricity. RECs are attributional in nature because the product incorporates

21. "The Trust Machine: the promise of the blockchain." 2015. *The Economist (October 31).* Available from http://www.economist.com/news/leaders/21677198-technology-behind-bitcoin-could-transform-how-economy-works-trust-machine.

22. Letouzé, Emmanuel (developed by UN *Global Pulse*). 2012. *Big Data for Development: Challenges & Opportunities.* Available from http://www.unglobalpulse.org/sites/default/files/BigDataforDevelopment-UNGlobalPulseJune2012.pdf.

23. Tapscott, Don. 2013. *Global Solutions Networks.* Available from http://issuu.com/globalsolutionnetworks/docs/introducing-global-solution-network/1?e=9482313/6974754.

specific attributes of the electricity produced, such as generation type, vintage, and location.

Environmental Commodities: Carbon Offsets

A carbon offset represents a reduction (or avoidance/removal) in emissions of one metric tonne of carbon dioxide equivalent (tCO2e) created in order to compensate for an emission of one tCO2e made elsewhere. As carbon offsets represent a reduction in relation to another emission, they are predicated on the principle of additionality, meaning that the reduction of one mtCO2e would not have taken place in the absence of carbon finance. To protect environmental integrity, standards and methodologies are developed to help ensure that GHG emissions reductions from carbon-offset projects are real, measured, monitored, reported, verified, additional, and permanent. Additionality, however, is irrelevant when the objective is to manage carbon risk. Rather, the ability to gauge and compare carbon intensity becomes key to decision making.

Sustainability Initiatives: Standards and Certifications

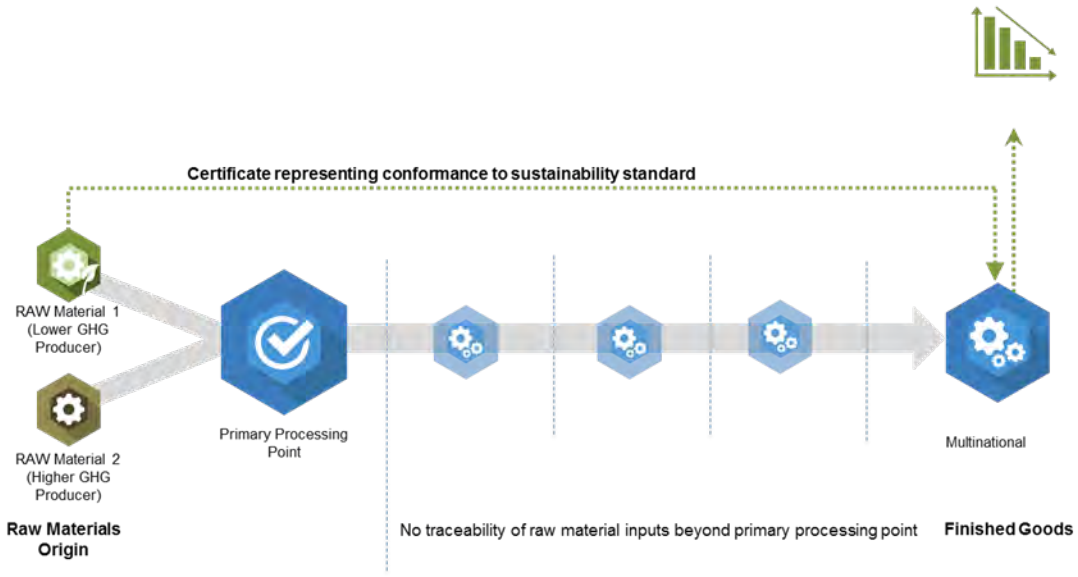
Many sustainability standards and certifications, amounting to approximately 500 "eco-labels,"[24] have been developed and are used by companies to demonstrate performance related to various environmental, social, governance, and ethical issues—and the number of standards is increasing.[25] Compliance with such standards is often voluntary and usually third-party assessed. As a result of the proliferation of standards and eco-labels, efforts are now underway to assess the quality of the standards and eco-labels themselves. ISEAL, which has established a set of principles to ensure that standards and eco-labels are credible, is an example of the trend. In some cases, certification standards can differentiate commodities and the related products—for example, Palm Oil Certificates

24. Big Room Inc. *Ecolabel* Index. Available from http://www.ecolabelindex.com.

25. Rural Infrastructure and Agro-Industries Division (AGS); Food and Agriculture Organization of the United States (FAO). 2013. "Voluntary Standards: Impacting Smallholders' Market Participation." Policy Brief (July). Rome, Italy: AGS and FAO. Available from https://unfss.files.wordpress.com/2015/10/fao-publication-on-impact-of-vs-on-smallholders.pdf.

(Figure 4).[26] While these types of standards can influence market choices, they typically do not provide verified, quantified greenhouse gas emission metrics, and the extensive procedural requirements unique to different industries and geographic regions limit these standards from reaching global scale.[27]

Figure 4: Illustrating the Indirect Crediting Approach Developed by the Roundtable on Sustainable Palm Oil, Whereby Certificates Representing Sustainable Palm Oil Are Sold to End Users



Sustainability Initiatives: Direct Supply Chain Investment

Driven by stakeholders and shareholders to demonstrate action, particularly in reducing GHG emissions within the supply chain, and frustrated with the lack of options, multinationals have begun developing direct investments in their supply chains. Direct supply chain investment, known also as "carbon insetting" can be defined as a partnership–investment in an emission reducing activity within the sphere of influence or interest of a company (outside WRI/WBCSD Scopes 1 and 2), whereby the GHG reductions are acknowledged to be created through partnership and where mutual benefit

26. Roundtable on Sustainable Palm Oil (RSPO). 2015. "About Us." RSPO. Available from http://www.rspo.org/about.

27. May-Tobin, Calen. 2013. "What's in a Name? Why the RSPO's Definition of "Sustainable" Falls Short." Blog: *The Equation* (September 19). Union of Concerned Scientists. Available from http://blog.ucsusa.org/calen-may-tobin/whats-in-a-name-why-the-rspos-definition-of-sustainable-falls-short-248.

is derived.[28] These proactive steps show that demand for *low-carbon measures* within the supply chain exists, but insetting can be costly, is inherently discreet and, thus, difficult to scale. Additionally, insetting does not require third-party verification to ensure quality.

Challenges

Regardless of the approach, one attribute is essential to any claim representing an intangible attribute or benefit: *integrity.* In order to ensure integrity, two things are required: (1) a standard to define a practice, process, or attribute, and (2) verification that the requirements of the standard have been met. To date, integrity has come at the cost of efficiency and scale. A second required attribute *is economic viability,* which requires efficient allocation of capital within reasonable timeframes. The final attribute is *relevance:* the solution must be directly aligned with business operations today.

Standards

International standards provide economic benefits through transaction costs, by improving trade via harmonized technical specifications that assure the safety and performance of products, and by assuring that products are safe. However, most standard development systems require significant cost and time. A typical ISO standard requires 3 to 4 years of development; involves up to fifty experts at international meetings and hundreds of experts for national level meetings; and can cost $1 million a page to develop.[29] In addition, the high cost and long timelines can prevent the right experts from being able to participate in development or review, leading to a lack of credibility in the finished standard. The demand for standards is increasing, exacerbating the lack of access to qualified experts, and resulting in duplication and lack of a standard approach. Any truly effective solution must solve the standard development challenges by creating a globally recognized standard process that is cost effective, engages experts in a timely manner, and involves regular updates.

Verification

Given the recent discovery of the VW emissions deception and ongoing distrust of voluntary action, independent assurance of environmental claims is essential. If we look at compliance carbon markets where integrity of carbon offsets is critical and rigor is high,

28. Tipper, R., N. Coad, J. Burnett; reviewer: M. Brander. 2009. "Is 'Insetting' the New 'Offsetting'?" Technical Paper TP-090413-A. *Ecometrica Press.* Available from http://ecometrica.com/assets/insetting_offsetting_technical.pdf.

29. International Organization for Standardization (ISO). Available from http://www.iso.org/iso/home/standards_development.htm.

we find many challenges to scale: the verification process is manual, expensive, and time consuming; it involves repeated reviews of the same documentation or locations; and it is all done without a central repository for data. Additionally, verification bodies, while accredited, are currently engaged and paid by project developers, thus creating a need to "audit the auditor."

Market Economics and Capital Allocation

The economics and capital delivery mechanisms of existing environmental incentives, with the notable exception of RECs, are a major impediment to scale. Carbon offsets are the most indicative of this particular challenge, but the challenges are not solely limited to offsets. Contributing factors to this challenge include the following:

- Project versus Production-Based: Carbon offsets are developed as individual projects in which capital outlays associated with credit generation typically occur in advance with the expectation of a return on investment in the future. The return on investment would be in the form of an "annuity stream" from the sale of offsets. This project approach is not easily transferable to production models in which marginal units are produced incrementally, based on marginal returns.
- Past versus Future: In the case of carbon offsets for compliance markets, issuance takes place long after the project-related emissions reduction activities have taken place, usually from six months to several years later. This is consistent with compliance carbon markets themselves, which are designed in such a way that participants demonstrate compliance at the end of a specified term. This "backward looking" view is antithetical to global markets in general (financial, commodity, or other), which are forward looking in nature. In the case of raw materials, the futures market provides the assurances and facilitates capital flows for producers. Integration of environmental impacts in existing commodity markets will require that they be valued in a manner consistent with the valuing of raw materials themselves.

Financial Benefits: Quantifying the benefits of conformance to various sustainability certifications remains a significant challenge—particularly for smallholders or other less sophisticated raw material producers.[30]

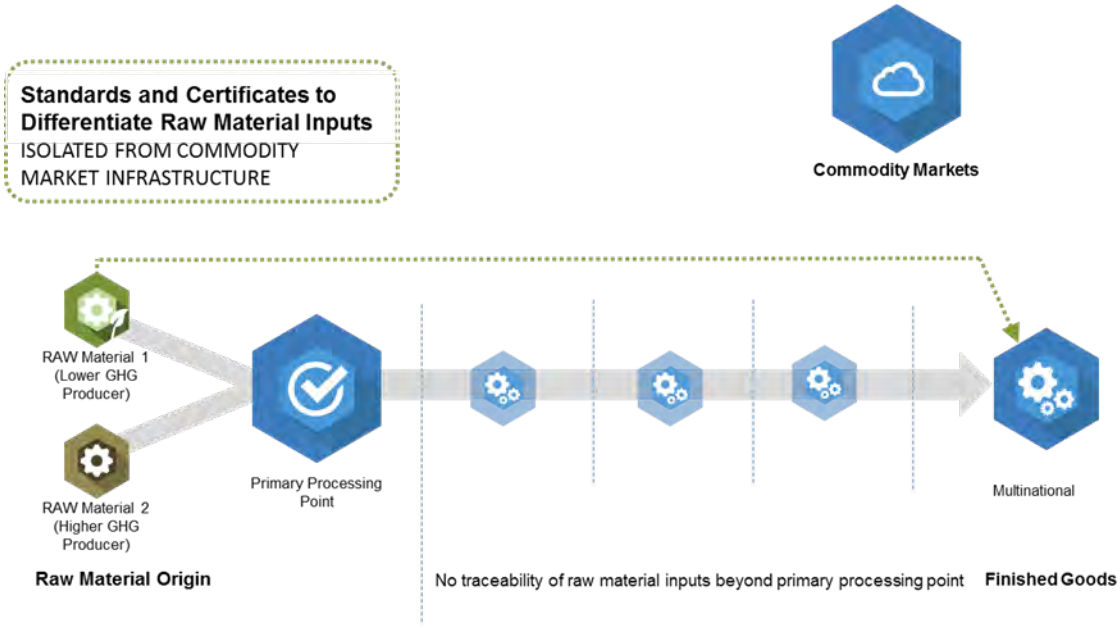
Relevance

The biggest challenge to the adoption of *low-carbon sourcing* and production methods for raw materials is that current approaches *are not integrated with commodity markets*

30. AGS; FAO, "Voluntary Standards." Available from https://unfss.files.wordpress.com/2015/10/fao-publication-on-impact-of-vs-on-smallholders.pdf.

(Figure 5). The backbone of the commodity market, the futures contract, stipulates desired product attributes for future delivery. By engaging in a futures contract, commodity producers gain price certainty and make more informed production decisions.

Figure 5: Current Solutions Are an Afterthought to Business Practice and Excluded from Market Decision Making



Incentivizing *low-carbon* commodity production requires that related carbon externalities be incorporated into commodity markets and aligned with the existing mechanisms for transacting physical commodities. Until this happens, ancillary efforts to address the issue will be insufficient to drive low-carbon commodity sourcing on a global scale.

Introducing the Carbon Impact Factor

Taking a systems perspective, we can apply proven technologies with established precedents in environmental standards and commodities and address the capital markets' drive to quantify and minimize carbon risk in global markets. We have conceptually designed a family of low-carbon financial instruments that is apolitical, cost efficient, scalable, extensible, and relevant and that possesses market-worthy integrity. The solution allows buyers of commodities to invest in low-carbon production practices and rewards the producers that implement those low-carbon practices.

Introducing the Carbon Impact Factor (CIF): a family of quantified, serialized, cryptographic, blockchain-enabled financial instruments to quantify and value the carbon efficiency associated with the sourcing and production of various commodities. The CIF combines components of RECs, carbon offsets, carbon insets, and sustainability certificates to create a new form of efficiency currency that can be quantitatively valued in commodity sourcing decisions. Further, CIFs can be purchased by multinationals to demonstrate and communicate their efforts to reduce carbon intensity (risk) within their supply chain. For the purposes of this paper, carbon intensity means the carbon emissions per unit of production whereas the carbon efficiency represents relative comparison of carbon intensities either between two units of production or in relation to an established point of reference. Depending on sector and application, the CIF can

A. Represent carbon efficiency in relation to an accepted point of reference for carbon intensity within a given sector (enabling fungibility). For example, an industry sector has developed a methodology to quantify GHG emissions and established an accepted reference point of 5 $mtCO_2e$ of GHG emissions per unit produced for given Raw Material Input. Raw Material Producer A is verified to utilize processes that result in 4 $mtCO_2e$ according to the methodology, resulting in 1 CIF being generated for each unit of production.

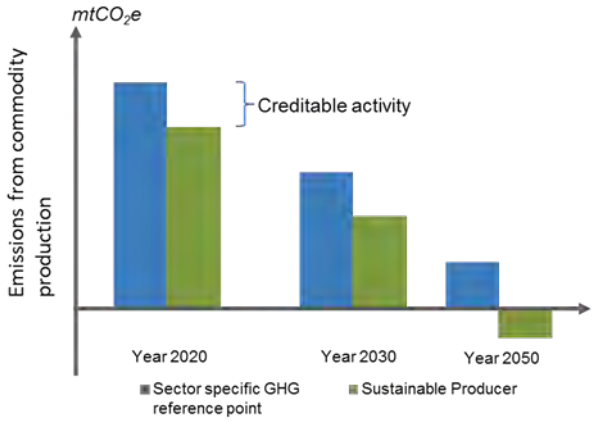
B. Represent carbon intensity by input source, enabling direct comparison between specific inputs. As an example, one unit of Raw Material X could have a footprint ranging from about 3 to 20 tCO_2e.[31] A CIF could be derived from the inverse of the footprint, multiplied by a factor for convenience of use to generate a

31. Reijnders, L., and M.A.J. Huijbregts. "Palm oil and the emission of carbon-based greenhouse gases." 2008. *Journal of Cleaner Production* 16(4): 477–482. Available from http://www.sciencedirect.com/science/article/pii/S0959652606003593.

comparative score. For a unit Raw Material X whose production generates 5 tCO2e, 1/5 x 100 = 20. For a unit of Raw Material X whose production generates 10 tCO2e, 1/10 x 100 = 10. The former results in a CIF score of 20 per unit and the latter in a CIF score of 10 per unit, enabling a direct comparison of carbon efficiency between the two units.

These are illustrative examples of how CIF can be applied in global markets to value carbon efficiency; there are likely others depending on sector, processes, and sophistication or accessibility of the technology. CIF is not a carbon offset, nor a carbon inset. It is a measure of carbon efficiency (Figure 6). The unit not only incentivizes the production of each commodity with carbon efficiency as a consideration, but it also incentivizes the selection of commodities with higher carbon efficiency.

Figure 6: The Creditable Carbon Efficiency Is Transformed into a CIF (over time, carbon efficiency increases)



Because CIF is a dynamic measure of carbon intensity in relation to an accepted point of reference or a direct comparison within a given sector, it can drive compounding benefits over time as carbon efficiency increases—from low(er) carbon to carbon neutral and, in some cases, eventually to carbon negative. There are already examples of very low carbon[32] and carbon negative inputs[33] emerging in GHG intense sectors like cement and polymers.

32. VHSC. "PozzoSlag." Available from http://www.pozzoslag.com.

33. Newlight Technologies. Available from http://newlight.com.

The CIF System

The first step in the CIF system is the creation of globally accepted standards to establish processes and quantification methods. Stakeholders (industry participants, standards body, verifiers, NGOs, and technical experts) utilize global solutions platform to generate a globally accepted standard within a given sector. Figure 7 illustrates the key elements of the CIF System, which are outlined in Figure 8.

Figure 7: An Overview of the CIF System

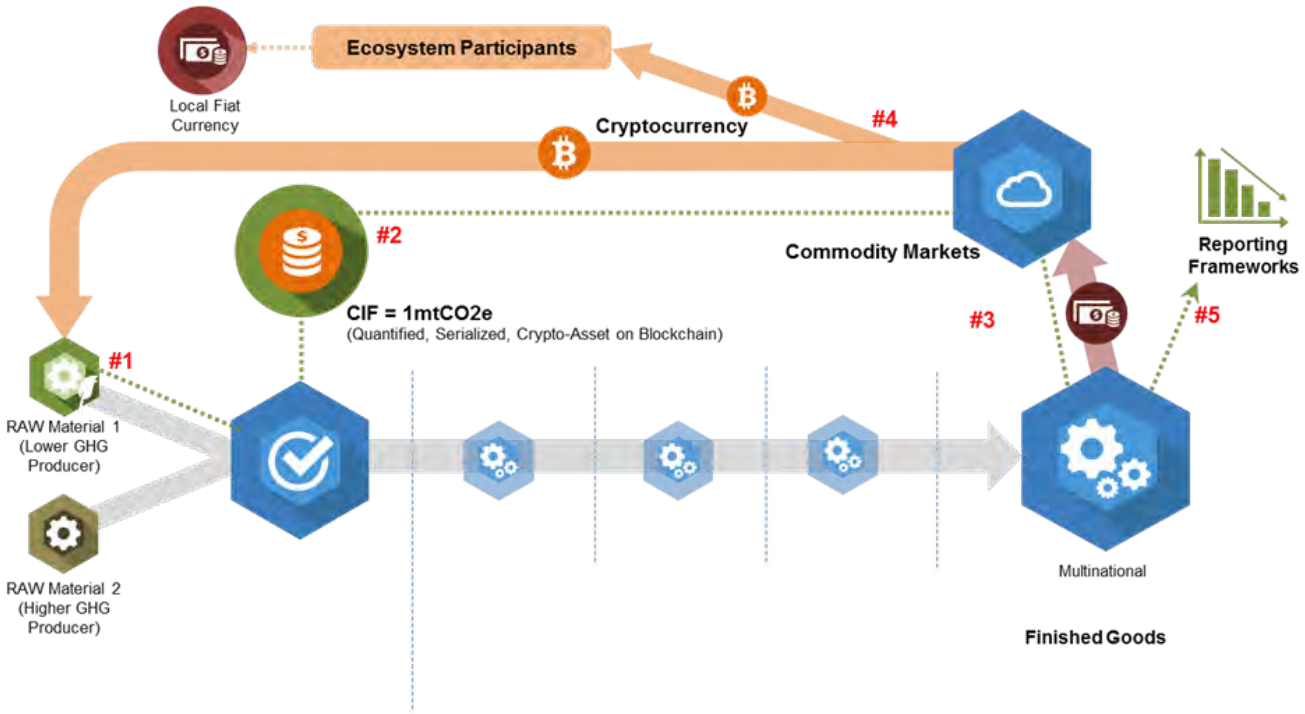


Figure 8: Corresponding Outline of the CIF System

	Action	Process Description
1.	Individual producer receives certification for raw materials it generates and sends to market	Raw material producer undergoes certification to determine the specific GHG impacts of its materials (impact score) in relation to the accepted reference point. The certification is time bound.
2.	Materials produced and metrics decoupled	Raw material producer generates and ships materials to primary processing point. Logistics data (origin, destination, volume) and impact score are applied against an algorithm prescribed by accepted standard to generate metrics. Metrics are decoupled and translated into unitized, serialized data sets (CIFs) representing 1 tCO_2e with relevant data (origin, destination, volume, etc.) placed into the producers' crypto account.
3.	Metrics transferred to Finished Goods Seller	CIF is transferred to Finished Goods Seller's crypto wallet.
4.	Market values metrics and ecosystem is paid	Commodity trader receives payment for CIF. Payments from commodity trader can be made in cryptocurrency and instantly transferred to ecosystem participants' crypto wallets, in accordance with pre-existing contracts, while all remaining value is transferred to the producer's account. Ecosystem participants include standards body, verification providers, methodology developers, supporting NGOs, and reporting frameworks.
5.	Finished Goods Seller retires metrics, makes claim	Finished Goods Seller retires CIF units such that they cannot be transferred to any other crypto account and reports to GHG reporting body and/or other stakeholders. Retired units can be visible to ensure integrity.

Ecosystem participants receive payment in cryptocurrency and then exchange it back into their local fiat currency. Commodities delivered to market by the producer continue to produce CIFs, being monitored by third-party data (satellite or GPS; industry reports; sales; government; and public databases are used to identify anomalies in metrics generations). Any anomalies are investigated in depth to ensure the integrity of the system.

Integrity: Standards

Externalities associated with commodity extraction or production are separate from the materials themselves and cannot be detected or traced once the materials enter an undifferentiated flow. Thus, any claims or information associated with the extraction or production of material must be verified to be in conformance with a globally accepted standard that is, itself, produced in accordance with a globally accepted standard framework governing the development, use, and management of standards.

An integrated ecosystem for standards certification to support global market functions for externalities requires that standards be developed by experts across international boundaries who adhere to professional governance and are incentivized to participate. The experts must be able to collaborate openly to foster knowledge creation and expedite quality, which requires access to relevant data and metrics and the tools to translate data into intelligent decisions.

The evolution of Global Solutions Networks (GSNs) empowered by information and communication technology enables the rapid and low-cost development of (1) global standards to quantify the carbon intensity of practices and materials for raw material inputs by sector, (2) the framework to ensure consistent and compatible standards[34]within an interoperable system, and (3) the resources to apply the standards for quantification and decision making,[35] as well as assurance credibility.

Further, GSNs support the specific functions necessary for scalable application of standards, including but not limited to

1. Building and managing an open standards system as well as the development of specific protocols according to internationally accepted standards in a virtual environment;
2. Peer review between developers and standards validators (that is, an expert peer-review network);
3. Stakeholders (for example, producers, market participants, and NGOs) access the online standards and resources (such as via a "Standards Appstore") to use with

34. Aligned with the new ISO 14080 Guideline—Framework with Principles for Methodologies on Climate Actions.

35. Baumann, Tom; Stephanie Powers, Francisco Fraga, Sandra Odendahl, Angela Baker, Brendan Guy, Jacob Scherr, Spencer Schecht. "Climate Change." 2015. In Global Network Solutions *Summit 2015: Applying New Models of Global Problem Solving and Governance* (February 19–20): 10. Available from http://gsnetworks.org/wp-content/uploads/GSN-DC-Summit-Report.pdf.

online decision-making tools (for example, GHG emission-intensity calculators) to assess and value carbon efficiency in decision making;

4. Virtual standards-based reporting (producers);
5. Support for assurance of reports and claims, thus reducing time and cost.

The application of technology in the creation and maintenance of global standards enables the uniformity and assurances required by markets.

Integrity: Validation

In the CIF ecosystem, programmatic validation occurs in two ways: by initial audit and through ongoing validation:

1. The *initial audit* inspects producers' extraction or production methods to ensure they have the systems and procedures in place that comply with the globally accepted standard for low-carbon production and that data generation and reporting mechanisms are sufficient to support ongoing validation. This is not a verification of data or an assessment of the implementation of a practice that is equivalent to the concept of verification in today's carbon offset markets. Rather, this step validates that the systems and processes at the raw material producer conform to global standard criteria.

2. During *ongoing validation,* data sources will be mined to detect anomalies in reporting from CIF ecosystem participants. Data sources will include production data, government and industry group data, satellite data and imagery, and automated purchase and delivery ledgers. The data will be analyzed using computer-based algorithms and big data analysis techniques. Audits will occur both in the case of detected data anomalies and on an ongoing basis. The ongoing audits will be derived from a risk-based assessment.

The new verification model will be closely aligned with commodity "production" rather than the current project-based approach associated with carbon offsets. Once a raw material producer is validated to conform to the standard in an initial audit, all production that follows will generate CIFs in conformance with the applicable methodology on an ongoing basis for the term defined by the standard. Big data generated by third parties can then be analyzed. Spot audits can be carried out to ensure continued conformance with the standard, but, to the extent possible, data capture and analysis will be automated. Technological advances make this increasingly feasible. For example, remote sensing technologies can be both more accurate and timelier than measurements taken manually and only at a discrete point in time. Once standards and validation processes are in place,

data can be applied to an algorithm prescribed by the methodology to quantify carbon intensity.

Reporting Frameworks

The data generated can be seamlessly shared with and incorporated by both voluntary (CDP, SASB, etc.) and regulatory (national, subnational) GHG reporting frameworks to demonstrate carbon efficiency (reduced risk) as well as compliance with carbon reduction measure.

Capital Allocation, Fraud Prevention, and Security

As noted, the allocation of financial capital for intangibles like carbon impacts at the base of the supply chain is either nonexistent or inefficient within environmental commodity markets today.

The emergence of blockchain technology provides an opportunity to efficiently allocate financial capital across the ecosystem while simultaneously ensuring that the value created through CIF generation cannot be exploited through double counting.

Blockchain technology enables the encryption of all relevant data required for CIF generation in a data set that can only be held by a single entity at a given moment in time, while making the CIF's entire history transparent. The blockchain would track a CIF from the point of creation and enable its retirement to prevent subsequent use ("irreversible corruption").

Upon availability to the commodity marketplace, CIFs can be exchanged as a globally recognized crypto-asset that trades on multiple cryptocurrency exchanges. CIFs have the potential to become the "currency of carbon efficiency" or in blockchain terminology, "proof of efficiency." CIFs can be transferred directly to ecosystem participants' cryptocurrency wallets in accordance with contracted terms. Alternatively, ecosystem participants can chose a crypto-aware financial institution to convert their CIFs to bitcoin or to their local fiat currency. Blockchain technology is used to efficiently track CIFs as they move downstream from the producer and bitcoin (or other globally accepted cryptocurrency) can be used to quickly and efficiently pay the network of globalized (potentially small holder or unbanked) producers who lack the ability to engage in sophisticated OTC credit transactions, wire transfers, and currency exchanges.

CIF Vision: A Building Block to Value All Forms of Capital

In a world with a scientifically defined carbon budget, carbon inefficiency will not be tolerated. Recent developments in the capital markets are indicative of this trend, but it is

still early. Carbon efficiency will increasingly become an economic and strategic imperative, and only the most carbon-efficient resources will be consumed, forcing the differentiation of raw material inputs (oil, natural gas, steel, palm oil, cement, refrigerants, etc.), including the variable aspects of carbon intensity related to production and sourcing.

In a carbon constrained world

- A barrel of China Bozhong ≠ A barrel of Norway Ekofisk
- A ton of concrete containing fly ash ≠ ton of concrete containing Portland cement
- Recycling a liter of motor oil ≠ Producing a new liter of motor oil
- Recycling a kilogram of HFC ≠ Producing a new kilogram of HFC

The differentiation of previously undifferentiated materials in global markets poses a challenge, but also provides an opportunity. Even in a scenario with a binding international agreement on climate change, CIF provides a foundational financial instrument to store and value carbon efficiency within the infrastructure of global commodity markets. Further, by focusing on raw material inputs at the base of the global supply chain, CIF is complimentary to national, subnational, and corporate efforts, enabling a cost-efficient way to harness the power of the market economy to rapidly deploy capital toward increasingly carbon-efficient practices that minimize risk.

By linking institutional investors' desire to minimize risk (through data transparency and integrity) with the desire of raw material producers to maximize value (through direct access to market demand), an economically viable self-reinforcing system emerges as a solution for carbon efficiency.

The Carbon Impact Factor represents a point of origin, not a destination. If the human community is to realize the world envisioned by the UN Sustainable Development Goals (SDGs), existing markets must be part of the solution. This paper focuses solely on carbon, but the mechanism is extensible to other intangibles that represent both risk (liabilities) and benefits (assets) in a market context. We look forward to building out the concept and attaining a sustainable future in which global markets incorporate and value all forms of "capital."

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Glossary

Bitcoin	A type of digital currency in which encryption techniques are used to regulate the generation of units of currency and verify the transfer of funds, operating independently of a central bank.
Big Data	A broad term for data sets so large or complex that they cannot be adequately analyzed by traditional data processing applications.
Blockchain	A distributed database of cryptocurrency transactions and account balances. "The Blockchain" refers to the Bitcoin blockchain, but there are other cryptocurrencies with their own blockchains.
Carbon Risk	Financial institutions such as pension funds and insurers are exposed to risks through the climate change impacts of the companies they invest in. These impacts could affect the profitability of portfolio firms, reducing returns. The risks come from tougher legislation enacted to control carbon emissions, which could greatly increase costs, for instance by requiring firms to pay for emissions allowances or carbon taxes, or forcing them to invest in ***low-carbon technology***. Firms in highly carbon-intensive sectors, such as fossil fuels, are also at risk of reputational damage from negative media coverage. http://www.theactuary.com/features/2015/06/carbon-risk-how-do-we-measure-and-manage-it/
CDP	Carbon Disclosure Project
CIF	Carbon Impact Factor

Crypto-Asset	A crypto-asset is a digital asset that is stored and transferred on a blockchain. It is different from a cryptocurrency in that it is intended not for use as a currency for general transaction but to represent an asset digitally. Crypto-assets may represent dollars in a bank account, gold in a warehouse, or an environmental asset like CIFs.
Crypto-Wallet	A digital keychain. The wallet contains the private keys that can be used to spend the cryptocurrencies owned by the holder. The wallet holder has the keys to spend the coins they own.
ETF	Exchange traded fund
GHG	Greenhouse gas
GHG Emission Reporting	Categorized into three scopes as defined by the World Resources Institute (WRI) and World Business Council on Sustainable development (WBCSD)
Global Solutions Network	"A fundamental change underway in how we govern ourselves on this shrinking planet. Emerging networks of civil society organizations, private companies, governments, and individuals are coming together in powerful new ways, enabled by digital technology, to achieve new forms of social innovation—advocating for and delivering solutions for global problems. Enabled by the digital revolution, multi-stakeholder, self-governing networks are transforming how we solve global problems. GSNs are characterized by addressing a global problem, engaging diverse stakeholders, exploiting the digital revolution and self-organizing and self-governing."
INDC	Countries across the globe committed to create a new international climate agreement by the conclusion of the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP21) in Paris in December 2015. In preparation, countries have agreed to publicly outline what post-2020 climate actions they intend to take under a new international agreement, known as their Intended Nationally Determined Contributions (INDCs). The INDCs will largely determine whether the world achieves an ambitious 2015 agreement and is put on a path toward a ***low-carbon***, climate-resilient future.

ISEAL	Global membership association for sustainability standards. The mission of ISEAL is to strengthen sustainability standards systems for the benefit of people and the environment.
Mobile Technology	Technology that is portable; it refers to any device that you can carry with you to perform a wide variety of tasks. It is technology that allows those tasks to be performed via cellular communication (phones, PDAs, vehicles, laptops, etc.)
REC	Renewable Energy Credit
SASB	Sustainability Accounting Standards Board
Scope 1	Emissions are direct emissions from owned or controlled sources.
Scope 2	Emissions are indirect emissions from the generation of purchased energy.
Scope 3	Emissions are all indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions.
SDG	Sustainable Development Goals
WBCSD	World Business Council on Sustainable Development
WRI	World Resources Institute

Climate Change Finance Data: Looking Under the Hood

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Abstract

This paper describes the current state of financial data as it relates to climate change mitigation. The authors present a comprehensive approach that explains how this data flows—from company reporting to investment products—and that includes all the players and steps in between. At present, the usage of such data is limited or in very rudimentary stages of collection and aggregation; however, increased comprehensiveness and sophistication can be expected as the industry matures and as asset owners and managers demand more consistency. The purpose of this report is to help asset owners and managers think more critically about how to incorporate climate data into their investment decision-making.

Climate Change Finance Data: Looking Under the Hood

Disclaimer: *This paper does not claim to provide any guidance on investment in any particular investment products and is not a solicitation of investment.*

Introduction

As we move out of one of the warmest average years in recorded history, 2016 is already shaping up to be a salient year of globally focused discussion around one of the most important issues facing the planet: climate change. A number of events in mid to late 2015 held the attention of government officials, business leaders, and citizens across the globe.

Pope Francis's inaugural visit to the United States in September 2015 marked a moment of intense focus around the impacts of climate change on the world's poor. The Pope's visit also coincided with the United Nation's formalization of the new Sustainable Development Goals, which aim to integrate economic, social, and environmental issues globally. Then, from November 30 to December 11, leaders from around the world gathered for the 2015 Paris Climate Conference (COP21), and achieved a universal agreement on climate with the aim of keeping global warming below the internationally

agreed upon 1.5 degrees Celsius.[1] This was the first time a global climate agreement emerged in over 20 years of UN negotiations.

Any conversation about climate change would be remiss without acknowledging the decline of the coal industry over the past several years as a result of regulations, societal demand, and the growing reliability of alternative energy sources. The Obama Administration, for instance, has placed a moratorium on new coal mining leases on federal lands and a review of the federal program that allows mining companies to extract coal at a cost that is not necessarily reflective of the broad environmental impacts, or the low returns to taxpayers (Kershaw 2016). Furthermore, while the long-term trends in oil remain to be seen, and the reasons for the recent price volatility are complex, the recent downward trend in prices over the past several years sends a signal to the market that a transition to a low-carbon economy has greater potential in multiple aspects of the global economy.

Investors play a critical role in transitioning large amounts of capital toward a lower carbon economy that can help mitigate and adapt to climate change. Several trends have begun to gain momentum.

One significant shift occurred between 2011 and 2015—divestment of fossil fuels from portfolios representing almost $2.6T in assets under management (Arabella Advisors, 2015).[2] Notable universities (Stanford), cities (Seattle), foundations (Rockefeller Brothers Fund), faith-based institutions (Church of England), and pension funds (Norway sovereign wealth fund) have joined the movement (Fossil Free, 2015). Figures such as US Secretaries of the Treasury Hank Paulson and Robert Rubin, Governor of the Bank of England, Mark Carney, Bob Litterman, former head of risk management at Goldman Sachs, and David Swensen, who has revolutionized endowment investing through Yale University, have presented strong statements supporting the consideration of climate risk in the investment process.

Companies that hold fossil fuel reserves as part of their asset base are at risk of having those reserves stranded as more governments take action to reduce emissions and adapt to climate change. The "Stranded Assets" argument poses that a majority of these reserves will likely be difficult to sell if the world takes steps to limit global temperature rise. While carbon emissions are not priced at a global level, the growing number of national and regional carbon regulations signals that a price of carbon is becoming more common across markets.

1. This figure refers to global average temperature and is relative to the pre-industrial level.
2. Assets Under Management for this figure represents the total Assets Under Management represented by the firms who have pledged to divest from fossil fuels.

According to The Carbon Tracker Initiative's 2013 report, between 60% and 80% of the world's coal, oil, and gas reserves of publicly listed companies are "unburnable" and at risk of becoming stranded. An expectation that companies can no longer sell these reserves would significantly affect financial markets (Campanale and Leggett 2011 and 2013). Climate change also presents opportunities for companies that might gain a competitive advantage through stronger climate regulation and/or changes in public sentiment.

Investors are increasingly seeking to mitigate and adapt to climate change through their portfolios from a moral perspective and a long-term economic value perspective. Many investors do not want to profit from, and contribute to, the destruction of natural ecosystems and disenfranchised communities (World Health Organization, 2015). Long-term investors such as endowments and pension funds plan their investments in decade-long timeframes and the impact of climate change is a significant risk to future economic growth.

Many investors have already begun to change the way they invest their capital in order to change the trajectory of capital flows towards a lower carbon economy. The agreement in Paris already catalyzed a pledge for financial support for poorer countries beyond $100 billion a year after 2020.

Significant capital has already begun to flow. New York State's $183.5 billion Common Retirement Fund just pledged, for instance, to double its $1.5 billion sustainable investment program. It's pledge includes committing $2 billion to a new index that will exclude or reduce investments in companies that are large contributors to carbon emissions and increase the Fund's investments in companies that are lower emitters (DiNapoli 2015). The number of climate-focused investment products, and associated data standards, has also increased to support this growing movement of institutions and individuals interested in divestment and/or reinvestment approaches. However, significantly more capital is needed. According to the International Energy Agency, meeting the COP21 pledges will require $13.5 trillion of energy-saving and low-carbon investments over the next 15 years.

With the rapid advancements in data and product development, the landscape of climate finance can seem overwhelming and circuitous to many investors. Disclosure of companies' contributions and risks related to climate change is often weakly regulated, as is the case in the United States. Thus, climate data can be difficult to find and update, unstandardized, filled with gaps, or simply irrelevant. A better understanding of the investment approaches and products available—as well as the underlying data that support these products—can empower more investors to join the climate investing movement. It is also critical for investment managers to understand the origins and limitations of the

underlying data, so that they can better support their client's decisions if they choose to reduce the carbon exposure in their portfolio.

While the number of climate-data providers has increased over the past decade, a lack of standardization in data collection, aggregation, and reporting can hinder effective analysis and the integration into investment decision-making. The first step for climate-focused investors and their advisors is to understand the different types and uses for climate data collection.

This paper also aims to explain the difficulties investors face in sorting through the climate impacts of any particular company or investment product that professes to be "low carbon" or "fossil fuel free." Principally, this report serves as the beginning of a roadmap for investment managers who are guiding their investment clients along the pathway to lower carbon investing. It provides a summary of the range of credible information sources related to climate change and investing.

Looking Under the Hood

There are two main sources of data that are used to evaluate the impact a company is having, or could potentially have, on climate change. These include greenhouse gas emissions data and the amount of reserves that a company is holding (this applies primarily to the energy production industry). These two data sources are discussed in more detail below.

Data Type 1: Greenhouse Gas (GHG) Emissions

Climate data for companies generally focuses on the amount of greenhouse gases (GHG) that are emitted through operations, supply chain, and end users. There is a range of greenhouse gas types, and the climate impact and global warming potential from each type differs. Greenhouse gas emissions accounting procedures require that each tonne of greenhouse gas be normalized in tonnes of carbon dioxide equivalent, (tCO_2e).[3] (Figure 1 shows these normalizations.)

3. Greenhouse Gas Emissions are sometimes reported as Carbon Dioxide Equivalents, CO_2e, or in terms of the Global Warming Potential, GWP. The terms are not interchangeable, but GWP can easily be converted into CO_2e. The conversion from gases to CO_2e or GWP is purely scientific, with standards set by UNEP and IPCC.

Figure 1: Greenhouse Gas Equivalents

Name of Greenhouse Gas	Source of Emissions (Examples)[4]	Abbreviation	Normalized 100-year Global Warming Potential (GWP)
Carbon Dioxide	Living organisms and the combustion of fossil fuels through cement production, chemical processes, and so forth. (There are also numerous examples of where CO_2 is a direct-waste gas by-product of nonfuel combustion).	CO_2	1
Methane	Coal formations, landfills, livestock digestion, decomposing waste, and activities such as wetland rice cultivation and draining peat lands.	CH_4	28–36
Nitrous Oxide	Fertilizer manufacturing and application, industrial processes, and combusting fossil fuels.	N_2O	310
Hydrofluorocarbon	By-products of the manufacturing of CFCs that are used as refrigerants and in semiconductor manufacturing.	HFCs (example: HFC-23)	140–11,700
Perfluorocarbons	By-product of aluminum smelting, semiconductors, uranium enriching and substitute for HFCs.	PFCs (example: PFC-11)	7,000
Sulphur Hexaflouride	Used in cable cooling systems to insulate high-voltage equipment, and as a cover gas for magnesium production; released through these processes.	SF_6	23,900

Source: *Adapted from Sims et al. 2007.*

4. Please note that this list of examples is not comprehensive.

In 2001, the World Resources Institute and the World Business Council on Sustainable Development created the Greenhouse Gas (GHG) Protocol (World Resources Institute, 2012)—a classification system for different categories of carbon dioxide emissions to create a standardized accounting system for GHG emissions. The Protocol created three "Scopes" of emissions accounting (Figure 2). These scopes make up the current standard framework for emissions accounting.

Figure 2: The Greenhouse Gas Protocol: Scope Emissions Overview

Scope 1	Direct GHG emissions from operations owned or controlled by the organization. Scope 1 covers emissions directly generated by a company from the combustion of fossil fuels and the use of fluorocarbon gases.
Scope 2	Indirect Energy GHG emissions resulting from the generation of purchased or acquired electricity, heating, cooling, and steam consumed within the organization. Scope 2 emissions account for the emissions from purchased electricity. Electricity emissions are generated when the supplying power plants burn fossil fuels, so the emissions are not directly generated on site. Scope 2 emissions for companies are also counted as Scope 1 emissions for utility companies.
Scope 3	Other indirect GHG emissions (not included in scope 2) that occur outside the organization, including upstream and downstream from operations due to company's control.

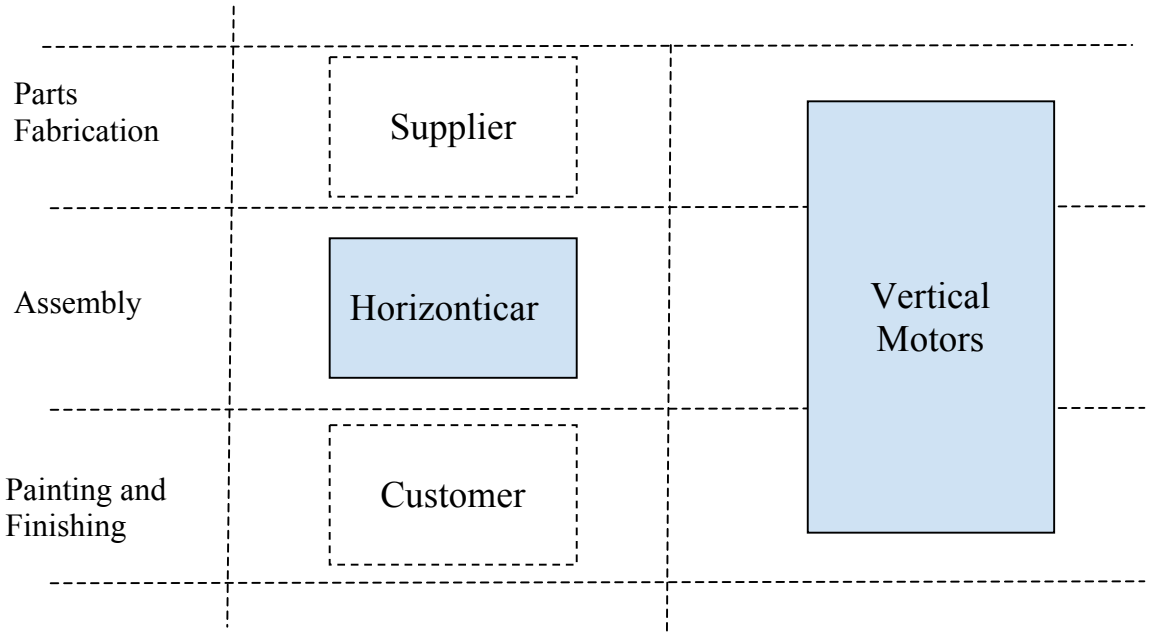
Source: *Greenhouse Gas Protocol, 2015.*

While some Scandinavian countries have since made carbon data reporting mandatory for certain industries, most countries have not. Typically, government-mandated reporting is limited to Scopes 1 and 2 only.

An example from the transportation sector can help illustrate the difference between Scope 1 and Scope 2. An automobile company's Scope 1 reporting would cover the emissions from fabricating parts, assembling cars and the painting and finishing of vehicles. Scope 2 reporting would cover the GHGs generated by the electricity and heat purchased from a utility company needed to power the assembly line. The emissions from a consumer driving the car would appear in consumer emissions, or in operational emissions of other companies using the automobiles (Scope 3).

Scope 3 emissions data is necessary, however, to compare companies at differing levels of vertical integration (Figure 3). With only Scopes 1 and 2 data, a vertically integrated company may appear to have much higher emissions than a horizontal company, while actually being significantly less carbon intensive.

Figure 3: Scope 3 Emissions Example in the Automotive Industry

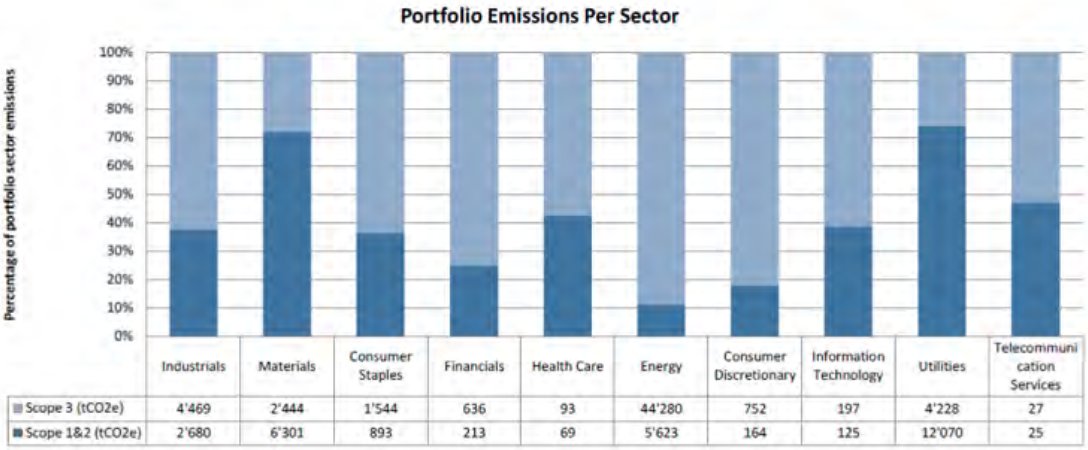


Source: *Authors, 2015.*

An auto company, "Vertical Motors," may efficiently source its own materials for building its car seats, while company "Horizonticar" purchases its car upholstery from a third party that has high emissions. Though "Vertical Motors" may be actively reducing its carbon footprint, a metric using only Scopes 1 and 2 means that "Horizonticar" has a lower total emissions footprint. Accounting for Scope 3 emissions of both companies, however, would highlight that fact that "Vertical Motors" has higher emission across the supply chain.

Scope 3 emissions are important to track because these emissions typically represent a significant portion of the total emissions. Even if impossible to measure perfectly, it is important to consider the Scope 3 emissions of certain industries and sectors in particular. Within the energy industry, for example, Scope 3 emissions would include the burning of gas or oil and represent 90% of the total emissions for the sector. The relative importance of the different GHG emission scopes in each sector is based on their relative contributions to total emissions in the sector (Figure 4). Since Scope 3 takes up a substantial portion of total emissions, investor strategies that ignore Scope 3 fail to properly account for carbon risk.

Figure 4: Portfolio Emissions Data by Sector



	Industrials	Materials	Consumer Staples	Financials	Health Care	Energy	Consumer Discretionary	Information Technology	Utilities	Telecommunication Services
Scope 3 (tCO2e)	4'469	2'444	1'544	636	93	44'280	752	197	4'228	27
Scope 1&2 (tCO2e)	2'680	6'301	893	213	69	5'623	164	125	12'070	25

Source: *"Discussion Paper: Reducing Emissions Across the Portfolio." UN Principles for Responsible Investment (UN PRI). Accessed July 22, 2015. Reprinted with permission from South Pole Group.*

Data Type 2: Fossil Fuel Reserves

A metric of increasing relevance for investors, particularly investors in fossil fuel companies, is the carbon content of a company's fossil fuel reserves.

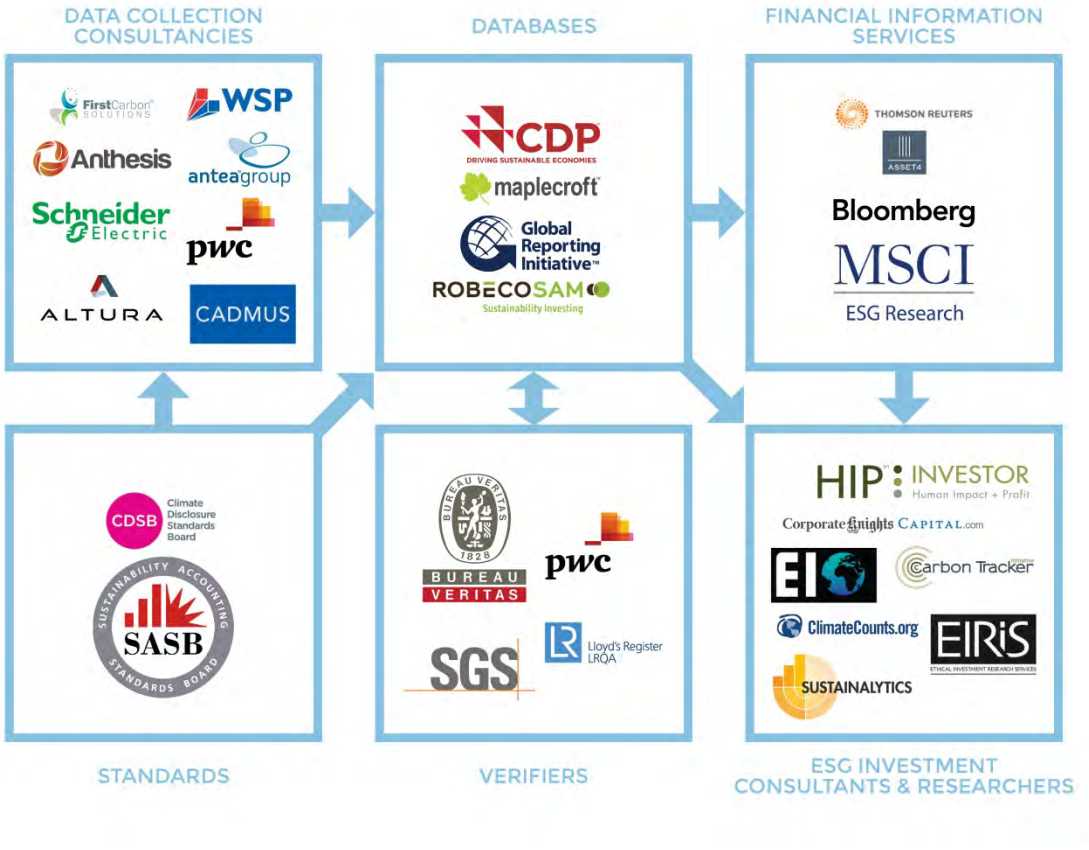
Some investor groups and nongovernmental organizations claim that companies with fossil fuel reserves are susceptible to devaluation from climate policy or alternative technologies because the valuation of these companies is heavily dependent on the ability to extract these reserves profitably. For instance, The Carbon Tracker Initiative estimates that approximately 50% of the valuation of a large oil company comes from the expected extraction of reserves at least 10 years into the future. Thus, if these reserves cannot be extracted profitably, they will be stranded and these companies could face significant devaluation (Campanale and Leggett 2011). This is referred to as the "stranded assets" argument. This reserves metric is applicable to the energy production industry and has limited use in other sectors of the economy.

The Carbon Tracker Report listed the top 100 coal reserves-owning companies and top 100 oil & gas reserves-owning companies ranked them by the potential emissions embedded in their carbon reserves (measured in Gigatons of carbon dioxide). Emissions embedded in reserves can be measured in terms of CO_2 even though the combustion of these reserves releases a variety of greenhouse gases because the global warming values of these gases can be accounted for in terms of CO_{2e} (carbon dioxide equivalent, as discussed in Figure 1).

Acquiring the Data

Five types of organizations work to bring GHG data to investors. (1) Companies or data collectors collect the initial data. (2) Standard setting agencies guide the framework for data collection, which is then entered into (3) database organizations that house the data. (4) Third-party verifiers and accountants often check the data before it is released to (5) financial information services firms, which present the information that is finally put into use by the ESG investment community, including investment firms, consultants, and research institutions (Figure 5).

Figure 5. Major Actors Involved in the Collection, Aggregation, Reporting, and Dissemination of Greenhouse Gas Emissions



Source: *Authors, 2015.*

Governments can play a role in helping to define roles for the organizations responsible for stages 1 through 4 in the sequence outlined above.[5] Regulated carbon markets around the world, including the EU Emissions Trading Scheme and the Regional Greenhouse Gas Initiative (RGGI) in the United States, collect Scope 1 emissions data on activities within the geographical boundaries of the market. The respective overseeing governments mandate the reporting of the emissions data according to its particular framework, collect the data, and employ third-party data verifiers to check the reported data. They also make this data publicly available.

Given that these data sets are regulated by governments and verified by third parties, they are rigorous, and among the most robust, granular, and reliable data sets that exist. This data collection and verification can help establish a strong foundation to support mitigation policies. Today, over 40 countries already mandate emitters (at regional, national, and subnational levels) to provide GHG emissions-related data, although the focus of these reporting requirements varies widely by country (Singh and Bacher 2015). The limitation of these data sets, however, is that they only require the disclosure of Scope 1 data. As discussed previously (Figure 2), Scope 1 does not convey the full climate risks and opportunities relevant to a company.

Companies may also disclose climate data voluntarily, due to investor pressure, because of existing or pending regulatory requirements, or to avoid litigation. On the regulatory side, the Securities and Exchange Commission (SEC), for example, ostensibly requires the reporting of material climate data (that is, emissions). Investors may also work in coalitions, such as through the Ceres Investor Network on Climate Risk (INCR), which represents US$13 trillion advocating for climate policies. INCR members consider the climate risk and opportunity of their own investments, advocate strong climate policy, and engage companies in their portfolios on climate disclosure and performance. The Climate Risk Disclosure Initiative was formed in 2005 by 14 leading investors and other organizations worldwide to improve corporate disclosure of the risks and opportunities posed by global climate change. Some companies also report greenhouse gas and carbon reserves data voluntarily for a variety of reasons, including company culture and public relations. As a result, in part, from investor pressure, Peabody Energy, a large private-sector coal company, recently reached a settlement with the New York State Attorney General to bolster its climate disclosure in order to avoid litigation (McDonnell, 2015).

5. For instance, under California's Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (MRR), industrial sources, fuel suppliers, and electricity importers must report their annual GHG emissions to the California Air Resources Board (ARB). For reporters subject to the California Cap-and-Trade Program, submitted data are verified by an ARB-accredited independent third-party verifier (California Environmental Protection Agency, Air Resources Board, 2015).

Most carbon data is incomplete because of the voluntary and unstandardized nature of the majority of disclosures, though there is still enough climate data to help guide investment decision-making from a broad perspective. For example, in 2014, the top 10% of companies responding to the CDP questionnaire received a disclosure score of 97% or above (Fox 2014). Additionally, there has been rapid improvement in the disclosure of data over the past few years. The 2014 CDP disclosure is a great improvement over the top 10% scoring 61% or above in 2008 (Fox 2014). Also, investors can join groups like the INCR to encourage companies to report more complete and thorough data.

The movement to standardize data is being led by the Sustainable Accounting Standards Board (SASB)[6] in the United States. This nonprofit organization convenes voluntary industry experts to develop a set of standard environmental, social, and governance metrics that are materially relevant to each industry.

SASB is lobbying the SEC to make the reporting of these industry-specific metrics mandatory and consistent (Figure 6).

Figure 6: SASB

SASB

The Sustainability Accounting Standards Board (SASB) was incorporated in 2011. Its mission is to establish industry based sustainability standards and to make disclosure of company information based on these standards publicly available.

Industry working groups are in the process of completing standards for 80 industry groups within 10 sectors by 2016 guided by SASB's classification system, the Sustainable Industry Classification System (SICS). These standards are designed for the disclosure of material (relevant to the prudent investor) sustainability information in mandatory SEC filings. The standards are also open to public comment as they are being developed through a transparent, multi-stakeholder process.

SASB is funded by grants and donations mainly from philanthropies focusing on climate change and investing. SASB is also working in partnership with other climate data groups such as CDP and the Climate Disclosure Standards Board (CDSB).

The UK-based CDP (originally the "Carbon Disclosure Project") is both a data collector and a database: it solicits data from companies via questionnaires, and then scores companies on their performance and their transparency (Figure 7). CDP hosts a database of responses from 70% of Fortune 500 companies (Fox 2014). Unfortunately, this data is

6. Disclosure: one of this report's authors has been involved in several of SASB's sector working groups.

impacted by the voluntary nature of the requests: many companies answer only a subset of the questions asked.

Another major growing area in carbon data is third-party verification, which relates to the issue of monitoring versus estimation. For example, PricewaterhouseCoopers is one of several used by companies that have verified the data submitted to the CDP database. Unfortunately, verifiers often evaluate unstandardized measurements, such as Scope 3 emissions, along the value chain. SASB is pioneering improved accounting standards to resolve this issue.

Figure 7: CDP

CDP

The Carbon Disclosure Project was founded in 2000 in the United Kingdom, though the official name was later shortened to "CDP." CDP is the largest source of voluntarily disclosed corporate climate data in the world.

CDP produces a comprehensive questionnaire each year on company activities relating to the environment, and communicates with companies to encourage them to fill it out. CDP publishes the responses publicly on its website, indicating when the data is third-party verified, offering a subscription service for individuals or institutions who want to download large chunks of data at once.

CDP is funded by a mix of subscription, philanthropic, government, and corporate sponsors.

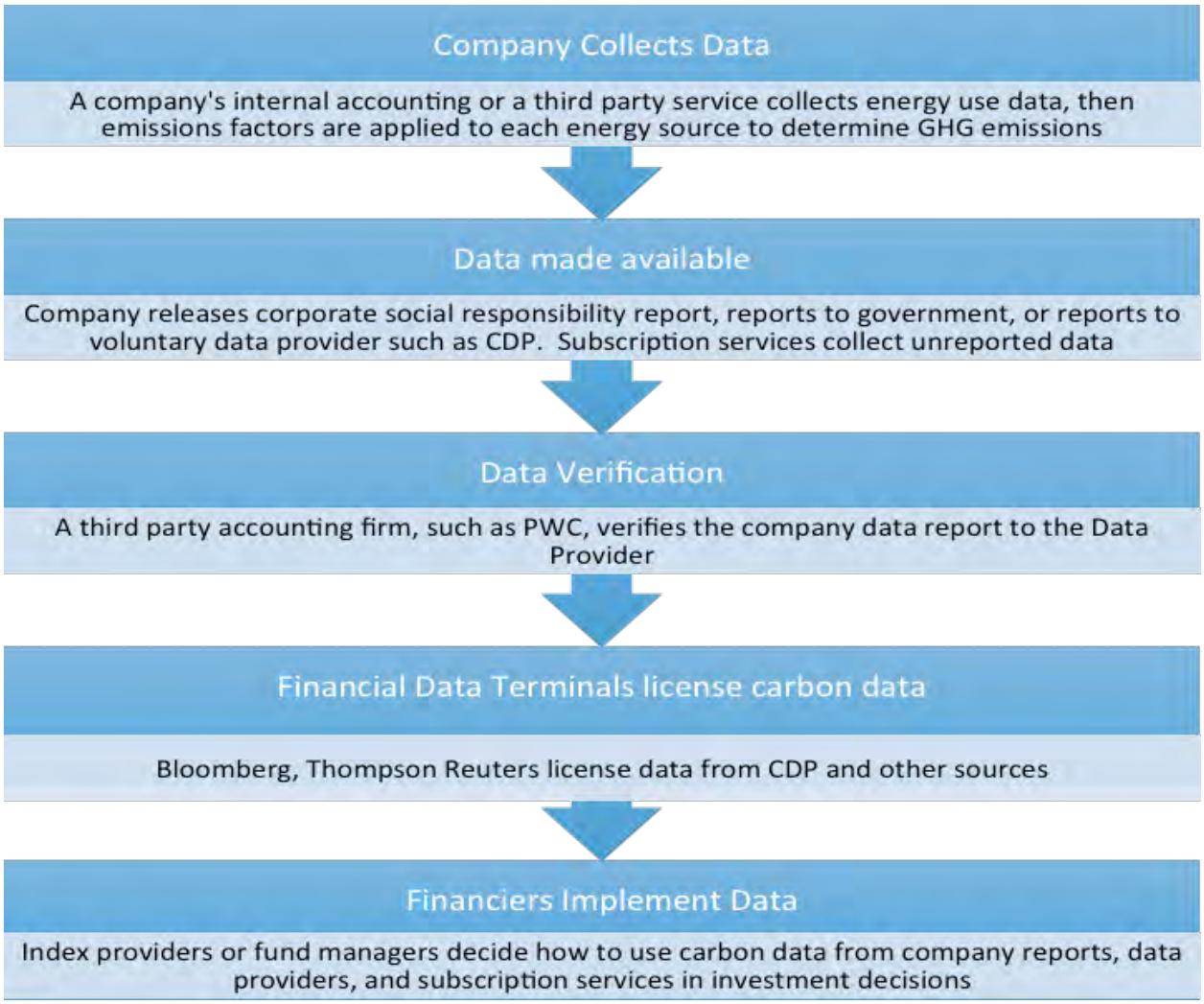
CDP collects data on a variety of climate risks and greenhouse gas emissions data reported by companies. From this data, CDP produces several quantitative disclosure and performance scores for companies based on the data they provide and how well they perform relative to industry peers. High marks are also given for qualitative categories, including whether a company has designed and implemented a sustainability plan.

By the time disclosed carbon data reaches the screen of a financial terminal like Bloomberg, it has already passed through many phases. The data first had to be requested by a data collector, government, coalition of investors, or a database such as CDP. Then, the company has to collect the data to the best of its ability and submit that data to a database. Subsequently, a third party is often commissioned to verify that data. Finally, an entity like Bloomberg holds a license with that data provider to acquire the data.

Flow of Data

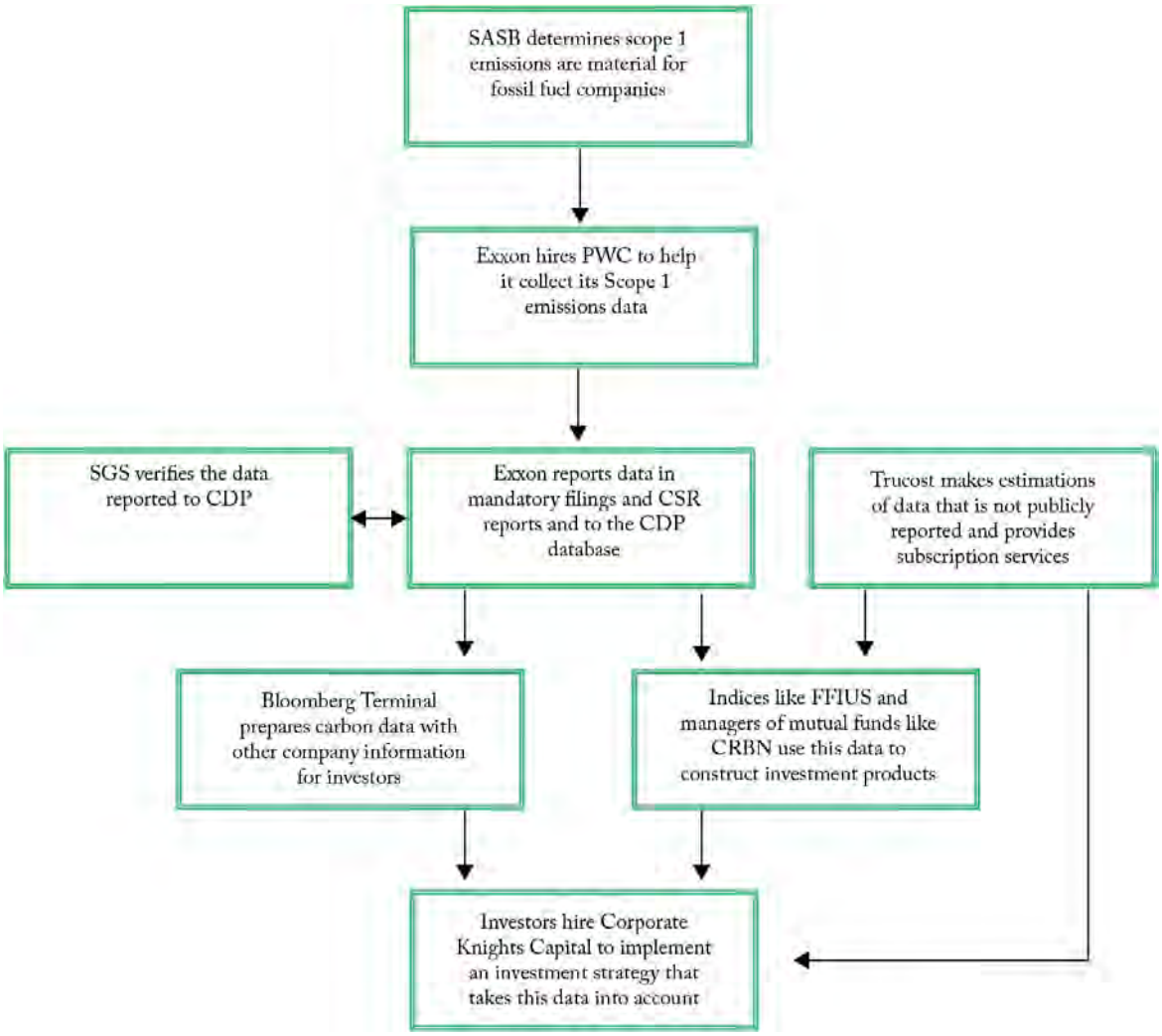
The process by which GHG emissions and reserve data flows from a company to an end-user is a fairly lengthy process. The overall process is outlined in Figure 8, and a specific example is given in Figure 9.

Figure 8: How Data Flows from Company to End User



Source: *Authors, 2015*.

Figure 9: Example of How Greenhouse Gas Emissions Data Flows from Company to Investor



Source: *Authors, 2015.*

Using the Data

As mentioned, GHG data is incomplete in a number of ways: not all data is reported; not all data is verified; data does not always allow for meaningful comparison between companies; and data is not always relevant to all companies.

However, the data has improved and will likely continue to improve significantly over time. First, more companies are recognizing the importance of reporting climate data. For example, the number of companies voluntarily reporting to CDP has steadily increased from 253 companies in 2003 to 5003 companies in 2014, with the top 10% of company disclosure consistently rising between 2008 and 2014 (Fox 2014). Additionally, investors

are demanding mandatory standardized reporting, led by groups like the SASB and the Climate Disclosure Standards Board. As groups like the Global Reporting Initiative continue to issue reporting guidance, companies will have an easier time reporting data at the same time as consultancy services are growing, given the increased demand for data.

There is currently a consistent complaint among companies and investors regarding "data overload." Without knowing what metrics are relevant to whom, climate data may be ignored by financial analysts. However, as standardization occurs it is likely a smaller set of data that is most material to investors will begin to emerge, and a virtuous cycle will begin: The financial community will find climate data more useful and invest in making it robust. With good data in hand, the next question becomes: What can investors do with it?

Company Comparisons

When deciding how to compare companies, it is important to weigh the trade-off between materiality and comparability. While ranking all companies based on Scope 1 emissions allows comparison between companies across sectors, it is not always relevant to actual company climate performance and risk. For example, fossil fuel companies may have low Scope 1 emissions compared to revenues, but Scope 3 emissions can make up 90% of fossil fuel company emissions; therefore, analyzing Scope 1 emissions does not capture the climate-risk profile of most companies.

SASB focuses on the materiality approach and recommends particular sustainability metrics for specific industries. Other data platforms and ranking systems, like the CDP Leadership Index, emphasize comparability: They compare all companies based on steps they are taking to mitigate and adapt to climate change (this data is outside the scope of this report). The choice between comparability and materiality will be determined by the various screening and reinvestment approaches that the majority of investors are taking.

Next, the emissions data should be normalized to consider emissions intensities of companies as opposed to absolute emissions, which strongly correlates to company size. GHG emissions can also be compared against revenues, unit sales, or some other aspect of corporate financial indicators.

Investors can use this normalized measure to evaluate the regulatory risk a carbon price will have to a given company or industry. The following section (beginning with Figure 10) explores the pros and cons of the various comparison metrics. These comparison factors include those found in the Bloomberg terminal.

Figure 10: Comparing Greenhouse Gas Emissions Approaches

Comparison Factor	Advantages	Disadvantages
GHG Emissions/ Sales (Operating Revenue or EBITDA)	Allows for companies across industries, with products of varying price, to be compared.	Within an industry, revenue/EBITDA is not as useful as per-unit product because revenue and EBITDA vary based on factors such as regional inflation. Furthermore, there are other income contributors to a company's revenue that are not indicators of the company's core business, such as income from investments.
GHG Emissions/ Unit Product	Within industries of comparable products, **emissions/unit product** is better for comparing carbon intensity of products than **emissions/sales**. This metric removes regional cost-of-living price distortions and other global market differences from the analysis of the comparative climate risk to firms. Per-product comparisons can also determine commitment to low-carbon businesses because changes in emissions intensity of products must mean that products or the processes to create the products are less emissions intensive.	A per-unit product metric is difficult to use when comparing products of different value and lifetime. An airplane manufacturer cannot be usefully compared to an appliance manufacturer on a unit-product basis because, based on size of the product, the airplane manufacturer will always have more emissions per-unit product. Additionally, it is difficult to measure per-unit product for service industries, such as the financial sector.
GHG Emissions/ Assets	This approach makes the most sense when examining the **embedded** emissions of assets compared to total assets. For example, this approach allows investors to examine the degree of stranded asset risk (technology and regulatory risk) from held fossil fuel reserves.	This approach depends heavily on the company business model; Uber will have high emissions/assets because it does not own automobiles, while a taxi company will have low emissions/assets, despite similar levels of automobile emissions rates. This flaw disappears when using the revenue or product/service ratios.
GHG	**Emissions/employees** should	If two hypothetical firms create the same

Emissions/Number of Employees	approximately capture the carbon footprint of varying levels of labor. This measure is often useful for companies in the service industry that do not sell products.	product with the same total emissions, **emissions/employee** would make the labor-intensive firm seem deceptively less polluting. Additional difficulties abound in categorizing companies that rely on independent contractors or distance themselves from their supply chain.
Green Products & Services/ Total Products & Services **Or** **Revenues from Green Products & Services/ Total Revenues**	This approach provides an indicator of how committed a company is to being a part of the green economy. For example, a fossil fuel company may earn greater sales from ventures outside of its fossil fuel portfolio, lowering emissions/sales, even if its fossil fuel product portfolio remains static. This metric avoids this issue. Clean energy exchange-traded funds often use this metric to decide whether a company belongs in the fund.	This approach does not reflect climate leadership in operations. For example, Google installing solar power for servers would show up in an emissions metric, but in this measurement, it is not a product or service being offered in the market, nor is it a revenue source.

Source: *Authors, 2015.*

These measures are useful in examining the event of a price on GHG emissions. In this case, the best performing companies, all else being equal, should be those with the lowest emissions per-unit sales. For example, while a carbon price would increase costs for plastic companies, plastic companies with the most efficient fuel and waste processes would gain a comparative advantage within their industries.

Investment Strategies

A number of investment strategies that investors use for climate investing can be grouped into six specific approaches (Figure 11).

Figure 11: Selected Climate Investing Strategies

Approach	**Description**
Industry Inclusion (Promoting a "Green Economy")	Include all companies from a specific industry classification
Industry Exclusion	Exclude all companies from a specific industry classification
Reserves-Based Exclusion	Exclude companies based on current recognized fossil fuel reserves and forecasted reserves from fossil fuel exploration
Carbon Intensity	Select securities based on reported/relative greenhouse gas emissions and fossil fuel reserves
Environmental, Social, and Governance (ESG) Integration	Weight carbon and climate factors within a broader, existing ESG strategy
Active Management Climate Theme	Discretionary investing in climate factors, opportunities and risks, that aims to outperform the market

Source: *Authors, 2015.*

Each strategy focuses around a particular type of data; the growth of emissions-based investment strategies will depend in large part on the growth of supporting data. Any of the strategies employed should also be consistently monitored to incorporate changes in sector or company progress toward reducing emissions, or the increasing exposure to low-carbon technologies, depending on the approach employed.

Industry-Inclusion and Industry-Exclusion Approaches. These approaches entail including or excluding companies based on their industry classification. Renewable-energy inclusion strategies will focus on the "green economy," while fossil fuel industry-exclusion approaches will exclude oil-, gas-, and coal-related companies such as the extraction, production, exploration, and refining companies. Screens that are more exclusive may include fossil fuel service and equipment, and marketing companies. Screens that are even more detailed may exclude heavy fossil fuel users, such as utility and trucking industries. To construct industry inclusion and exclusion funds and indexes, a classification system must be employed. Three major classifications are used in climate investing products (Figure 12).

Figure 12: Industry Classifications Used to Screen Out Various Sectors

GICS	The Global Industry Classification Standard, used by MSCI and S&P, classifies companies by their market orientation.
ICB	The Industry Classification Benchmark, used by Dow Jones and FTSE, classifies companies by the nature of their business.
SICS	The Sustainable Industry Classification System, recently developed by SASB, classifies companies by resource intensity and sustainability innovation potential.

Industry exclusion is a process that allows investors to avoid participating in an industry that they think in some way conflicts with their values, such as by contributing to climate change, environmental damage, or the displacement of vulnerable populations, and so on. Investors may also want to remove specific risks (such as companies with the highest fossil fuel reserves) from their portfolio. The industry-exclusion approach also provides a fairly straightforward means for negatively "screening out" companies based on already available classification systems.

At the broadest level, the logic behind industry exclusions from a risk perspective is that certain sectors are tied to fossil fuels, regardless of their performance relative to their industry, and that they will likely be affected by increased climate regulation and alternative-energy technology development. Thus, it makes sense to identify and remove all or some of them from certain portfolios, depending on how much an investor wants to reduce exposure.

On the other hand, the industry-exclusion approach may miss companies that will be heavily affected by climate change if their main lines of business are not considered fossil-fuel-related (classification systems only assign one classification to each company, so a general mining company that also produces a lot of coal may be missed by the industry-exclusion approach). Most industry-exclusion approaches, for example, do not exclude all companies on the Carbon Underground 200,™ a list of the 200 companies with the largest coal and oil reserves. The industry-exclusion approach can also reduce industry diversification within a portfolio, which may be unacceptable to some investors. Investors who have a moral imperative to avoid all companies tied to the fossil fuel industry might choose the industry-exclusion approach.

The "Green-Economy Industry-Inclusion" approach selects companies whose primary business is related to promoting the green economy, the largest subsection of which is clean renewable energy. Many companies primarily focused on the green economy may still produce and generate revenue from fossil-based products or hold fossil fuel reserves (often utility companies fit this description), many green economy funds may still hold companies involved in the fossil economy and companies that hold fossil fuel reserves.

This approach reduces exposure to climate risk and provides exposure to climate opportunity. Investments in the green economy can also have impact on climate mitigation, especially if the funds invested are additive within an illiquid market such as private equities. Investors who want to promote the transition to a green economy and want to take part in the upside of this transition might choose the industry-inclusion green-economy approach.

Reserves-Based Approach. This approach typically uses a fund or index to exclude companies based on emissions embedded in reserves or embedded emissions relative to company size. The reserves-based approach responds to the threat that existing fossil fuel reserves will not be sold due to climate regulations. As investors evaluate this downside probability, the market may re-price fossil fuel companies well before restrictive legislation is enacted—as soon as there is an expectation that the reserves will be stranded.

Since oil and gas reserves vary in quality, and refining produces a variety of oil and gas products with varying emission factors, a general carbon-intensity coefficient is used by data providers to calculate forecasted reserves-based emission. Relative rankings and screens for companies based on company-owned carbon reserves offer investors another climate factor; a reserves-based approach can also be used to examine fossil-fuel-reserves value as a percentage of net asset value. This information can often be found on company filings, but subscription sources, like Fossil Free Indexes, actively track reserves data.

For an example of a reserve-based approach: a portfolio could be constructed using the Carbon Underground 200™ list to exclude the top 100 coal-reserves-owning companies and top 100 oil- and gas-reserves-owning companies according to emissions embedded in fossil fuel reserves. This particular approach covers approximately 97%–98% of listed company reserves ownership and is the strategy most fossil-fuel-divested individuals and institutions have used to divest (Fossil Free Indexes 2015). Investors looking to minimize climate risk and investors who have a mandate to avoid fossil-fuel-reserve-holding companies might choose the reserves-based approach.

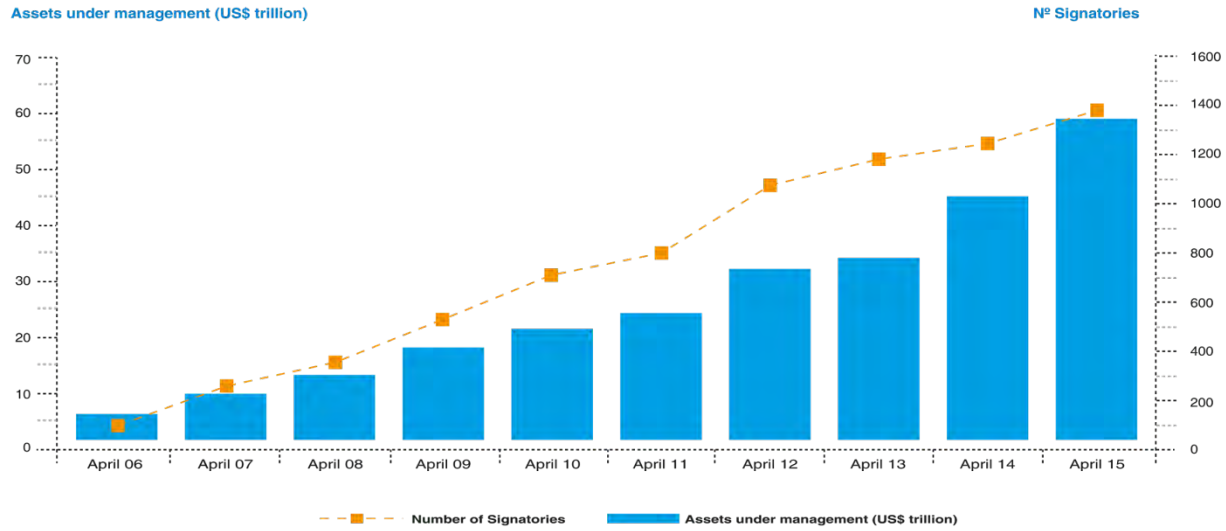
Carbon-Intensity Approach. This approach has a number of variations aimed at reducing fossil fuel exposure without excluding entire industries. For instance, carbon indexes constructed to mimic traditional market-cap-weighted indexes will construct portfolios from a previous time period's carbon emissions and seek a lower carbon intensity per dollar (perhaps while maintaining covariance against an index such as the S&P 500). This ensures that investors can adopt climate-investment strategies while tracking an investment-policy-mandated traditional market-cap-weighted index.

A "best-in-class" approach would include companies leading their industries in mitigating carbon risk, while a "worst-in-class" approach would exclude companies significantly below their industry average. Even without excluding companies, this investment strategy reduces risk exposure to climate policy by underweighting emissions-intensive companies.

Carbon-intensity approaches can employ Scopes 1, 2, and 3 emissions data, though it is important to keep in mind which scopes are relevant to each industry group. Given that Scope 1 and 2 emissions-calculation methodologies are common to all companies and have clear methodologies, most carbon-intensity approaches utilize these scopes. Investors who want to minimize climate risk, yet do not have a moral mandate to entirely avoid investments in those companies contributing the most to climate change, might choose the carbon-intensity strategy.

Environmental, Social, Governance (ESG) Integration. Integration of ESG metrics in investments has grown from nearly $6 trillion in 2012 to $12.9 trillion in 2014 (Global Sustainable Investment Alliance 2014). Commitments to the UN Principles for Responsible Investing have also grown significantly since UN PRI's inception in 2006. In April 2006, less than $10 trillion in global assets under management were represented, whereas in April 2015 the number had grown to approximately $60 trillion (Figure 13). Climate factors are one of many ESG strategies—any of the above strategies may be used synergistically with other ESG strategies to identify companies to perform both inclusions and exclusions. Investors who employ general socially responsible investment practices and investors who want to avoid risk and maximize opportunity associated with social, governance, or environmental issues might choose the ESG-integration approach.

Figure 13: Growth in UN PRI Commitments (2006-2015)



Source: *UN PRI. "PRI Fact Sheet." 2015*. http://www.unpri.org/news/pri-fact-sheet/. *Accessed November 6, 2015.*

Actively Managed Climate Investment Strategies. If investors are interested in taking an active approach to investing using climate change as a frame, they could theoretically construct portfolios based on macroeconomic factors, such as regulations; traditional factor-based investing (for example: momentum, growth, or value); and, fundamental company analysis while also integrating climate factors into their security selection process. These investors could aim to apply first, second, and third order climate effects and apply additional data sets relating to climate change to the valuation process for security selection.[7] Accordingly, investors pursuing *actively managed climate-investment strategies* may be able to better identify risks and opportunities from climate change, although there is no guarantee of outperformance.

Concluding Remarks

As the response to global climate change grows, so do the potential risks to investors. Asset owners and advisors are increasingly examining their underlying assets to determine risk and opportunity when it comes to mitigating and adapting to climate change. Many of these decisions must be made based on quantitative data. Therefore, to be able to make

7. Changes in government regulations because of climate change risks will affect global trade, economies, and financial valuations beyond the fossil fuel sector. Industries and sectors as diverse as agriculture, construction, energy, information technology, infrastructure, insurance, mining, timber, transportation, waste, and water will be affected by climate change. Thus, actively managed climate-investment strategies may be better able to realize better performance from a traditional market-cap-weighted benchmark that is not aware of or able to navigate climate risks and opportunities.

sound investment decisions, astute investors must keep abreast of the evolving landscape of climate data.

Over the next several years, the biggest potential impact on investors related to climate change could come from government regulation, which could set a standard price on carbon. Furthermore, if regulators were to emphasize accurate disclosure of particular metrics, investment strategies would likely adapt to incorporate those standard metrics. In the absence of uniform disclosure, strategies based on emissions data are lacking crucial information. In this current data regime, many investors are choosing an industry inclusion-/exclusion- or a reserves-based approach to minimize carbon-risk exposure.

Coordinated investor requests for voluntary company climate-data disclosure, such as those coordinated by the UN PRI, continue to have a large effect at securing data and building understanding of the data issues among investors and regulators. Ultimately, the more certain investors can be of the climate risks of their investments, the more informed they can be when deciding how to evaluate the risk and return profiles of their investment portfolios.

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Do Palm Oil Financiers Care about Sustainability?

Pek Shibao

The following article is an expansion of one that first appeared in the *JEI* in March 2015 and was subsequently adapted from a series of articles that ran in *Mongabay* from 26 January to 8 February 2016.

Within the sustainability sector, finance is increasingly being seen as a powerful lever to help companies "green" their operations. Over the past few years, a growing number of corporate banks and investors have begun using both positive and negative screening methods to improve the sustainability of their portfolios and client companies. Positive screening methods preferentially provide capital to sustainably run companies and include socially responsible investment (SRI) funds and green bonds that are dedicated to responsible companies. On the other hand, negative screening methods focus on weeding out unsustainable companies, generally by using environmental, social, and governance (ESG) screens that grade companies on a number of metrics, such as carbon footprint and fair labor policy.

Sustainable finance is still regarded as a niche market, but its share of the financial industry continues to grow. According to the Global Sustainable Investment Alliance, from 2012 to 2014, the global sustainable investment market expanded from $13.3 trillion to $21.4 trillion.[1] Reflecting this trend, consortiums such as the UN-backed Principles for Responsible Investment (PRI) are attracting an increasing number of signatories.[2] Millennials[3] and institutional clients[4] are driving much of this demand for sustainable investment. Some of these institutional clients, such as the Interfaith Center on Corporate Responsibility (ICCR), may have chosen to be ethically or religiously obligated to pay attention to such concerns when making investing decisions.[5]

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1. *2014 Review,* Global Sustainable Investment Alliance, 2014, p3. Available from http://www.gsi-alliance.org/wp-content/uploads/2015/02/GSIA_Review_download.pdf.

2. *Report on Progress 2014*, Principles for Responsible Investment, 2014, 30. Available from http://2xjmlj8428u1a2k5o34l1m71.wpengine.netdna-cdn.com/wp-content/uploads/2014_report_on_progress.pdf.

3. Cary Krosinsky (personal communication, July 30, 2015).

4. *Palm Oil Investor Review: Investor Guidance on Palm Oil*, WWF and EnviroMarket, 2012, 23.

5. Interfaith Center on Corporate Responsibility, "The Connection Between Faith & Investing." Accessed November 22 2015 from http://www.iccr.org/our-approach/connection-between-faith-investing.

Sustainable finance can be a powerful force for good. Its proponents claim that by placing similar importance on societal impact and financial returns, sustainable investing strategies can change prevailing profit-centric attitudes in the financial industry.[6] However, the sustainable finance movement is now at a crossroads, its momentum stalled by a fundamental problem: the difficulty of measuring the effectiveness of many sustainable financing products.[7]

"Virtually nothing is known about the environmental impact of green loans and bonds," says Cary Krosinsky, lead consultant at PRI and independent sustainability advisor. Because there is no standardized method for evaluating the environmental impact of sustainable financial products, investors are forced to rely on proprietary methodologies that can be confusing and opaque.[8] The 2015 Volkswagen emissions scandal illustrates how easily green funds may be misappropriated. The German automaker had received €4.6bn from the European Investment Bank that was supposedly directed toward low-emissions research. But it was discovered that many of its cars had "defeat devices" installed to ensure that their emissions performance tested more accurately in the laboratory than on the road.[9]

Sustainable investment was again thrust into the spotlight in late 2015, as forest fires in Indonesia surged to become the worst ever recorded.[10] The irresponsible forest clearing practices of some palm oil and paper companies caused these sectors to be fingered as key culprits.[11] Consequently, the financial institutions that had extended these companies large amounts of capital to establish their palm oil and paper plantations also came under close scrutiny for their use of environmental assessments—or lack thereof.

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6. *The Impact of Sustainable and Responsible Investment*, US SIF Foundation, 2013, 2. Available from http://www.ussif.org/files/publications/ussif_impactofsri_aug2013_final.pdf.

7. Todd Cort and Cary Krosinsky, "Green Finance Environmental Impact Hard to Measure," *Financial Times,* November 4 2015. Available from http://www.ft.com/intl/cms/s/0/abeb036c-78a8-11e5-a95a-27d368e1ddf7.html.

8. Ibid.

9. Russell Hotten, "Volkswagen: The Scandal Explained," *BBC News*, November 4 2015. Available from http://www.bbc.com/news/business-34324772.

10. "Indonesia's Forest-Fire Haze," *The Economist*, November 6 2015. Available from http://www.economist.com/blogs/graphicdetail/2015/11/daily-chart-3.

11. "Indonesia's Forest Fires: Everything You Need to Know," *The Guardian*, November 11 2015. Available from http://www.theguardian.com/sustainable-business/2015/nov/11/indonesia-forest-fires-explained-haze-palm-oil-timber-burning.

Do Financiers Account for Environmental Performance When Deciding Whether to Extend Capital to Palm Oil Companies?

Palm oil companies raise capital through two main sources: (1) by selling equity to private investors and on the stock exchange, and (2) by taking loans from commercial banks.

The majority of equity investors in the palm oil sector do not take environmental performance into account when making investment decisions.[12] Such ESG screens are usually performed only by SRI funds or screened funds that have a specific sustainability focus.[13] Mainstream funds instead base their initial investment decisions largely on a company's earnings ability.[14]

For a palm oil company, two metrics are commonly used as proxies for earnings ability: the size of its land banks and the age of its plantations.[15] "Evidence suggests that some companies are rewarded for growth-linked KPIs [key performance indicators], which often mean conversion of more land banks," says Iain Henderson of the United Nations Environment Programme Finance Initiative (UNEP FI).[16] Immature plantations are also preferred to more mature ones because they are more likely to deliver a higher total output over time. Both of these metrics create incentives for plantations to expand rapidly and continuously, rather than sustainably.

Eric Wakker, head of the Asia division of sustainability consultancy Aidenvironment, notes that while some major mainstream funds do incorporate ESG risk assessment, this usually "lags behind the investment decision." The Norwegian Government Pension Fund is one major fund that follows such a post-investment screening approach. The Fund appoints a Council on Ethics that periodically reviews the Fund and advises whether certain companies should be excluded from its portfolio.[17] In August 2015, for example, the Fund announced it would exclude four of Asia's largest conglomerates (Daewoo

12. Eric Wakker, head of the Asia division of sustainability consultancy Aidenvironment (personal communication, November 7 2015).

13. *Palm Oil Investor Review*, 25.

14. Ibid.

15. Eric Wakker (personal communication, November 7 2015).

16. Iain Henderson (personal communication, October 29 2015).

17. Annual Report 2014, *Council on Ethics for the Government Pension Fund Global*, 2014, 6. Available from http://etikkradet.no/files/2015/01/Council-on-Ethics-2014-Annual-Report.pdf.

International, Posco, Genting, and IJM) because of their links to Indonesian palm oil plantations.[18]

In the absence of more rigorous and widely accepted metrics, many investors follow the actions taken by funds seen as leaders in the ESG field. The Norwegian Government Pension Fund's "List of Excluded Companies" is particularly influential on many funds' investment and divestment decisions.[19] Investors taking a positive screening approach may invest preferentially in the companies whose sustainability policies are regarded as "best-in-class" in a particular sector. These companies' partners in the supply chain may also be regarded as "good" investment choices, thanks to their association with the sustainable company.[20]

Other investors use metrics that are less specific. Some have developed formulas that measure a company's ESG risk by monitoring its media coverage and tracking key words that signal possible environmental concerns.[21] Other investors do not use screens for individual companies; instead, they identify and evaluate the most egregious material ESG risks on the sector level only.[22]

At the bottom of the scale, some investors may only exclude securities that are regarded as "worst-in-class" within a particular sector. "This is often just a way to hedge reputational issues," Henderson notes.[23] Finally, some investors may not implement ESG methods to any significant extent. A 2012 report by the World Wide Fund for Nature (also known as the World Wildlife Fund; both referred to as "WWF") found that, in general, few institutional investors quantified or even tracked the exposure of their portfolios to palm oil.[24]

When compared with equity investors, the commercial banks that extend loans to palm oil companies to finance land expansion have taken a more proactive approach to incorporating sustainability. Most large Western and international banks consider

18. Richard Milne, "Norway Fund Excludes Four Asian Groups Over Palm Oil Links," *Financial Times,* August 17 2015. Available from http://www.ft.com/intl/cms/s/0/b8305bbe-44c7-11e5-b3b2-1672f710807b.html.

19. *Palm Oil Investor Review*, 22.

20. Iain Henderson (personal communication, October 29 2015).

21. Eric Wakker (personal communication, November 7 2015).

22. Ibid.

23. Iain Henderson (personal communication, October 29 2015).

24. *Palm Oil Investor Review*, 21.

environmental risk a part of their risk assessments,[25] and many of these banks are members of the Equator Principles, a widely used framework that helps banks evaluate and manage their environmental and social risk.[26] Besides expanding their corporate banking operations, many high-profile banks have also been expanding their ESG operations and products. For example, Goldman Sachs's asset management wing has recently created a new position, Head of Global ESG,[27] and Morgan Stanley has created an Institute for Sustainable Investing and an Investing with Impact Platform for wealth management clients conscientious about the sustainability impact of their investments.[28, 29]

In the palm oil industry, both equity investors and banks regard membership in the Roundtable on Sustainable Palm Oil (RSPO), the industry's largest regulation and certification body, as the de facto standard for sustainability best practices and good management.[30] At the same time, many investors also recognize the flaws in the RSPO's methodology, and are looking for other ways to quantify and measure the sustainability of palm oil companies.[31]

While current trends are promising, there remains room for improvement across the financial sector, since the extent to which banks implement ESG principles in practice varies greatly.[32] Even banks with sustainability departments often still evaluate investment decisions only after they have been made.[33] In its annual survey, the 2013 Global Investor Survey on Climate Change found that about half of the asset owners and managers who were contacted used a framework to quantify material climate-change risk, but only about a quarter had actually changed an investment or decision-making process as a result of this

25. Eric Wakker (personal communication, November 7 2015).

26. Equator Principles, "Members & Reporting." Accessed November 22 2015 from http://www.equator-principles.com/index.php/members-reporting.

27. James Comtois, "Goldman Sachs Asset Management Names ESG Leader," *Pensions & Investments*, June 9 2015. http://www.pionline.com/article/20150609/ONLINE/150609847/goldman-sachs-asset-management-names-esg-leader.

28. Morgan Stanley, "Institute for Sustainable Investing." Accessed November 22, 2015 from http://www.morganstanley.com/what-we-do/institute-for-sustainable-investing.

29. *Investing with Impact: Creating Financial, Social and Environmental Value,* Morgan Stanley, 2014. Available from http://www.morganstanley.com/globalcitizen/pdf/investing-with-impact.pdf.

30. *Palm Oil Investor Review*, 25.

31. Ibid.

32. Benjamin McCarron (personal communication, October 23 2015).

33. Eric Wakker (personal communication, November 7 2015).

analysis.[34] Most worryingly, many regional and local banks, especially the Southeast Asian banks that conduct large amounts of business with oil palm companies, do not consider ESG risk at all.[35] Until these issues are addressed, financiers will continue putting their money into unsustainable palm oil, whether they are aware of it or not.

What's Preventing Palm Oil Investors from Addressing ESG Risks More Adequately?

Evidence suggests that the demand for ESG assessment is rising and steadily becoming more widely accepted in the financial sector. However, although many investors want to implement improved, extensive ESG methods,[36] they are prevented from doing so by an array of obstacle. Most of these impediments can be grouped in five categories: internal organizational constraints; a lack of research, data, and expertise; a lack of proven materiality; short-termism and the lack of incentives for environmental performance; and issues specific to palm oil.

Internal Organizational Constraints

Individual investment managers may be aware of environmental issues, but they find it difficult to influence investment decisions at a firm-wide level, especially in mainstream investment institutions.[37] This is because these institutions rarely have a central ESG department accessible to all fund managers within the firm. As a result, ESG analysts often report their findings only to the firm's SRI fund divisions, rather than to the Asian fund management divisions that control the palm oil portfolio.[38]

"Analysts may be barred from talking to fund managers of their own financial institutions because of 'Chinese walls,'" Wakker notes. "They can only 'throw their assessments over the wall' and hope someone reads [them]."[39] Because of these

34. *3rd Annual Report on Actions and Progress,* Global Investor Survey on Climate Change, 2013, 6. Available from https://www.ceres.org/resources/reports/global-investor-survey-on-climate-change-2013/at_download/file.

35. *Sustainable Finance in Singapore, Indonesia and Malaysia,* World Wide Fund for Nature, 2015, 47–67. Available from http://d2ouvy59p0dg6k.cloudfront.net/downloads/wwf_frc_forest_risk_commodities_report_2015_online_1.pdf.

36. *Palm Oil Investor Review*, 21–25.

37. *Palm Oil Investor Review*, 21.

38. Ibid.

39. Eric Wakker (personal communication, November 7 2015).

constraints, ESG specialists often find themselves advocating for sustainability principles not just for their external clients, but also within their own companies.[40]

Lack of Research, Data, and Expertise

Sustainable investing is a relatively new field, and experts agree that a lack of knowledge about sustainable investing remains a major problem for financiers. The palm oil sector, in particular, is "both definitionally and metrically challenged," Henderson notes. For instance, there remains no universal agreement about the meaning of terms such as "zero deforestation" and "degraded land," which are crucial for designing ESG metrics.[41]

Not enough research is being done into the modeling and prototypes necessary to quantify ESG risk. Regarding ESG issues, "many banks are still in the research phase—they just don't know how to do this kind of evaluation yet," Krosinsky says. "Efforts are not being focused enough on the crucial areas of climate change and agriculture."[42] As a result, passive investors interested in applying ESG metrics are stymied by "a lack of essential tools, such as robust and publicly available exclusion screens, white lists, blacklists, and benchmark ratings." Many investors are forced to defer to the lists produced by a few prominent funds, such as the Norwegian Government Pension Fund's "List of Excluded Companies."[43]

Many companies simply do not disclose the data necessary to subject them to meaningful ESG evaluations. "Disclosure is particularly poor in the land-use sector for publicly listed companies," says Henderson,[44] citing research led by the SRI mutual fund firm Calvert Investments, which found that just 6% of publicly listed companies worldwide reported their raw materials use.[45] Banks themselves are sometimes complicit in this lack of transparency; for example, loans to small companies are still extremely opaque, and often involve the use of multiple shell companies.[46]

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40. Gabriel Thoumi (personal communication, October 20 2015).

41. Iain Henderson (personal communication, October 29 2015).

42. Cary Krosinsky (personal communication, July 30, 2015).

43. *Palm Oil Investor Review*, 22.

44. Iain Henderson (personal communication, October 29 2015).

45. Calvert Investments, Fauna & Flora International, and Crowell Moring, "Global Financial Indices and Natural Capital Policies Assessment: Q3 2014 Baseline Analysis," 2014, 4. Available from http://www.calvert.com/NRC/literature/documents/Global%20Financial%20Indices%20and%20Natural%20Capital%20Policies%20Assessment%20Q3%202014%20Baseline%20Analysis%20Final.pdf.

46. Cary Krosinsky (personal communication, July 30, 2015).

Finally, institutions willing to implement ESG methods often find that they lack the necessary expertise and institutional capacity to do so. Many lack the expertise to understand the complex issues surrounding specific industries, including—crucially—palm oil.[47] The typically small- to medium-sized teams that run investment funds also find themselves under-equipped because they lack the staff or hours to deal with ESG issues that are growing increasingly more complex.[48]

Lack of Proven Materiality

Perhaps the most fundamental challenge facing sustainable investing is that there is still not enough evidence to prove that unsustainable investing has a negative impact on corporate value. This makes it tough for investors to justify incorporating ESG principles at scale in mainstream portfolios, especially when these principles conflict with conventional models projecting high returns.[49] "For investors, the risk of 'little environmental impact' has always been secondary to the risk of low returns," remarks Krosinsky. "It is not accidental that due diligence on risk of return is a highly standardized method with large brand names such as Moody's on the front lines, while due diligence of environmental impact remains a scattered approach led by companies you have probably never heard of."[50] Hence, in the absence of "sticks" in the form of externally imposed regulations and penalties, profit-seeking investors naturally gravitate toward the "carrots" of investing in unsustainable companies.

This is not to say that companies' unsustainable practices do not have a negative impact on their returns. Rather, it is more likely that the assessment methods currently used by banks are not sophisticated enough to detect these negative effects.

Short-Termism and the Lack of Incentives for Environmental Performance

The problem of proving materiality is closely linked to short-termism, which is a structural issue associated with the present financial markets. Short-termism refers to the tendency of fund managers to consider investments for their immediate, or short-term, returns, rather than their long-term value. This can be manifest in several forms, including the decrease in CEO tenure; short-term benchmarks for measuring the performance and compensation of fund managers; and the definition of risk as volatility around an index,

47. *Palm Oil Investor Review*, 22.

48. Ibid., 21.

49. Iain Henderson (personal communication, October 29 2015).

50. Todd Cort and Cary Krosinsky, "Green Finance Environmental Impact Hard to Measure."

rather than as long-term absolute risk to capital.[51, 52] Short-termism is linked to the problem of proving materiality because if fund managers have incentives to evaluate an investment's value solely in the short term, they are likely to miss or care less about the negative impacts on value caused by unsustainable practices, which usually become apparent only in the long term.

There are currently few roles in the financial industry whose compensation is tied to environmental performance. "Environmental performance is an incentive for managers of carbon markets, and some CEOs have linked their remuneration to environmental performance," says Gabriel Thoumi, sustainability analyst and member of the faculty at the University of Maryland's Robert H. Smith School of Business. "But I don't know of any portfolio managers who have linked their remuneration to environmental performance."[53]

Within the general analyst community, buy-side analysts are more likely to take ESG assessments seriously, because their compensation is closely tied to how their investment recommendations perform. However, it is difficult to tell what method buy-side analysts use to assess environmental risk or how well or how frequently they do so because they do not publish their reports.[54] In comparison, sustainability is rarely a concern for sell-side analysts, especially at Asian banks.[55] This is because sell-side analysts' compensation is linked more closely to the speed at which they can obtain new financial information, as well as to their ability to market their firm's services to clients.

Additional Issues Specific to Palm Oil

In addition to the issues just outlined, some details specific to palm oil make assessing the ESG impact of palm oil investments difficult for many investors.

- **Palm oil constitutes only a small part of the direct investment portfolio for North American and European funds, which have the most active SRI policies.** For these funds, direct investments in palm oil may constitute less than

51. Ben Caldecott and Jeremy McDaniels, "Financial Dynamics of the Environment: Risks, Impacts, and Barriers to Resilience," *UNEP Inquiry* Working Paper, 2014, 6–7. Available from http://apps.unep.org/publications/pmtdocuments/Financial_Dynamics_of_the_Environment_Risks_Impacts_and_Barriers_to_Resilience.pdf.

52. Iain Henderson (personal communication, October 29 2015).

53. Gabriel Thoumi (personal communication, October 20 2015).

54. Eric Wakker (personal communication, November 7 2015).

55. Ibid.

1% of assets under management.[56] In comparison, only about 20 fund managers control over 80% of the funds directly invested in the palm oil sector. It is unclear what ESG methods these managers use, if any.[57]

"For this reason, sustainability efforts in Europe originally focused on encouraging buyers to demand certified sustainable palm oil (CSPO)," Asia Research & Engagement's Benjamin McCarron says. "European investors have a much larger exposure to fast-moving consumer goods (FMCG) retailers in their home market than to (palm oil) producers listed in Southeast Asia."[58]

In reality, however, funds in the Western world are probably much more exposed to palm oil than these figures suggest, because many of them track indices containing palm oil or palm-oil-linked companies.[59] A 2012 study by the WWF concluded that due to "the pervasive nature of the commodity and globally interconnected supply chains," the "majority" of global portfolios will be exposed to palm oil.[60]

- **Western funds are separated from palm oil companies by geographical and language barriers.** Ninety percent of palm oil growers by total market capitalization are listed in Southeast Asia, specifically Singapore, Malaysia, and Indonesia. For Western investors, this geographical remoteness accentuates cultural and language barriers and limits access to companies' management.[61]
- **Southeast Asian banks have to follow implicit government policy.** Palm oil revenues continue to be a cornerstone of economic development policy in Malaysia and Indonesia.[62] As a result, banks based in these countries may find it difficult to restrict capital from palm oil companies, or challenge the sustainability of their operations.[63]

56. Iain Henderson (personal communication, October 29 2015).

57. *Palm Oil Investor Review*, 19.

58. Benjamin McCarron (personal communication, October 23 2015).

59. Benjamin McCarron (personal communication, October 23 2015).

60. *Palm Oil Investor Review*, 8.

61. Ibid.

62. Will Greene, "Palm Oil in Indonesia and Malaysia: A Controversial Industry," *Tigermine Ventures,* May 13 2013. Available from http://www.tigermine.com/2013/05/13/palm-oil-malaysia-indonesia-controversy/.

63. Gabriel Thoumi (personal communication, October 20 2015).

Do Poor Environmental Practices Affect Palm Oil Companies' Bottom Lines on a Scale Meaningful for Investors and Financiers?

The question of materiality is key to understanding the drivers behind palm oil finance. Evidence shows that the majority of investors have incentives to evaluate and make investment decisions based on short-term gain. On the other hand, investors do not usually account for losses in value resulting from palm oil companies' unsustainable practices, because these are both harder to quantify and likely to occur in the longer term.

In its 2012 report, "Palm Oil Investor Review: Investor Guidance on Palm Oil," the WWF identified five categories of material risk for oil palm companies with unsustainable practices. Of these, only one category, "productivity risks," is an inherent mechanism, meaning that it does not depend on enforcement by a third party. The report listed the following ways in which poor environmental practices could have a negative impact on productivity and, ultimately, revenues:

- *Soil erosion, water contamination, and failure to maintain site fertility may reduce future yields and returns;*
- *Planting on peat lands is a high-cost and low-yield practice that may impact margins;*
- *Failure to maintain biodiversity may eliminate natural pest-control animals and increase costs and pollution risks from use of pesticides;*
- *Loss of natural habitat in and around plantations leads to localized climate differences, in particular a drier microclimate, that may further reduce palm oil yields;*
- *Suboptimal timing for planting of nursery palms (often planted at three years of age, which is too old) may lead to lower productivity in the early years*. [Palm Oil Investment Review, page 11][64]

However, experts agree that these risks alone do not create enough of a business case to adopt sustainability.[65] In a 2014 report for the UNEP Inquiry, Ben Caldecott and Jeremy McDaniels of the Stranded Assets Program at Oxford find "little evidence to suggest that environment-related risks currently pose a systemic risk to the financial system."[66] Eric Wakker of Aidenvironment Asia concurs, saying that while environmental non-compliance "could certainly hurt" companies materially, they usually do not pose a

64. *Palm Oil Investor Review*, 11.

65. Cary Krosinsky (personal communication, July 30, 2015).

66. Ben Caldecott and Jeremy McDaniels, "Financial Dynamics of the Environment," 6.

"massive financial risk."[67] Benjamin McCarron offers a slightly different viewpoint, suggesting that environmental problems may be an indicator of underlying mismanagement, which is likely to have material consequences.[68] Nevertheless, in this case, material impacts would be a consequence of mismanagement issues, rather than environmental issues themselves.

Researchers believe that increased temperatures[69] and decreased soil moisture levels[70] due to intensifying climate change[71] and the formation of microclimates around large palm oil plantations[72] will eventually have a material impact on oil palm yields.[73] Potentially the most material threat to peatland palm oil plantations is flooding. A May 2015 report by Deltares and Wetlands International projected that due to deforestation and peatland draining, soil levels will subside, putting up to 56% of existing peatland plantations at risk of being submerged by floods.[74] Some stranded assets have already been reported in the oil palm industry,[75] such as in Dumai in northern Riau, where large areas of palm oil plantations have reportedly become flooded and unproductive.[76]

67. Eric Wakker (personal communication, November 7 2015).

68. Benjamin McCarron (personal communication, October 23 2015).

69. Christopher Boon Sung Teh, "Effect of Climate Change on Oil Palm Yield in Malaysia: Some Simulations," 2012. Available from http://www.christopherteh.com/blog/2012/09/cc-oil-palm/.

70. NaanDan Jain Irrigation, "Oil Palm," 2011, 3. Available from http://he.naandanjain.com/uploads/catalogerfiles/oil-palm-2/NDJ_OilPlam_eng_booklet_130311F.pdf.

71. Hanim Adnan, "El Nino Dry Weather to Lead to Rise in the Palm Oil Price," *The Star Online*, September 28 2015. Available from http://www.thestar.com.my/Business/Business-News/2015/09/28/The-return-of-El-Nino/?style=biz.

72. Edgar Turner et al., "The Impact of Oil Palm Expansion on Environmental Change: Putting Conservation Research in Context." *Environmental Impact of Biofuels*, ed. Marco Aurelio Dos Santos Bernardes, InTech, 2011, 26. Available from http://eprints.soton.ac.uk/359401/1/19109.pdf.

73. Ben Caldecott and Jeremy McDaniels, "Financial Dynamics of the Environment."

74. *Flooding Projections from Elevation and Subsidence Models for Oil Palm Plantations in the Rajang Delta Peatlands, Sarawak, Malaysia,* Deltares, 2015, 39. Available from https://www.deltares.nl/app/uploads/2015/06/Rajang-Delta-Peatland-Subsidence-Flooding-Deltares-2015.pdf.

75. Gabriel Thoumi (personal communication, October 20 2015).

76. David Fogarty, "It's Not Just Haze—Forest Clearing Leads to Subsidence," *The Straits Times,* October 1 2015. Available from http://www.straitstimes.com/asia/se-asia/its-not-just-haze-forest-clearing-leads-to-subsidence.

Nevertheless, analyses show that the majority of these environment-related risks become most apparent only in the long term.[77] In the short to medium term, it is doubtful whether these effects will be significantly internalized in companies' financials, or to the extent that they will cause financiers and growers to change their behavior.[78]

Other Mechanisms of Material Risk for Oil Palm Companies

In addition to productivity risks, the WWF report enumerates four other categories of risk through which palm oil companies with poor environmental practices could suffer negative financial consequences. However, almost all of these require enforcement by an external party.

Compliance Risks. Violating environmental regulations, which comes under the category of "compliance risks," could lead to fines and the suspension of the plantation owner's license to operate.[79] However, this is dependent on the monitoring and auditing systems of regulatory bodies such as the RSPO and the judicial system of the Indonesian government, both of which have had their reliability called into question.[80, 81]

Reputational Risks. The "reputational risks" caused by unsustainable practices may damage the reputation of plantation companies, as well as that of their trading partners, decreasing the willingness of other companies to work with them. In addition, consumer backlash against environmental violations may lead to boycotts and reduced sales, and negative media attention may cause erosion in brand value.[82] This mechanism depends on the work of whistleblowers and activist NGOs to uncover and spread awareness of unsustainable practices among the public.

Market Risks. Under "market risks," environmentally minded financiers may deny growers capital through negative screening and divestment, leading to downward pressure

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77. Ben Caldecott, Nicholas Howarth and Patrick McSharry, "Stranded Assets in Agriculture: Protecting Value from Environment-Related Risks," *Stranded Assets Programme*, 8. Available from http://www.climatechangecapital.com/images/docs/publications/stranded-assets-agriculture.pdf

78. Ben Caldecott and Jeremy McDaniels, "Financial Dynamics of the Environment," 6.

79. *Palm Oil Investor Review*, 11.

80. *Who Watches the Watchmen?: Auditors and the Breakdown of Oversight in the RSPO,* Environmental Investigation Agency, 2015. Available from https://eia-international.org/wp-content/uploads/EIA-Who-Watches-the-Watchmen-FINAL.pdf.

81. Patrick Anderson, "Business and Politics in Indonesia's Expanding Palm Oil Sector," *Inside Indonesia*, Jul–Sept. 2014. Available from http://www.insideindonesia.org/business-and-politics-in-indonesia-s-expanding-palm-oil-sector.

82. *Palm Oil Investor Review*, 11.

on share prices and an inability to finance expansion.[83] However, this relies on all possible creditors uniformly implementing effective ESG assessments, a process that faces numerous hurdles, as enumerated previously in this article. Another market risk is that the demand for certified sustainable palm oil (CSPO) may grow, causing unsustainable palm oil growers to become unable to find markets and international trading partners.[84] This scenario seems unlikely in the near future; currently, the global supply of CSPO far exceeds demand, and only about 50% of sustainably produced palm oil is able to find buyers.[85]

Among the market risks, the most significant is probably the recent adoption of "no deforestation, no peat, no exploitation" policies by major palm oil traders such as Wilmar, Musim Mas, and Golden-Agri Resources. Since these traders cover approximately 96% of the global palm oil trade,[86] growers who do not change their practices risk being cut out of the supply chain.[87] However, this mechanism is again dependent on enforcement and monitoring by actors external to the grower itself.

Social Risks. Conflicts with laborers and local communities, categorized under "social risks," may lead to industrial stoppages and operating losses.[88] On the other hand, many laborers are migrant workers and child laborers with few legal rights,[89, 90] and in Indonesia, legislature governing the rights of indigenous communities remains weak.[91] Palm oil

83. Ibid.

84. Ibid.

85. Salahudin Yaacob, "Global Demands for CSPO—Where Are the Markets Headed?," presentation, February 12 2015. Available from http://www.mpoc.org.my/upload/P5-Reach-and-Remind-2015-Mr-Salahudin.pdf.

86. Joel Finkelstein, "The Chain: 96% of Global Palm Oil Trade Covered by Zero-Deforestation," *Chain Reaction Research,* 8 December 2014. Available from http://chainreactionresearch.com/2014/12/08/the-chain-musim-mas-no-deforestation-policy/.

87. Various reports by Chain Reaction Research, in particular "Triputra Agro Persada," 2015, 20. Available from https://chainreactionresearch.files.wordpress.com/2015/05/triputra-agro-persada-crr-report.pdf.

88. *Palm Oil Investor Review*, 11.

89. *Exploitative Labor Practices in the Global Palm Oil Industry,* Accenture, 2013, 33–38. Available from http://humanityunited.org/pdfs/Modern_Slavery_in_the_Palm_Oil_Industry.pdf.

90. Syed Zain Al-Mahmood, "Palm-Oil Migrant Workers Tell of Abuses on Malaysian Plantations," July 26 2015. Available from http://www.wsj.com/articles/palm-oil-migrant-workers-tell-of-abuses-on-malaysian-plantations-1437933321.

91. *Palm Oil and Indigenous Peoples in South East Asia,* International Land Coalition, 2011, 7. Available from http://www.landcoalition.org/sites/default/files/documents/resources/FPP_Malaysia_Indonesia_web_11.03.11.pdf.

companies are known to suppress worker disobedience through violence and the termination of workers' employment.[92, 93] With such an unequal balance of power between companies and local communities, it is hard to see how social conflicts can pose a consistent and significant risk to an unsustainable company's revenues.

The Crucial Role of Regulation and Government

From the above analysis, it seems clear that the threat of reduced productivity at some point in the future is not enough to reduce the value of unsustainable companies in investors' eyes. Hence, governments and regulatory bodies such as the RSPO play a crucial role in getting companies to internalize the negative impacts of their unsustainable activities.

Some experts believe regulators have yet to exercise this role to its full potential. "The RSPO could demand tens to hundreds of dollars in 'compensation debt' from companies for clearing land prior to completion of HCV (High Conservation Value) assessments," says Wakker. "Instead, it appears to go easy on growers." Though the RSPO does suspend companies for failing to submit annual sustainability progress reports,[94] "if a company clears or otherwise loses HCV areas, RSPO does not have clear rules on what is supposed to happen next."[95]

The Increasing Trend Toward Government Regulation—and the Difficulty of Legal Sanction

Until recently, few countries had legislation regulating what financial institutions, investors, and other companies in the palm oil supply chain could or could not do. In the Southeast Asian palm oil sector, "there has been no real legal system or precedent for taking action against those who do the wrong thing," says Thoumi. With a lack of legal oversight, quantifying material risk becomes even more complicated: "It is hard to tell if local banks are actually making money from oil palm deals. . . . It is possible that they are

92. E. Benjamin Skinner, "Indonesia's Palm Oil Industry Rife with Human-Rights Abuses," *Bloomberg Business,* July 18 2013. Available from http://www.bloomberg.com/bw/articles/2013-07-18/indonesias-palm-oil-industry-rife-with-human-rights-abuses.

93. World Rainforest Movement, "Indonesia: Harsh Conditions for Women Workers in Oil Palm Plantations," *World Rainforest Movement Bulletin No. 134*, 2008. Available from http://wrm.org.uy/oldsite/bulletin/134/Indonesia.html.

94. Roundtable on Sustainable Palm Oil, "Termination and Suspension of RSPO Membership," November 17 2015. Available from http://www.rspo.org/news-and-events/announcements/termination-and-suspension-of-rspo-memberships.

95. Eric Wakker (personal communication, November 7 2015).

losing money on the deals themselves, but gaining net profit from the overall partnership."[96]

The first governmental attempts to regulate sustainable palm oil came from consumer countries downstream in the supply chain. In 2010, the Netherlands launched the Dutch Task Force for Sustainable Palm Oil, which mandated that only sustainable palm oil could be purchased for the Dutch market by the end of 2015. As a result, the percentage of sustainable palm oil used in the Netherlands jumped from 30% in 2011 to 72% in 2014.[97] Other European countries, including Belgium,[98] France,[99] Germany,[100] and the UK,[101] have responded by issuing mandates with similar timelines.

More recently, countries that play key roles in palm oil financing have taken steps to tighten regulations. In 2014, Singapore passed its Transboundary Haze Pollution Act, which allowed entities causing haze pollution in Singapore to be taken to court, regardless of whether they were based in Singapore or not.[102] In October 2015, the Association of Banks in Singapore followed up the Act with Singapore's "Guidelines on Responsible Financing," which mandated stricter disclosure, governance, and capacity building regarding ESG issues for the majority of banks in the country.[103] Japan's "Corporate Governance Code," introduced in March 2015, provides a voluntary governance

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96. Gabriel Thoumi (personal communication, October 20 2015).

97. *Annual Report 2014,* Task Force for Sustainable Palm Oil, 2014, 2. Available from http://www.taskforceduurzamepalmolie.nl/uploads/media/TaskForceDuurzamePalmolie-summery-2013_EN-v40.pdf.

98. Roundtable on Sustainable Palm Oil, "Belgium Palm Oil Market Pledges to Become Sustainable by 2015," March 5 2012. Available from http://www.rspo.org/news-and-events/news/belgium-palm-oil-market-pledges-to-become-sustainable-by-2015.

99. Roundtable on Sustainable Palm Oil, "Launch of the French Alliance for Sustainable Palm Oil." Accessed 22 November 2015 from http://www.rspo.org/file/LAUNCH-OF-THE-FRENCH-ALLIANCE-FOR-SUSTAINABLE-PALM-OIL.pdf.

100. Forum Nachhaltiges Palmöl, "Our Aim." Accessed 22 November 2015 from http://www.forumpalmoel.org/en/ueber-uns/unser-ziel.html.

101. Department for Environmental, Food & Rural Affairs, "UK Statement on Sustainable Palm Oil: 2 Year On Progress Report," 2014. Available from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/388973/palm-oil-2yearson-201412.pdf.

102. *Transboundary Haze Pollution Bill,* Parliament of Singapore, 2014. Available from https://www.parliament.gov.sg/sites/default/files/Transboundary%20Haze%20Pollution%20Bill%2018-2014.pdf.

103. *ABS Guidelines on Responsible Financing,* Association of Banks in Singapore, 2015. Available from http://www.abs.org.sg/pdfs/Publications/ABS-Guidelines-Responsible-Financing.pdf.

framework that may make it harder for Japanese financiers to invest in unsustainable palm oil.[104] Most notably, in October 2015, the China Chamber of Commerce also presented its "Guide for Overseas Investment and Production of Sustainable Palm Oil by Chinese Enterprises." These guidelines are still in the process of being finalized, but if successfully implemented, China's commitment will play a big role in turning the tide towards sustainable palm oil: China is one of the world's largest purchasers of palm oil, accounting for 12% of the global market.[105]

The Indonesian government has lagged in enforcing sustainability policy, but the severity of recent fires has triggered some changes. In September 2014, Indonesia finally became the last country to ratify the ASEAN Agreement on Transboundary Haze Pollution, binding the government to take measures to prevent and monitor the spread of haze across borders.[106] In November 2015, President Joko "Jokowi" Widodo's administration instructed companies to refrain from clearing peatlands in existing concessions and planting areas that burned.[107] A legally binding presidential decree on the matter is said to be forthcoming. Most recently, in January, Jokowi made good on his promise to establish a peatland restoration agency, which aims to restore 2 million hectares of degraded peat within the next five years.[108]

The Indonesian environment ministry is currently investigating 276 companies for their role in 2015's fires; of these, 23 have been served with sanctions ranging from increased supervision to a permanent suspension of their licenses to operate.[109] In September 2015, the Supreme Court ordered PT Kallista Alam to pay a record $26 million in fines and

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104. *Japan's Corporate Governance Code: Seeking Sustainable Corporate Growth and Increased Corporate Value over the Mid- to Long-Term,* Tokyo Stock Exchange, 2015. Available from http://www.jpx.co.jp/english/equities/listing/cg/tvdivq0000008jdy-att/20150513.pdf.

105. *Profitability and Sustainability in Palm Oil Production: Analysis of Incremental Financial Costs and Benefits of RSPO Compliance,* WWF, 2012, 4. Available from http://d2ouvy59p0dg6k.cloudfront.net/downloads/profitability_and_sustainability_in_palm_oil_production__update_.pdf.

106. Jessica Cheam and Manilyn Manibo, "Indonesia Finally Ratifies Asean Haze Treaty," *Eco-Business*, 17 September 2014. Available from http://www.eco-business.com/news/indonesia-finally-ratifies-asean-haze-treaty/.

107. "A Hope for Peatland Protection, No More Business as Usual on Peat," *Eyes on the Forest News*, 12 November 2015. Available from http://www.eyesontheforest.or.id/?page=news&action=view&id=878.

108. "Peatland Restoration Agency Established to Prevent Forest Fires," *ANTARA News,* 14 January 2016 Available from http://www.antaranews.com/en/news/102502/peatland-restoration-agency-established-to-prevent-forest-fires.

109. "Indonesia Punishes Firms over Deadly Forest Fires," *Channel NewsAsia*, 22 December 2015. Available from http://www.channelnewsasia.com/news/business/indonesia-punishes-firms/2369068.html.

reparations for clearing land with fire in Aceh's Leuser Ecosystem, but in December a South Sumatra court threw out a similar case brought by the government against pulp and paper supplier PT Bumi Mekar Hijau.[110] The environment minister, Siti Nurbaya, has vowed to personally oversee the government's appeal.[111] Historically, few companies have been successfully prosecuted for their role in causing fires and haze.[112] It remains to be seen whether the latest efforts will garner different results.

How Are NGOs Innovating to Reach Financiers and Companies? Are Their Reports and Campaigns Getting Through?

In the previous section, we discussed the role of governments and regulators in getting the palm oil industry to internalize its environmental risk. However, regulators are only half the puzzle. This section will focus on NGOs, who play an equally crucial role.

In the palm oil sector, environmental NGOs have traditionally played the role of whistleblowers and public activists. This approach has had some success in drawing public attention to the issue and keeping companies accountable. Some notable achievements include Unilever's adoption of a sustainable palm oil policy following public demonstrations at its headquarters by Greenpeace,[113, 114] and the divestment of Deutsche Bank from Indonesian producer Bumitama Agri after consultations with the German NGO, Rettet den Regenwald, as well as a public petition receiving nearly 88,000 signatures.[115]

However, as the complexities surrounding the issues in the palm oil industry become more apparent, NGOs are progressively taking on the roles of mediators and knowledge providers to help companies' transitions to sustainability. "NGOs have increasingly

110. Amanillah and Arzia Tivany Wargadiredja, "Indonesia Suffers Setback in Fight against Haze after Suit Rejected,"*Reuters,* 30 December 2015. Available from http://www.reuters.com/article/us-indonesia-haze-idUSKBN0UD0PD20151230.

111. Indra Nugraha, "Indonesia Seeks Re-Do on Court Decision Absolving Company for Haze-Causing Fire,"*Mongabay.com,* 12 January 2016. Available from http://news.mongabay.com/2016/01/indonesias-environment-czar-to-personally-oversee-rematch-with-bmh/.

112. Alan Khee-Jin Tan, *The "Haze" Crisis in Southeast Asia: Assessing Singapore's Transboundary Haze Pollution Act 2014,* National University of Singapore Faculty of Law Working Paper 2015/002, 13–14. Available from http://law.nus.edu.sg/wps/pdfs/002_2015_Alan%20Khee-Jin%20Tan.pdf.

113. "Greenpeace Campaign Forces Unilever U-Turn on Palm Oil," *Greenpeace*, May 1, 2008. Available from http://www.greenpeace.org/international/en/press/releases/greenpeace-campaign-forces-uni/.

114. Judith Walls (personal communication, October 13, 2015).

115. "Deutsche Bank Dumps Controversial Palm Oil Company," *Mongabay.com*, May 27, 2014. Available from http://news.mongabay.com/2014/05/deutsche-bank-dumps-controversial-palm-oil-company/.

engaged in dialogue with companies," says Judith Walls, Assistant Professor at Nanyang Technological University, who researches the intersection of business and sustainability. "Even activist NGOs such as Greenpeace now regularly sit on corporate boards and consult with companies about how to address environmental issues."[116]

By relying on the traditional activist approach, NGOs risked simply "targeting larger brands, rather than the most destructive entities," says Benjamin McCarron, of Singapore-based consultancy Asia Research and Engagement.[117] To get through to financiers, NGOs need a much more comprehensive approach presented in terms investors can understand: namely, material risk. "We need a package consisting of improving standards, looking at lending, engaging with companies, and viable audits," says Cary Krosinsky. "Every sector is different and needs its own strategy."[118]

Efforts to reach financiers generally fall into two categories: research reports and shareholder tools. Research reports focused specifically on the financial impacts of unsustainable palm oil are picked up by financiers through controversy mining tools.[119] For example, the work of Chain Reaction Research (CRR) in highlighting the financial risks of unsustainable companies has played a key role in the adoption of more robust sustainability policies by companies such as Bumitama, as well as the blacklisting of companies such as Sumbermas Sarana by major palm oil traders.[120] "CRR reports and news updates are distributed to hundreds of analysts and others in the finance sector," says Eric Wakker, a senior consultant with CRR, who noted that the analyst community's reception to these reports has been positive.[121]

Shareholder tools are used by a specific category of activists known as activist investors, who also own shares in a company, and whose actions can significantly affect the amount of risk investors perceive to be associated with a particular firm. Shareholder tools are diverse, ranging from proxy votes and letter-writing campaigns to shareholder resolutions and boycotts, but all share the characteristic of advocating change from within the financial system.[122] Activist investors are seen as more credible by risk analysts and

116. Judith Walls (personal communication, October 13, 2015).

117. Benjamin McCarron (personal communication, October 23, 2015).

118. Cary Krosinsky (personal communication, July 30, 2015).

119. Benjamin McCarron (personal communication, October 23, 2015).

120. Eric Wakker (personal communication, November 7, 2015).

121. Ibid.

122. Chuck Eesely, Katherine DeCelles, and Michal Lenox, "Through the Mud or in the Boardroom: Examining Activist Types and Their Strategies in Targeting Firms for Social Change," University of

fellow investors, for they believe that the financial interests of activist investors are likely to be aligned with their own.[123]

One of the most significant activist investor groups in the palm oil sphere is the Sustainable Palm Oil Investor Working Group (IWG). The IWG comprises 25 institutional investors, all of which are members of the UN-supported PRI, representing over $2 trillion of assets under management. IWG members take an active role in engaging the palm oil companies in their portfolios by asking for clear commitments and time-bound plans to adopt RSPO certification.[124]

Aside from these specialized groups, however, some feel that there still exists a gap between activists and the finance world. "Many NGOs, especially local NGOs, find it hard to understand the financial sector and how to influence them," says Wakker, who helps organize training workshops for NGOs to better educate them on the subject.[125] Cary Krosinsky, lead consultant at PRI, is concerned that too much effort is being focused on divestment and corporate governance, and too little on pressing issues such as stopping deforestation. In addition, he observes, "everyone is currently promoting their own agenda . . . the key point, which is that you can outperform financially with ESG, is being lost."[126]

Whatever the approach taken, experts emphasize that fruitful results from the NGO-financier relationship in the palm oil sector depends heavily on dialogue—not just between NGOs and financiers, but also between financiers and palm oil companies. "Dialogues between investors at the more responsible end (of the spectrum) and listed producers . . . have had some success," says McCarron.[127] "With dialogue, each party becomes more aware and knowledgeable of the struggles the other party faces," adds Walls. "(But) if one party . . . only wants to point fingers or deny things, then nothing will change."[128]

Virginia Darden Business School Working Paper No. 2574046, 2015, 3–4. Available from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2574046.

123. Ibid., 3.

124. Principles for Responsible Investment, "Institutional Investors Call on Palm Oil Producers to Adhere to RSPO Principles as Next Phase of Engagement Begins," July 16, 2013. Available from http://www.unpri.org/viewer/?file=wp-content/uploads/2013-07-16PalmOilmediarelease.pdf.

125. Eric Wakker (personal communication, November 7, 2015).

126. Cary Krosinsky (personal communication, July 30, 2015).

127. Benjamin McCarron (personal communication, October 23, 2015).

128. Judith Walls (personal communication, October 13, 2015).

Differing Responses to Activism from Public and Private Companies

Compared to private companies, publicly listed companies have generally been perceived as being more receptive to activism. As a result, they have become the focus of the majority of activist campaigns. "Publicly listed companies tend to have better disclosure and be more responsive, as they are more in the public eye," says McCarron.[129]

The traditional recourse for investors owning shares in unsustainable companies has been divestment. However, there has been significant pushback against the divestment model. Many investors express the sentiment that in the absence of binding industry-wide regulations, divestment will not change a company's actions if it can simply find financing elsewhere.[130]

Now, more proactive investors are seeking to stimulate organizational change through engagement with errant companies. "Rather than divestment, it's about future investment in these companies and how it can be directed," says Krosinsky. "For example, if forest areas need to be preserved, companies can be encouraged not to place capital expenditures there."[131] For institutional investors, divesting from a company generally involves a formal review process lasting one to three years; during this period, the investee company should be strongly incentivized to engage with investors.[132] Divestment, if performed, should be regarded as a last resort.

Though private companies are seen as harder to influence, some experts express hope that they, too, can be engaged, by using the corporate value chain.[133] Private companies often still need to borrow, which subjects them to corporate banks' ESG screens and risk management policies. Additionally, unsustainable private growers will be materially impacted by the no deforestation, no peat, no exploitation policies of publicly listed traders.[134] Finally, private equity firms offer an additional channel through which to influence companies. Private equity investments are generally committed for a period of over five years, making divestment difficult; on the other hand, this creates an incentive

129. Benjamin McCarron (personal communication, October 23, 2015).

130. *Palm Oil Investor Review*, 31.

131. Cary Krosinsky (personal communication, July 30, 2015).

132. *Palm Oil Investor Review*, 32.

133. Iain Henderson (personal communication, October 29, 2015).

134. Ibid.

for investors to take a proactive approach, using their majority stake to influence these companies' operations and create lasting value.[135]

A Positive Approach to Sustainable Finance

Banks and investors are increasingly looking for ways to hold companies accountable for their actions. In previous sections of this article, we looked at how financiers may deny capital to companies with poor environmental performance. Now, some leading banks are also exploring a more positive approach by introducing incentives that encourage companies to perform better.

Among the commercial banks with ESG policies, a significant number also have standalone policies on financing palm oil. Many require their clients in the palm oil sector to either be members of the RSPO, or have a time-bound plan to achieve this.[136] Now, banks are moving toward a more collaborative model: working with clients to identify gaps, and providing the necessary financing for them to fully adopt sustainable palm oil.

One of the most important agreements in this direction is the Soft Commodities Compact, developed as a collaboration between the Banking Environment Initiative (BEI) and the Consumer Goods Forum (CGF). Signatory banks to the Compact agree to use "appropriate financing mechanisms" to help non-RSPO certified clients achieve certification, so that by 2020, all their corporate and investment banking clients in the palm oil sector will be RSPO-certified.[137] The signatory banks to the Compact are Barclays, BNP Paribas, Deutsche Bank, Lloyds, Rabobank, RBS, Santander, Standard Chartered, UBS, and Westpac.[138]

A few banks have also begun extending preferential credit to "good actors" in the palm oil sector. In 2014, HSBC launched a discounted finance product for clients trading certified

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135. *Palm Oil Investor Review*, 31.

136. Various banks; for example, see Citi's "Environmental Policy Framework," 2012. (http://www.rspo.org/file/acop/citi/F-Lending-Policy.pdf) and UBS's "Environmental and Social Risk Policy Framework," 2015. Available from http://www.ubs.com/content/dam/ubs/global/about_ubs/corporate_responsibility/UBS-ESR-framework.pdf.

137. *'Soft Commodities' Compact,* Banking Environment Initiative, 2014. Accessed November 22, 2015 from http://www.cisl.cam.ac.uk/business-action/sustainable-finance/banking-environment-initiative/pdfs/the-bei-and-cgfs-soft-commodities-compact.pdf.

138. Cambridge Institute for Sustainability Leadership, "The Banking Environment Initiative (BEI) and Consumer Goods Forum (CGF)'s 'Soft Commodities' Compact." Accessed November 22, 2015 from http://www.cisl.cam.ac.uk/business-action/sustainable-finance/banking-environment-initiative/programme/soft-commodities.

sustainable palm oil internationally.[139] Another such bank is Rabobank, which gives clients that are "leaders in sustainability" "priority when providing finance," "[doubling] the amount of services provided to these customers."[140] Rabobank also has its Sustainable Agriculture Guarantee Fund, which "[enhances] access…to working capital credit" for "small- and medium-sized producers of sustainable agricultural products in developing countries."[141]

Another milestone came in January 2014, with the introduction of the Sustainable Shipment Letter of Credit by BEI.[142] Under this agreement, the International Finance Corporation (IFC) will offer preferential terms of credit to its partner banks when they finance the import of RSPO-certified sustainable palm oil to emerging markets.[143] Uptake has been promising, with one bank reporting nearly $50 million of new "sustainable shipment" business from July to December 2014. A similar approach is now being explored for the shipment of other commodities.[144]

A few banks have even gone as far as making "greenness" an integral part of their corporate agenda. One of these is South Africa's Nedbank, which launched South Africa's first ESG-benchmarked index, the Nedbank Index, in 2011.[145] Other Nedbank initiatives include a dedicated Carbon Finance Team, which develops strategies for clients to reduce

139. HSBC, "Forestry and Agricultural Commodities." Accessed November 22, 2015 from http://www.hsbc.com/citizenship/sustainability/finance/forestry-and-agricultural-commodities.

140. *Annual Report 2014,* Rabobank Group, 29. Available from https://www.rabobank.com/en/images/annual-report-2014-rabobank-group.pdf.

141. Rabobank International, "Rabo Sustainable Agriculture Guarantee Fund," 4. Available from https://www.agriskmanagementforum.org/sites/agriskmanagementforum.org/files/Documents/Rabo%20Brochure.pdf.

142. *The BEI's Sustainable Shipment LC: A Financing Innovation to Incentivise Sustainability Commodity Trade,* University of Cambridge Programme for Sustainable Leadership, 2014. Available from http://www.cisl.cam.ac.uk/publications/publication-pdfs/the-banking-environment-initiative-sustainable-shi.pdf.

143. International Finance Corporation, "Sustainable Shipment LCs." Accessed November 22, 2015 from http://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/industries/financial+markets/trade+and+supply+chain/gtfp/gfm-tsc-gtfp-sustainablelc.

144. Andrew Voysey, "Can Changing How World Trade Is Financed Actually Change the World?" *Consumer Goods Forum,* June 9, 2015. Available from http://www.theconsumergoodsforum.com/blog/406-can-changing-how-world-trade-is-financed-actually-change-the-world.

145. Dennis Ndaba, "South Africa's First Green Index Launched," *Engineering News*, August 12, 2011. Available from http://www.engineeringnews.co.za/article/nedbank-capital-launches-south-africas-first-green-index-2011-08-12.

their carbon footprints,[146] and a Green Affinity Banking program, which donates money to environmental causes on behalf of clients at no additional cost.[147]

One condition is crucial for green financing schemes to succeed: All commercial banks within a region must adopt the same message. For instance, offering preferential rates to "good" actors is unlikely to have an impact if other banks decide to offer even lower rates, with fewer restrictions.[148] Cooperation is also a key consideration for the consortiums of banks that underwrite major loans and IPOs. "When a consortium finances a group, one bank isn't going to give incentives when the others don't," notes Wakker.[149]

The Way Forward

Despite large leaps forward in the past few years, the green finance industry is still in its infancy. Though an increasing number of financiers are recognizing the importance of sustainable finance and implementing stricter ESG standards, "institutions are still learning to make buy and sell decisions that actively incorporate environmental risks and opportunities," says Gabriel Thoumi.[150]

However, time is of the essence. Unsustainable forest commodity farming is causing forests to be lost at an alarming rate, and with them, irreplaceable biodiversity and the livelihoods of millions of indigenous people. From a financial perspective, the inability of agribusiness companies to internalize environmental costs is a massive economic problem. Early estimates indicate that when healthcare, logistical, and fire-fighting costs are considered, this year's forest fires may have cost Indonesia US$47 billion.[151]

146. Nedbank Capital, "Carbon Finance." Accessed November 22, 2015 from http://www.capital.nedbank.co.za/capital/carbon-finance.

147. Nedbank, "Green Affinities," Accessed November 22, 2015 from https://www.nedbank.co.za/website/content/GreenAffinities/.

148. Iain Henderson (personal communication, October 29, 2015).

149. Eric Wakker (personal communication, November 7, 2015).

150. Gabriel Thoumi (personal communication, October 20, 2015).

151. Francis Chan, "$47b? Indonesia Counts Costs of Haze," *The Straits Times,* October 11, 2015. Available from http://www.straitstimes.com/asia/47b-indonesia-counts-costs-of-haze.

The following factors will be crucial in accelerating the transition of palm oil financing toward full environmental sustainability:

1. **Greater transparency about company ownership and environmental footprint.** Currently, none of the major business information agencies provide comprehensive data on company ownership. A number of services do exist to help listed companies understand their own ownership, including NASDAQ, CLSA, and the corporate access teams within major banks.[152] Both services are key for investors to make sure they do not contribute, directly or indirectly, to financing unsustainable palm oil.

   ESG materiality assessments for companies are not mandatory in the vast majority of jurisdictions. Without these assessments, critical ESG issues will not be discussed in financial statements, and will not be brought to the attention of financial analysts. There should be a shift in regulations so that ESG assessments are no longer considered optional, but a part of standard reporting and disclosure procedures.[153]

2. **Greater collaboration between environmentally minded financiers.** Many of the issues in sustainable finance are too big for any institution to tackle alone. Corporate banks need to work together to present a cohesive stance to the palm oil industry and avoid being undercut by competitors less concerned with sustainability. There is also great potential for leading funds, such as the Norwegian and Swedish pension funds, to spearhead large-scale conservation finance projects; CalPERS is one example of a major fund that is leading inter-institutional efforts to promote regulation and legislation.[154]

3. **Enforcement of "no deforestation, no peat, no exploitation" policies.** In the absence of stronger regulations by the Indonesian government, the no deforestation, no peat, no exploitation pledges made by major palm oil traders and consumer goods manufacturers remain the most material risk to unsustainable palm oil companies. Enforcing these pledges would cut unsustainable companies out of major segments of the market. It would also negatively affect measures of risk used by financial analysts, making these companies less attractive prospects for investors and financiers.[155]

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152. Cary Krosinsky (personal communication, July 30, 2015).

153. Ben Caldecott and Jeremy McDaniels, "Financial Dynamics of the Environment," 28.

154. Ibid., 41–42.

155. *Indonesian Palm Oil Growers' Exposure to Sustainability Purchasing Policies,* Chain Reaction Research, June 30, 2015. Available from https://chainreactionresearch.files.wordpress.com/2015/07/2015-06-30-idx-companies-report.pdf.

4. **Defining the value of palm oil companies in terms of yield, not size of land banks.** If the yield of all existing palm oil plantations were improved by 2% each year, the increase in output would be enough to meet 100% of the projected growth in global demand.[156] Yet, many investors continue to measure the potential of oil palm companies in terms of the size of their land banks, creating an incentive to clear land rather than to adopt better farming methods. Measuring earnings potential in terms of productivity would direct more capital toward more sustainable companies, which would also generate more value in the long run.
5. **A cultural shift for many in the financial industry.** Though many financiers have recognized the importance of implementing ESG standards, the industry as a whole is still restricted by systemic structures that favor short-term profit over long-term environmental performance. To overcome this, says Gabriel Thoumi, metrics measuring environmental performance need to be built into the compensation structures of analysts and fund managers. "When individuals employed to build environmental value are considered profit centers, rather than cost centers, that will be the sea change."

Biography

Pek Shibao is a sustainability researcher and consultant based in Singapore. He is interested in sustainable finance and forestry, particularly commodity supply chains. Pek also works with PM.Haze, a citizen's activist group that aims to find solutions to the haze problems affecting Southeast Asia.

156. Fitrian Ardiansyah, "Climate Change, Deforestation and the Role of Sustainable Palm Oil," *WWF Indonesia*, 6. Available from https://www.academia.edu/1086768/Climate_Change_Deforestation_and_the_Role_of_Sustainable_Palm_Oil.