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CLAREMONT MCKENNA COLLEGE

Promoting Bold Investment in Renewable Energy Research and Development

SUBMITTED TO

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AND

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BY

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for SENIOR THESIS

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Table of Contents

ACKNOWLEDGEMENTS	4
<u>CHAPTER 1: INTRODUCTION</u>	<u>5</u>
THE THREAT OF CLIMATE CHANGE	5
CLEAN ENERGY POLICY IN THE UNITED STATES	7
PRIVATE INVESTMENT IN RENEWABLE ENERGY R&D	14
<u>CHAPTER 2: PRIVATE INVESTMENT VEHICLES</u>	<u>16</u>
THE PROFIT MAXIMIZATION OBLIGATION?	28
SOCIAL RESPONSIBILITY AND PENSION FUNDS	34
SOCIAL RESPONSIBILITY AND MUTUAL FUNDS	42
<u>CHAPTER 3: GREEN MUTUAL FUND CASE STUDIES</u>	<u>43</u>
PAX WORLD	43
TRILLIUM	49
CLEAN ENERGY MUTUAL FUNDS	57
SUMMARY	73
<u>CHAPTER 4: RISK OF INVESTMENT</u>	<u>79</u>
GOVERNMENT POLICIES THAT AFFECT RISK	79
WHY DO FUNDS CLOSE?	82
TERMINATED CLEAN ENERGY FUNDS	84
<u>CONCLUSION</u>	<u>86</u>
<u>APPENDIX A – GREENEST MUTUAL FUND CHARTS</u>	<u>89</u>
<u>APPENDIX B- COMPANY RANKINGS</u>	<u>90</u>
<u>APPENDIX C –FUND PERFORMANCE TABLES</u>	<u>97</u>
<u>BIBLIOGRAPHY</u>	<u>100</u>

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CHAPTER 1: INTRODUCTION

Even though the consequences of climate change persist for the very long term, the time to avoid those consequences is very short. A delay – of even a decade—in reducing CO₂ emissions will lock in large-scale, irreversible change. Delay also increases the risk that the whole climate system will spin out of control (Harvey and Aggarwal, 2012, 1)

The lack of progress in climate change mitigation calls for new sources of funding for environmental solutions. As the burning of fossil fuels is the largest contributor to climate change, investment in renewable energy research and development (R&D) is needed to catalyze the transition away from a carbon economy. Although charities, government, and foundations support clean energy, much more money is needed to meet estimated costs of mitigation. This thesis argues for ambitious investment in renewable energy by the private sector. The rise of companies with an environmental or social focus challenges the traditional conception that business exists only to maximize profit. Rather, it suggests that the private sector has a potential role to play a role in climate change mitigation. Incorporating an environmental or social focus into a company's business plan does not necessarily entail underperformance compared to traditional investments. However, the investment needed to stimulate significant breakthroughs in clean energy technology that will best address climate change may not yield the kind of profit that the private sector usually requires.

The Threat of Climate Change

Not enough is being done to address climate change. Forty years ago, a Ford Foundation report examined energy supply in the long term and warned against the greenhouse gas effect (Jones and Bouamane 2012, 17-18). Since the 1992 Earth Summit

in Rio, and subsequent summits, countries have banded together to address climate change, stabilize emissions, and develop non-binding reduction targets. In the early 1990s, the scientific community agreed that two degrees Celsius was the maximum increase the climate could absorb before destabilizing the conditions humans and other species have adapted to (Nijhuis, 2014). However, recent scientific evidence has suggested that even the two-degree limit is not ambitious enough. Despite this general consensus, the non-binding provisions of these conventions have proved to be unsuccessful at motivating climate change mitigation. A 2014 Global Carbon Project report shows a 2.3 percent increase in global greenhouse gas emissions and a 2.9 percent increase in the United States in 2013 (Gillis, 2014).

Waiting to address climate change is poses serious risks. Very low emissions are required to stabilize any concentration of carbon dioxide (CO₂) because carbon accumulates in the atmosphere over time. As time passes and emissions are released, more and more carbon accumulates, making it increasingly difficult to stabilize. Industrial activity has introduced as much CO₂ into the air from burning fossil fuels in the past fifty years as has been accumulated over millions of years of natural carbon flows (Harvey and Aggarwal, 2012, 2). Furthermore, there is a time lag in the effects of climate change caused by emissions, so even if emissions were halted today, consequences from past emissions would endure. Thus, the world has not yet felt the full effects of past emissions and is unaware of the climate disruptions the currently increasing emissions will cause.

Compounding the problem, the natural systems that mitigate climate change are being deteriorated. Plants and water bodies that absorb CO₂ are becoming over saturated

and “without [these] carbon sinks the atmospheric CO₂ levels will rise twice as fast as they have been” (Harvey and Aggarwal, 2012, 4). Because emissions have not been mitigated fast enough, many impacts are now irreversible and “optimistic projections of climate warming estimate that 18 percent of all species will become extinct because of ecosystem alternation and loss” (Harvey and Aggarwal, 2012, 6). The time to act is now.

In order to mitigate climate change, the use of non-renewable fossil fuels must be phased out. The International Energy Agency has estimated that to have a 50 percent chance of staying below the two-degree limit, only a third of current fossil fuel reserves can be burned (Spedding, Mehta, and Robins, 2013, 2). This concept of stranded assets should encourage investment in clean energy in order to meet energy demands without surpassing the two-degree limit. Investing in clean energy will save money, because investing in capital equipment that is energy efficient and compatible with renewable technology now reduces the need for retrofitting and renovating later on. However, oil and gas companies are still pouring resources into extraction. A 2013 Carbon Tracker Report estimates that the top 200 fossil fuel companies allocated \$674 billion from 2012 to 2013 for extraction (Carbon Tracker 2013, 4). In order for renewable energy to compete with fossil fuels, research and development (R&D) must meet, if not exceed this investment.

Clean Energy Policy in the United States

There are past examples of investment in renewable energy. In 1878 a Frenchman developed a solar powered steam engine, but was limited by insufficient government funding that could not cover the high costs of development (Jones and

Bouamane 2012, 3). After World War II, a shifting and growing population in the United States called for cheap and efficient affordable housing. In an effort to meet these demands, Carl Koch developed an easily assembled affordable house model that utilized passive solar heat in 1954 (Jones and Buamane 2012, 11). However, the interest in solar diminished quickly as fossil fuel costs lowered. Clean energy achieved robust popularity again in the mid-1970s as concern for oil supply grew due to turmoil in the Middle East. U.S. President Jimmy Carter spiked federal interest in renewables and even installed solar panels on the White House. In response to the 1979 oil shock due to the Iranian Revolution, the Carter administration developed “a new \$3 billion program of research into the solar industry” and “by the early 1980s the US represented 80 percent of the world market for solar energy” (Jones and Buamane 2012, 21). Despite these gains in the past, investment in renewable energy in recent years has been inadequate and illustrates a lack of innovation and development over the past three decades. In 2013, the United States was ranked as only the third largest solar market (Gross 2014).

While the government is a significant investor in clean energy, its process is cumbersome. A changing political climate can delay progress. Although Carter was a strong advocate of renewable energy, when Reagan came to office, much of the progress under Carter was reversed. Similarly, under the George W. Bush Administration, the U.S. federal budget for energy R&D decreased by 11 percent from 2004 to 2005, which was amidst increasing fossil fuel generation and growing concern about climate change (Nemet and Kammen 2007, 747). This led to government investment in energy R&D in 2007 to drop below expenditures in the 1990s. While Obama’s 2015 fiscal year plan has

ambitious energy research plans that may help overcome the reduction¹, ten years passed since the reduction under the Bush administration in which more fossil fuels were extracted, emissions rose, and climate disruptions hurt communities around the world. Therefore, while the energy bill was cut, the damage to the climate increased, compounding the negative effects and the time needed for mitigation.

The United States has fallen behind many other countries in renewable energy development. Laird and Stefes (2010, 2619) note that the United States and Germany had similar energy policies after the 1970 energy crisis, but have since diverged. After the crisis, the United States increased domestic supply of fuel, established public institutions dedicated to renewable energy, and increased total energy research and development (Laird and Stefes 2010, 2620). Similarly, Germany increased research and development for domestic energy and public expenditure on renewable energy research (Laird and Stefes 2010, 2621). Laird and Stefes dismiss two explanations for the later divergence: difference in endowments and public opinion of renewable energy. According to them, the United States has more renewable energy resources than Germany, and poll data reveals that Americans have wanted renewable energy to be the focus of the Department of Energy as early as 1995 and as recently as 2007 (Laird and Stefes 2010, 2620). Rather, they argue that it was the political climate and energy policies the countries adopted in the 1990s that account for the differences today.

¹ The Obama Administration has proposed an ambitious energy plan for the fiscal year 2015 including 2.6 and 22 percent budget increases from 2014 for the Department of Energy and the Office of Energy Efficiency and Renewable energy respectively. The 2015 fiscal budget also proposes a 67 percent increase for smart grid R&D. (Environmental and Energy Study Institute 2014)

In the United States, despite the investments in renewable energy after the 1970 crisis, clean energy did not enter the energy system as much as in Germany, and so it remained off the political radar. Furthermore, advocacy groups were less effective and fewer manufactures of renewable energy equipment emerged (Laird and Stefes, 2010). Also, in the United States, the energy budget constantly fluctuated due to changing leadership and conflict between the president and congress. In contrast, Germany's renewable energy associations were able to build a strong coalition both externally and within parliament and passed a feed-in tariff law that proved that the renewable energy sector could thrive if given sufficient funding (Laird and Stefes, 2010). Over the years, the original feed-in tariff law was revised and improved and now, the German renewable energy sector is very strong. Another difference was that global warming was very important to Germany early on, so when crises that called for renewable energy development occurred, members of parliament were ready to exploit these opportunities and create new policies (Laird and Stefes, 2010). Therefore, although both countries have good public support for renewable energy, in Germany, government support for renewables leads public opinion. Alternatively, it appears that the United States government's spark of interest in renewable energy post-1970s oil crisis was driven by a desire for the cheapest fuel source rather than a desire to change the status quo. The only significant energy policy that emerged in the United States over the same time frame was a tax credit granted to producers of renewable energy, but due to its frequent need for renewal and lack of cohesive political support, the tax credit did little to introduce renewables into the market.

Denmark is another country that has surpassed the United States in its renewable energy production. Mendonça, Lacey, and Hvelplund (2009) attribute Denmark's success to its use of a combination of the neoclassical approach and the concrete institutional economy and innovative democracy approach. The neoclassical approach assigns the government the role of keeping the free market in order, meaning energy policy is employed to correct market failures (Mendonça, Lacey, and Hvelplund, 2009, 11). This approach is equipped with three tools: internalizing external costs, establishing free market competition, and increasing renewable energy research (Mendonça, Lacey, and Hvelplund, 2009, 11). In Denmark, quotas with grandfathering are given to internalize costs based on European Union policy, and Denmark introduced a feed-in tariff policy in the 1970s to make renewables competitive in the free market.

However, Denmark also encouraged a cooperative model for renewable energy ownership, which comes from a concrete institutional economy and innovative democracy approach. This approach recognizes that most markets have been designed to support certain industries, like fossil fuels, giving them market influence, so free market rules cannot apply. Therefore, new and independent actors must be introduced into the market (Mendonça, Lacey, and Hvelplund 2009, 13). The tools within this approach include maintaining a political balance between larger established energy companies and newer smaller firms or NGOs, renewable energy research, a feed-in system, ownership rules that support local and regional renewable energy development, infrastructure that supports renewable energy, and internalization of costs without grandfathering (Mendonça, Lacey, and Hvelplund 2009, 13). Across the board, Danish energy policy has favored decentralized power, giving individuals access to the renewable energy market.

Tax exemptions were given to households that owned wind power, most wind farms or turbines were owned cooperatively granting membership only to those that lived close to the turbines, and a 30 percent government subsidy was given to new wind energy installations (Mendonça, Lacey, and Hvelplund 2009). By 2001, 80 percent of all wind turbines in the country were household owned (Mendonça, Lacey, and Hvelplund 2009, 7). In 2014, Denmark held the world record in wind energy with 39.1 percent of all electricity generated by wind power (Danish Wind Industry Association 2015).

Denmark's combined approach starkly contrasts that of the United States. As previously mentioned, the United States has focused on federal tax credits as the main energy policy responsible for introducing renewable energy into the market. However, unlike the Danish cooperative model, most Americans are excluded from the renewable energy market because many do not owe enough taxes to qualify for credits. Therefore, the market is limited to corporations and wealthy individuals (Mendonça, Lacey, and Hvelplund 2009, 1). The authors note that tax credits can grow renewable energy when left stable for long periods of time, however in the United States, there have been inconsistent policies and lack of support from either party. They also note that there was a feed-in tariff policy introduced in 1978 when fossil fuels were expensive that required energy utilities to purchase energy from renewable generators, but the system failed when conventional energy prices dropped (Mendonça, Lacey, and Hvelplund 2009). This provides further evidence that the main motivation behind renewable energy development in the United States has been temporary rises in conventional fuel price rather than a lasting initiative to change the energy system to be more sustainable.

According to both the Danish and the German experience, the clean energy sector in the United States would benefit greatly from a feed-in tariff system. While the United States appears to be taking more of a neo-classical approach due to its preference for centralized corporate energy development, even support for renewable energy in this form has been largely inconsistent and volatile. A feed-in tariff policy would help decentralize the power and open the market up to more players, allowing for better diffusion into the energy market and introducing a concrete institutional economy and innovative democracy approach to U.S. energy policy. As previously mentioned, even back in the 1970s, German energy policy was been driven by a desire to be more sustainable, which is a more recent goal of the United States government. Thus, a feed-in tariff policy is likely to be more effective now than when it was initially introduced in 1978.

However, even with improved federal policies, there is a limit on how far government can push the envelope on clean energy initiatives because of forces aligned in opposition. The International Energy Agency executive Maria van der Hoeven notes the following:

Uncertainty over policy support for biofuels is rising in the EU and the United States, slowing expectations for production growth and threatening the development of the advanced biofuels industry at a time when the first commercial plants are just coming online (International Energy Agency 2014).

Van der Hoeven highlights how there are certain directions government funded initiatives will never go due to lacking popular support. If there is enough public opposition or opposition from another party, it is unlikely the government will be able to address the problem. In this case, although the technology of biofuel is ready for adoption, the

political climate in the E.U. and the U.S. are not inviting. This limits the degree to which the government can introduce biofuels and other sources of renewable energy. Thus, another source of funding is needed in addition to government, to allow for renewable energy R&D to persist despite governmental funding set backs.

Private Investment in Renewable Energy R&D

Investments in renewable energy R&D need to scale up significantly in order to make breakthroughs in technology. The current technologies are still too expensive for widespread distribution because of product cost and lacking distribution mechanisms. Reddy and Painuly (2003) note that many barriers prevent renewable energy technologies from competing with fossil fuels, the most blatant being cost. Additionally, Hekkert et al. (2007) argue that “in order to make technological change sustainable, technical change alone is not sufficient. Change in the social dimension—such as user practices, regulation, and industrial networks—are [sic] inevitable.” Therefore, even if product costs are reduced, policy changes are necessary to enable the diffusion of renewable energy technology.

The world demand of energy is expected to increase by 50 percent by 2040 (Gates 2014) and if clean energy technology is not expanded and made available to all countries at a lower cost, then much of this demand will be met with the increased burning of fossil fuels. Currently in the United States, the private energy sector invests only 0.42 percent of sales into energy R&D and only two percent of the federal R&D budget is spent on energy (Gates 2014). Although the United States is the leader in overall gross expenditures on R&D (Greuber and Studt 2013), it ranks eleventh in public energy R&D

(Gates 2014). The Information Technology and Innovation Foundation suggests tripling U.S. federal spending on energy R&D to \$15 billion per year (Stepp and Nicholson 2013). However, as previously mentioned, government investment can be slow due to a changing political climate and lack of policy support. Furthermore, its energy R&D budget has to be divided between renewable energy and fossil fuel research because existing infrastructure is designed for traditional energy. Private investors of course, can invest solely in renewable energy and are not obligated to also invest in traditional energy. Thus, increased private spending is necessary in addition to increased government spending to make breakthroughs over a shorter time horizon.

The private investment that is needed to make technological breakthroughs to overcome the current cost barrier will need to be ambitious and non-profit oriented. Reddy and Painuly (2003, 1445) summarize the difficulty of private investment in renewable energy technology:

Demonstration programmes are necessary to test new energy technology manufacturing and energy conversion facilities and to prove their technical and economic viability. The private sector may find it difficult to build demonstration plants for various reasons—high capital requirements, required rates of return, high risk, and difficulties to appropriate long-term benefits.

They conclude that public policy is needed to stimulate the investment. However, as previously established, public policy can be slow and the energy R&D budget in the United States is too low to sufficiently fund clean energy breakthroughs. Therefore, private investors who are willing to receive less than competitive return in an effort to make the biggest impact are desperately needed to catalyze the diffusion of renewable

energy into the energy market. Individuals interested in contributing to this effort require mechanisms that are currently underdeveloped.

CHAPTER 2: PRIVATE INVESTMENT VEHICLES

There are several avenues for donors who wish to contribute to social and environmental causes. One option is a charitable donation² that gifts money to a charitable organization whose staff and board determine how the money is spent. Individuals who make larger, longer-term donations and want more agency in determining how the money is spent to ensure their social or environmental goals are met, may prefer starting a private foundation or creating a donor-advised fund (DAF).

Unlike a charity that receives many donations from various sources, a private foundation is created by one or few individuals who provide an initial endowment. The owners and staff of the foundation determine its mission and how the assets are distributed among for-profit program related investments, charitable purposes, and individuals (Fidelity 2013).³ The DAF does not require the start up costs of a foundation, but still allows for the donor to manage how assets are spent. The assets in a DAF are invested into socially responsible and impact investment options such as socially screened mutual funds, community investment notes, and private equity stock in impact

² Charitable donations allow for tax deductions on donations of up to 50 percent of income. This method is ideal for those making few smaller contributions as the individual must research and select a charity, record every donation and file for tax return (Fidelity 2013).

³ Foundations are required to grant out 5 percent of their portfolio annually (Old Point Investment Services 2014). Donations to private foundations can be tax deducted only up to 30 percent of income.

ventures. The returns from these investments allow the fund to grow, and periodically a grant is gifted to a charity of the donor's choosing (ImpactAssets 2014).⁴

However, the lack of funding for climate change solutions is not solved even though huge contributions are given to charities, particularly in the United States. According to the National Philanthropic Trust, 95.4 percent of American households give to charity with an average annual household contribution of \$2,974 and an aggregate donation of \$335.17 billion in 2013 (National Philanthropic Trust). However, the majority of charitable dollars go to religion and education, not climate change. A 2006 Stern Review “estimated that mitigation would cost 1 percent of [global] GDP whereas the cost of dealing with unabated climate change could reach 20 percent or more of [global] GDP” (Harvey and Aggarwal, 2012, 14). One percent of global GDP in 2006 is approximately \$595.65 billion in present value.⁵ The funding from charities, foundations, and government combined do not reach this target. In 2013, only \$9.72 billion of US charitable donations went to environmental and animal issues. According to the Foundation Center, in 2008 US foundations granted nearly \$900 million and in 2012 \$1.3 billion foundation grants were distributed to environmental initiatives worldwide (Lawrence 2010). As the United States is a leader in charitable giving, even with the contributions from other countries, the global aggregate of philanthropic dollars going to climate change mitigation is below the approximated Stern estimate by a large margin. Furthermore, the cost today is even higher than this estimate because since 2006, the

⁴ The initial investment is tax deductible and the assets in the DAF appreciate tax free (ImpactAssets 2014).

⁵ 1% of GDP in 2006 was approximately 503 billion (GDP = 50,334,896,708,308 total GDP) (The World Bank 2014). \$100 in 2006 is approximately \$118.42 in 2014 (Bureau of Labor Statistics).

concentration of greenhouse gases in the atmosphere has increased and more climate disruptions have occurred.

Several foundations do contribute to renewable energy R&D. For example, the Hewlett Foundation's main objectives are to provide clean power and clean transportation. It focuses its investing strategy on five environmental areas: reducing reliance on high carbon energy, increasing renewables, increasing efficiency, encouraging clean transportation, and building broad support for expanding clean energy and climate change (The Hewlett Foundation 2014). Thus, it funds grantees that develop renewable technologies, advocates for environmental policy reform, conducts urban planning for sustainable transport, and improves energy efficiency. Most of its grants are awarded to the ClimateWorks Foundation and the Energy Foundation, which re-grant funds (The Hewlett Foundation 2014). From 2000-2013 the Hewlett Foundation granted \$1.29 billion to environmental causes (The Hewlett Foundation 2014).

Companies that focus on clean technology and environmental solutions provide another channel for private investment in clean energy. The main obstacle in encouraging companies to contribute more to clean energy is the profit obligation to shareholders. The companies that will make the greatest impact in the field are those that maximize impact over profit. However, there are examples of institutions that specifically maximize a non-profit mission, such as low-profit limited liability companies (L³Cs) and B Corporations.

L³Cs must be founded for a charitable purpose, but also can distribute some return to shareholders from profit making activities (Reiser 108, 2010). The high startup costs of renewable energy projects make L³Cs ideal as funding targets for such projects.

L³C s can take advantage of tax benefits offered to renewable energy projects, thus lowering “the cost of energy to the end use by accessing a wider base through foundations and non-profits” (Lang, Zimmer, and Mendelsohn, 6). L³Cs can attract investors that would often consider charitable activities too risky to invest in by allocating risk specifically to the non-profit entity (Lang, Zimmer, and Mendelsohn, 7). L³C legislation was first ratified in 2008 in Vermont, and nine other states have followed suit (interSector Partners L³C, 2014). However, thus far only one is focused on renewable energy. The Renewable Energy Design Group is a North Carolina-based L³C that focuses on solar power installation and design (RED 2014). Therefore, the L³C model has not reached its full potential as a means of funding and developing clean energy.

Another mechanism is the B Corporation, which employs the for-profit corporation model and adds a social imperative. B Lab is the non-profit organization that encourages for-profit businesses to solve social and environmental problems by providing a brand certification for companies that voluntarily decide to meet higher standards of social and environmental performance (B Corp 2014). B Lab’s doctrine is: “government and the nonprofit sector are necessary, but insufficient to address society’s greatest challenges. Business, the most powerful man-made force on the planet, must create value for society, not just shareholders” (B Corp 2014). By becoming B certified, companies commit to considering all stakeholders, not only shareholders. However, B Lab does not specify which should have top priority.

B Lab helped develop and advocate benefit-corporation legislation, which is a legal status provided by twenty-six states that have adopted the legislation. Benefit corporations are not necessarily certified B Corporations, though there are similarities.

Both certified B Corporations and benefit corporations voluntarily agree to meet higher standards of transparency and accountability, have an environmental or other social objective, and publish annual reports on their impact achievements (Benefit Corp 2014). However, B Corporations are subject to the B Lab impact assessment and engage with B Lab on a regular basis, whereas the only affiliation B Lab has with benefit corporations is its role in developing the legislation. While only twenty-six states legally recognize benefit corporations, a business in any state or country can become B certified, but it does not convey a legal status.

By becoming B certified, companies have access to services and support from B Lab including increased network and customer pools and impact assessment metrics. In order to become certified, B Corporations are required by B Lab to meet a minimum score of 80 out of 200 on its impact metrics (B Corp 2014). This impact assessment is largely focused on internal policies and processes of the company rather than the impact of their products or services on the greater good. B Lab examines companies' "operations, hiring and promotion practices, environmental management practices, and governance" (Renewable Choice 2014). The assessment is compared to a benchmark composed of 536 certified B Corporations, 1,075 sustainable businesses that voluntarily took the B Lab impact assessment but did not pursue certification, and 141 businesses that have no explicit environmental or social intent (B Corp 2014). Thus, B Lab sets forth an ideal for companies to align their internal processes with their environmental or social mission by upholding a good corporate culture and reducing environmental harm. However, it does not directly measure the effectiveness of the company in bringing social or environmental change through its products and services.

Only twenty-seven of over 1,000 B Corporations certified by B Lab focus primarily on renewable energy (B Corp 2014).⁶ Three are renewable energy research and design firms; thirteen generate and install renewable energy; one manages assets invested in renewable energy products; three produce renewable energy electronics; two design/build renewable energy products; and five belong to miscellaneous categories (B Corp 2014). While the B-Corporation certification requires businesses to voluntarily “meet rigorous standards of social and environmental performance, accountability, and transparency,” it does not specify if profit maximization must be sacrificed in an effort to create value for all of society, not just shareholders (B Corp 2014). B corporations focused on renewable energy scored within the range of 80 to 179 with an average of 109.

Six of the renewable energy companies explicitly state a commitment to a triple bottom line of “people, planet, and profits” on their websites: Microgrid Solar, Sun Common, A&R Solar, Solar States, Joule, and South Mountain Company. Five of the six are renewable energy generation and installation companies, and Microgrid is in renewable energy research and design. By committing to a triple bottom line, these companies explicitly signal to shareholders that they take into account the interest of all stakeholders, not only profit maximization to shareholders. However, none of the companies clarify if it is willing to prioritize planet and people over profit, just that they pursue all three simultaneously. In this subset, the B lab score ranged from 90 to 179 with an average of 111.

⁶ There are other B corporations that have a minor focus on renewable energy, but in this analysis only those that have a major focus on renewable energy are included.

Fourteen companies of the twenty-seven do not acknowledge their bottom lines on their websites beyond advertising their B Corporation certification: Renewable Choice Energy, First Power, Future Energy, Arcadia, Dwell Tek, Quetsol, Persistent Energy Partners, Spotlight Solar, Britec, Greenlight Planet, In Posse, Piedmont Biofuels, Climate Origin and Empowerd. Two focus on renewable energy research and development, four are renewable energy generation and installation companies, one is an asset management firm, three produce renewable energy electronics, one provides renewable design services, and three have miscellaneous functions related to renewable energy. If any of these companies do not maximize profits, it would be in their favor to make it clear on their websites to attract potential investors that aim to make a positive environmental impact. Additionally, it would make traditional investors that seek profit maximization aware of the stakes. In this subset, the B Lab score ranged from 80 to 156 with a 105 average.

Three companies do not use the term ‘triple bottom line,’ but indicate how they balance profits with other objectives. Ethical Electric is a Washington D.C.-based energy company that supplies 100 percent clean, local, renewable energy (Ethical Electric 2014). Its website states that it “uses [its] profits to fund causes that benefit our planet and advance equality, peace, justice and opportunity” (B Corp 2014b). It does not specify exactly how this is performed, beyond a one percent donation of gross revenue to partner organizations annually based on employee and customer recommendations. Namaste Solar is a Boulder-based cooperative that designs and installs solar power systems. It measures profit in the following metrics: dollars, customer satisfaction, employee morale, community involvement, impact on the environment, and “how well

they practice what they preach” (Namaste Solar 2014). Again, it offers no explanation of how these metrics are measured other than dollars. However, as a cooperative, Namaste Solar does not attract outside investors, so it is less imperative for it to make this information available on its website. Harvest Power is a Massachusetts-based company that uses organic waste to create renewable energy, soil, mulch, and natural fertilizer (Harvest Power 2014). It mentions a commitment to “regulators, customers, employees and all of our stakeholders” (Harvest Power 2014). A commitment to shareholders is not included; however its B certification ensures it is a for-profit operation. Additionally, its website lists its largest investors, all of which state a commitment to sustainability or to funding startups. It is likely that it is willing to accept a reduction in profit to pursue these objectives, but cannot be confirmed without further clarification. These companies scored 112, 145, and 87 respectively, with an average of 128.

Of the final two companies, one mentions sacrificing profits in certain scenarios and the other seems to suggest profit maximization is not sacrificed. Co-Op Power is a cooperative based in Massachusetts that creates clean energy products and services. By buying a share in the cooperative, members are entitled to one vote, and get discounts on all the services and products financed by the co-op. The members vote on how to use the funds and often profits are used to offer more discounts rather than being parceled out in dividends (Co-Op Power By Laws 2008). Additionally, its B-Corporation profile notes the following:

[Co-Op Power does not] always make money on things right away. They’re creative about matching up volunteers and donations of room and board and cars and money with projects that aren’t self-funding at the start. Each action they take

works for justice and sustainability and builds up a funding mechanism over time (B Corp 2014c).

This indicates that while its ventures intend to make a profit in the long run, the success of products initially is not measured in profit. Co-Op power scored a 150 on the B impact assessment. Alternatively, Combio-Energia, a Sao Paulo-based biomass provider, advertises that they interpret sustainability “as a synonym for profitability” as it leads to cost saving practices (Combio-Energia 2014). This might signal to investors that while they pursue an environmental mission, profit maximization is not derailed. Combio-Energia scored a 90 on the B impact assessment.

Of the twenty-four renewable energy B Corporations, only Co-Op Power clarifies that profit maximization is not always its objective. However, even with Co-Op Power, this is only in certain situations and as a cooperative model, its objectives differ from the traditional for-profit model. Therefore, it is unclear if the B Lab is certifying companies that are making the most beneficial social or environmental impacts. While a social or environmental mission is required for the certification, it appears that accountability, transparency, and internal operations are the primary foci. Whether these factors can translate to breakthroughs in the renewable energy sector is yet to be determined. If B Lab provided incentives for its corporations to eschew profits in an effort to make the greatest impact, it is likely breakthroughs would be achieved over a shorter time horizon. Although the B Corporation is utilized as a means of supporting clean energy more than the L³C model, it is still a minor focus. Climate change could be mitigated more rapidly and effectively if more L³Cs and B Corporations focused on renewable energy R&D, particularly those that eschew profits.

Even apart from B corporations and L³Cs, there are companies that have been explicit about not trying to maximize net profit. Various instruments, such as mutual funds, can aggregate the ownership shares of these companies and offer a largely untapped opportunity to support such companies. By the fiscal year end of 2013 there were \$14.7 trillion assets under management (AUM) in U.S. mutual funds⁷ (2014 Investment Company Fact Book) and \$26.8 trillion globally (2013 Investment Company Fact Book).

Some mutual funds are composed of only socially responsible investments (SRI or “impact investments”). What sets impact investments apart from mainstream investments is the incorporation of environmental, social, and governance (ESG) criteria. In the words of The Forum for Sustainable and Responsible investing, “in ESG incorporation, asset managers complement traditional, quantitative techniques of analyzing financial risk and return with qualitative and quantitative analyses of ESG policies, performance, practices and impacts” (US SIF 2014).

These funds often closely track, if not outperform, traditional investment portfolios. Du, Thomas, and Zvingelis (2014, 8) conclude “that in terms of the cross-sectional average performance of SRI and non-SRI funds there do not exist economically or statistically significant differences.” Similarly, a 2012 Deutsche Bank article performed a meta-study of hundreds of studies on investments that incorporate ESG and found that 89 percent of studies exhibited a positive correlation between a high ESG score and market outperformance (Fulton, Kahn, and Sharples, 2012). Therefore,

⁷ Alternatively, mutual funds are diversified portfolios of equities, bonds, and other securities that are pooled together and overseen by a wealth manager. When investors buy a share in a mutual fund they buy a stake in each of the investments in the portfolio. Because mutual funds pool many assets together, the risk associated with investing in a mutual fund is lower than a single stock.

investors should not be discouraged from investing in the SRIs under the assumption that impact and return are mutually exclusive.

In the past year, clean energy investments performed better than expected. On January 9th, 2015, Bloomberg New Energy Finance submitted a press release on the strong performance of clean energy investments in 2014. The overall investment in clean energy reached \$310 billion, a 16 percent increase from 2013, but 2011 still holds the record at \$317 billion. However, 2014 was the biggest increase of new investment in clean energy since 2011. Government funded research and development increased by 14 percent and corporate increased by 15 percent (Mills 2015). Private equity and venture capital investments increased by 16 percent, but overall investment is still three times below 2008 levels. In terms of region, the most investment came from the United States, China, and Europe. European investment increased only one percent since 2013, but is still the highest at \$66 billion. China's investment increased 32 percent to \$89.5 billion. Clean energy investment in the United States experienced a smaller increase of only eight percent reaching \$51.8 billion, \$15.5 billion of which went to utility scale asset finance. U.S. investment in solar increased by 39 percent whereas investment in wind decreased by more than 50 percent. India and Brazil both reached \$7.9 billion in clean energy investments, an 88 percent increase for the former and a 14 percent increase for the latter. French investment increased by 26 percent due to the installation of Europe's largest solar PV plant with 300MW capacity.

Bloomberg New Energy Finance reports that the majority of investment dollars went to asset finance of renewable energy including at least seven \$1 billion offshore wind projects in Europe and large-scale solar projects in Japan, South Africa, Kenya, and

Ontario. The second largest investment category was small-distributed capacity projects of less than 1MW, which primarily took the form of rooftop solar installations.

Approximately 50 percent of the investments were in solar, marking its highest share to date. Investment in wind increased by 11 percent and investment in smart energy technologies like smart grid and storage were the third largest category. Finally, green bonds reached a record high of \$38 billion, 2.5 times more than 2013 investment (Bloomberg New Energy Finance, 2015). The following section analyzes several environmentally focused investments and mutual funds.

However, the more impact is prioritized, the more advancement in the clean energy sector will be achieved. Therefore, maximum profit cannot be expected from very ambitious investment in renewable research and development given the uncertainty in aiming for significant technological breakthroughs.

Several mutual funds are advertised as sustainable portfolios either due to the exclusion of environmentally harmful companies, or further, by only including companies that contribute to environmental solutions. While this work is admirable and is a preferred option to the status quo, for an investor wishing to make an environmental impact, more could be done. As indicated by the 2012 Deutsche Bank study, many SRIs remain competitive, and in doing so, mostly target companies whose primary objective is not environmental benefits. For example, one of the largest holdings of Trillium Sustainable Opportunities is Apple (Trillium Sustainable Opportunities Fact Strategy Fact Sheet Q3 2014). While Apple does not directly contribute to fossil fuels, many of the aforementioned B corporations and other uncertified companies create greater environmental benefits than Apple. The impact achieved by mutual funds that remain

financially comparable to traditional investments are therefore likely to be only modestly impactful and could bring about greater environmental and social change if some profit was foregone.

The Profit Maximization Obligation?

There is a contentious debate on whether private corporations should engage in objectives other than profit maximization. In a 1970 *New York Times* article, renowned economist Milton Friedman strongly opposed such a notion. He posited that people who believe business should have a social conscious threaten the fundamental nature of a free society. Instead, he argued, business's only appropriate objective is profit maximization:

In a free enterprise, private-property system, a corporate executive is an employee of the owners of the business. He has direct responsibility to his employers. That responsibility is to conduct the business in accordance with their desires, which generally will be to make as much money as possible while conforming to the basic rules of the society (Friedman 1970).

Friedman assumed that shareholders who invest in a business generally only wish to achieve a profitable return, because if they wished to generate social benefit, they would make personal charitable donations. Therefore, it is inappropriate for managers to direct investors' money towards social initiatives as they see fit. In Friedman's view, an impact priority absolutely undermines the responsibility to owners. Friedman suggested that a firm's behavior in accordance with law should be a sufficient social objective, as it is the role of government to control and protect public interest. He acknowledged that some people might find government slow in implementing change and would prefer business to take action and solve problems faster. However, he dismissed this argument, noting how

the people who wish for more taxes and expenditures to be focused in this way “have failed to persuade a majority of their fellow citizens to be of like mind and they are seeking to attain by undemocratic procedures, what they cannot attain by democratic procedures” (Friedman 1970). Thus, Friedman would argue that the government is not limited by policy support, because if support is lacking, then the initiative is not justified. In other words, corporate social responsibility (CSR) that goes beyond maximizing profit violates the principle agent obligation of the manager.

Although Friedman notes that investors generally desire profit maximization alone, this is not always the case. There are instances in which investors do not want companies to remain neutral on social and environmental issues, and desire CSR that goes beyond legal compliance. An example of this perspective is the aforementioned blended enterprise, which explicitly states the intention to make an impact even if it entails a lower return. This remains true to Friedman’s call for corporate executives to act based on the desires of shareholders. For example, L³C investors are aware that the return from the operation will be small. By becoming a B Corporation, companies signal to shareholders that all stakeholders are considered in decision-making. In this case, maximum profits may still be pursued as long as high standards of social and environmental performance are also maintained.

There are also advocates of the profit maximization bottom line who believe social outcomes can be achieved without sacrificing this imperative. Porter and Kramer (2011) agree that government and civil society have tried to “address social weakness at the expense of business” however, they suggest that “capitalism is an unparalleled

vehicle for meeting human needs, improving efficiency, creating jobs, and building wealth” (Porter and Kramer 2011, 64). In their opinion, optimal CSR improves efficiency and reduces cost for the firm, thus allowing for profit maximization by making socially and environmentally responsible decisions. In their words, there is a “growing consensus that major improvements in environmental performance can be achieved with better technology at nominal incremental cost and can even yield net cost savings through enhanced resource utilization, process efficiency and quality” (Porter and Kramer 2011, 69). An example of CSR of this kind is improving efficiency in the supply chain: by reducing shipping distances, a firm reduces air pollution while also cutting time, inventory, and management costs. While Porter and Kramer strongly advocate this form of CSR, they do not suggest that CSR should go beyond the point at which profit is still maximized.

Further still, some argue that CSR should take priority over profit maximization. These advocates interpret Friedman’s critique not as “a dismissal of CSR, but a clarions call for more robust and strategically designed CSR initiatives which have real meat” (Rangan, Chase, and Karim, 2012, 4). Rangan, Chase, and Karim (2012, 6-7) suggest three forms of strategic CSR that are most impactful. The first is philanthropic giving, which returns intangible benefits such as improved public relations, improved relationship the community, which may lead to profit, but the objective is purely social and any financial return is a byproduct. The second form is the Porter and Kramer value chain efficiency; improving efficiency to reduce costs and achieve environmental and social benefits. The third calls for ““wide scale and disruptive change to a corporation’s business model that puts the priority first on crafting a solution to a societal problem,

which would then lead to financial returns in the longer run” (Rangan, Chase, and Karim, 2012, 9). This final form places the most responsibility on business to use CSR to create societal benefits. Rangan, Chase, and Karim (2012, 10) note the optimal position of businesses for such a role:

Large corporations, particularly those operating and selling products globally, have a unique ability to craft comprehensive solutions by harnessing their multiple spheres of influence and extensive market reach, both on the supply chain side and customer demand side [which gives them] an opportunity to play a more prominent role in addressing it’s ecosystem’s most complex and critical challenges.

This argument suggests that due to business’s capacity to wield large-scale change it is an unmatched candidate for socially responsible initiatives. They note that Friedman’s viewpoint assumes that if business, government and civil society uphold their respective duties then “a prosperous and just society would flourish with optimal allocation of resources” (Rangan, Chase, and Karim, 2012, 1). However, the corporate social responsibility they encourage, which transforms the very ecosystem of business, “recognizes that traditional divisions between the government, corporate and nonprofit sectors are ineffective in solving global environmental and social challenges” (Rangan, Chase, and Karim, 2012, 1). Therefore it is necessary for the various sectors to share roles and collectively contribute to social benefit, even if it opposes the bottom line of business.

In order for corporations to engage in this form of CSR, incentives must be increased. Currently, most CSR initiatives come from internal motivation or from external pressure. Top management or employees may show particular interest in certain issues and organize a CSR campaign. A more reactionary CSR initiative may start in

response to community complaints against past unfavorable behavior on part of the firm. However, there is no existing legislature demanding CSR, nor incentivizing voluntary action. Furthermore, except for the special cases of social enterprises such as L3Cs and B Corporations that eschew maximum profits, “business organization law generally expects managers of businesses to act to maximize profits for their owners despite occasional exceptions” (Reiser 2010, 106). This leaves CSR initiatives entirely dependent upon the corporate culture of a given business. With an increased legal incentive, it is likely more firms would engage in CSR.

Another circumstance that may discourage businesses from CSR is the lack of a rigorous method of measuring social impact. Veris Wealth Partners, a New York City-based sustainable wealth management firm comments on the lack of metrics:

Historically, efforts to measure social and environmental performance have been fragmented, as many investors have implemented proprietary measurement systems or have relied on anecdotes alone. This fragmentation creates inefficiencies [making] impact investment evaluation difficult (Veris Wealth Partners 2013).

Although metrics do exist to measure social and environmental impacts, not all companies with a sustainable mission use these metrics. Companies with a B Corporation certification are subject B Lab’s impact assessment, but only twenty-four companies in the renewable energy sector have this certification, and as mentioned previously, this is a largely internal assessment. The Global Impact Investing Network (GIIN) developed IRIS, a set of impact assessment metrics, to help investors measure their external environmental and social impacts (GIIN 2014). Yet again, this analysis is conducted on a voluntary basis and is not adopted universally across the impact investing market. A 2012

Harvard Business School study finds this limitation to be problematic, stating “in many areas the market machinery and infrastructure for evaluating social risk and returns are barely developed. This can have two effects: It can starve good organizations of funding and leave investors focused solely on financial returns” (Bugg-Levine, Kogut, and Kulatilaka, 2012). Therefore, in order to make breakthroughs in the renewable energy sector, metrics to assess impact must be further developed and expanded across the market.

The lack of mechanisms and structure add significant work for investors who seek to invest in companies making a positive environmental or social impact. This discourages investors from making investments in impact portfolios and in mission-focused companies directly. In addition to the lack of universal metrics, no coherent language or standards exist to help like-minded companies network and share information and strategies (Monitor Institute 2009). This means that investors who want to fund social and environmental work through purchasing shares in individual companies must conduct in depth due diligence on a firm to assess its impact. Investing in social enterprises can be more risky because they are often start-ups, which require support from the investor to build basic processes and systems (Bugg-Levine and Emerson 2011). The extra effort expected discourages investors from the field.

Furthermore, in the United States, the regulatory, legal, and tax structures are built for traditional investments (Monitor institute 2009). Private investment has been supported by policy initiatives such as the Employee Retirement Income Security Act. This Act enabled “pension funds to invest in venture funds and thereby dramatically

[increased] the supply of available capital. In addition, Congress lowered the capital gains tax rate,” further encouraging private investment (Monitor Institute 2009). Although pension funds can voluntarily invest in SRIs, no policies U.S. federal policies have been made in an effort to encourage investment in SRIs.

Social Responsibility and Pension Funds

It is particularly difficult for pension funds to pursue objectives beyond the financial bottom line, due to unique barriers outlined in preceding paragraphs. However, some pension fund managers have successfully incorporated social and environmental criteria into their investment strategies. Legislation has demanded such behavior in certain European countries, whereas efforts in the United States remain voluntary.

There are two common schemes of pension funds: defined benefit and defined contribution. For defined benefit schemes, the fund promises retirees a fixed payment per period. Alternatively, a defined contribution scheme allows employers and employees to contribute to investment vehicles, the proceeds of which do not have fixed value because they depend on the earnings of the investment vehicles. The primary risk in pursuing any objective other than profit maximization for defined benefit pension funds is that they have to “ensure the rate of return on their portfolio investment equals or exceeds the anticipated payout” (BankTrack 2003). If funds do not meet their needed return, managers demand larger pension contributions or reduce the promised pension benefits to cover the loss (BankTrack 2003).

From 1975 to 2005, the percent of defined benefit private pension funds decreased by 37 percent, while the percent of public pension funds decreased by only 6

percent (PRB 2013). The decrease in private defined benefit schemes is a recent trend due to the popularization of the defined contribution scheme. This shift reflects the increased regulation on private pension funds introduced by the Employee Retirement Income Security Act (ERISA) of 1974 (PRB 2013). The Internal Revenue Code regulates both private and public pension funds federally, but ERISA more directly affects private pension plans, as public pension plan compliance is largely determined at the state and local level. However, many state and local governments have introduced similar regulations. ERISA requires private sector plans to meet current obligations in the same year and pay off any debts within thirty years (PRB 2103). Furthermore, if the contributions and investments cannot cover the promised return, the sponsoring company has to pay the difference (PRB 2013, 3-4). ERISA also ensures private plan participants a certain quantity of benefits even if the plan is terminated due to company closure, and made more employees eligible for pension plans. Lastly, ERISA requires extensive reporting and disclosure to allow for close monitoring of fiduciary duties and transparency between participants and fund managers. ERISA sets forth many standards for fiduciary duties. The two of highest relevance are the Exclusive Benefit Rule, which requires managers to solely act in the interest of beneficiaries, and the Diversification Rule, which requires managers to minimize portfolio risk (PRB 2013, Appendix C, 25). Furthermore, the Pension Protection Act of 2006 applies more stringent funding and reporting regulations to private pension funds (PRB 2013, 12). The justification for tightened regulation over private funds is that private companies are more financially volatile and likely to shut down than government entities.

The decrease in private defined benefit schemes is also due to the popularization of the second obligation structure for pension funds, the defined contribution scheme. In this scheme, employers contribute to an account dedicated to each employee and encourage employees to do the same. The balance, including the return on investments within this account, is given to the employee incrementally once payouts commence (BankTrack 2003). By not promising a set payout, this scheme is far less demanding of the sponsoring employer.

The trend towards contributory plans opens up territory for SRI options. Pension fund managers who want to incorporate a social or an environmental objective have either explicitly stated that objective, or have opened up sub-funds with a specific focus. This allows the retiree and employer to decide if they want to apply such a screen and accept the possibility of a lower than competitive yield. However, in many cases, the returns on SRIs in pension funds have been as profitable, but by allowing individuals to choose, the risk incurred by not focusing solely on profit maximization is taken off management. As of 2012, the aggregate assets under management in the world's largest pension funds reached \$14 trillion (Towers Watson 2013). Therefore, if the pension funds are successful in incorporating SRI values into their investment strategy and other pension funds begin to follow suit, the capital available to SRIs will increase immensely.

However, there is a barrier to adding a social objective to pension fund management that applies to both contribution plans and fixed benefit plans. As pension funds are large, they often hold large shares in individual companies. Thus, divestment can be detrimental to the company, resulting in lay offs and other socially adverse effects (BankTrack 2003). Despite this drawback, many pension funds have been incorporating

SRI strategies into their management, which sets a good precedent for other funds that do not face as many barriers to follow suit.

In 2007, the United Nations Environment Programme Finance Initiative partnered with the United Kingdom Social Investment Forum to conduct a study on the twenty-five largest pension funds around the world (UNEP 2007, 9). Included in the final report were fifteen funds that represent the most diverse range of strategies for sustainable investment.⁸ The strategies set forth by these funds differentiate them from traditional pension funds and offer approaches to SRI that could be adopted by mutual funds.

Several trends were consistent across all fifteen funds. Each management team noted that it considered the application of a social and environmental screening on investments to be a financial strategy, as such investments are likely to do better in the long run. In their opinion, including SRIs is a form of long-term risk management. Additionally, all preferred the use of shareholder rights, such as voting and filing shareholder resolutions, to engage with company executives and address social and environmental concerns. The specific strategies used to create this dialogue varied from fund to fund. For example, ARIA of Australia encourages companies in less sustainable sectors such as oil and mining to do more CSR (UNEP 2007, 20). CalPERS, the pension fund for California's public workers, has several strategies, including encouraging companies to examine their environmental footprints, find ways to improve them, and to

⁸ The fifteen funds included in the report are Stichting Pensioenfond (ABP), Swedish National Pension Fund AP Funds Family (AP2), Australian Reward Investment Alliance (ARIA), Caisse de dépôt et placement du Québec (Caisse), California Public Employees Retirement System (CalPERS), Caisse de Prévoyance du Personnel Enseignant de l'Instruction Publique et des Fonctionnaires du Canton de Genève (CIA), Environment Agency Pension Fund (EAPF), Etablissement de Retraite Additionnelle de la Fonction Publique (ERAFP), Fonds de Réserve pour les Retraites (FRR), Government Pension Fund Global, Government Pension Fund (GPF), Metallrente, PGGM, PREVI, and Teachers Insurance and Annuity Association, College Retirement Equities Fund (TIAA-CREF).

conduct research on the financial risks presented by climate change (UNEP 2007, 26). Many of the other funds require companies to submit reports on their corporate governance policies including a plan for addressing areas of concern. Also, with the exception of three funds, all companies explicitly state a profit maximization objective or imply its pursuit as no alternative strategy is mentioned. Caisse of Quebec attempts to find a “workable balance between ethics and profitability,” suggesting that profits are not solely prioritized (UNEP 2007, 21).

Two of the funds observe a “best-in-class strategy” and avoid sectoral exclusion and divestment. In a best-in-class screening, no sector is fully excluded, but only the companies that are making the best environmental or social effort are included. The United Kingdom’s Environmental Agency Pension Fund uses a best-in-class selection method and applies an environmental overlay strategy across 100 percent of its pension fund (UNEP 2007, 35). FRR, a French pension fund, uses several portfolio construction strategies including a best-in-class screening and an “environmental social and governance” (ESG) matrix strategy, which rates sectors using ESG rating providers and internal research. The sectors that score low according to ESG criteria are given a stricter screening process than those that meet higher standards of ESG (UNEP 2007, 44). Both of these companies choose to use shareholder advocacy to make companies improve their CSR, rather than to divest.

Alternatively, many of the funds apply a negative screening that excludes sectors from their portfolios. Several do not include companies whose core business is in particularly socially unsavory industries such as alcohol, weapons, or tobacco. A few other funds mention the exclusion of companies that do not comply with certain

regulations or that have particularly heinous policies. CalPERS and PGGM of the Netherlands have unique exclusion policies. CalPERS does not invest in any companies that support Sudan's army and PGGM does not invest in companies based in "countries upon which human rights related economic sanctions have been imposed by the international community, the UN, the International Labour Organization (ILO) or the EU" (UNEP 2007, 28, 57). About half of the funds are willing to divest from holdings if necessary. Most of the funds note that divestment is a last resort that will only be pursued if companies have failed to address concerns brought up in shareholder resolutions or other dialogues.

Many of the funds consult third party organizations for strategic advice. For example, a Swiss pension fund known as CIA developed a third party proxy voting service called Ethos, which manages assets that include social and environmental criteria. CIA typically votes on shareholder boards based on recommendations from Ethos (UNEP 2007, 33). Alternatively, the French ERAFP consults outside service providers to help develop ESG indicators and assesses companies' compliance with its internal SRI policy (UNEP 2007, 41). Norway's Government Pension Fund Global employs a third party to identify companies that should be excluded from the portfolio due to ethical issues (UNEP 2007, 48).

Another way pension funds have included SRI in their investment strategies is by setting up a separate fund with an environmental or social focus. Although several of the pension funds included in the United Nations report contribute to special-focus funds, the programs at CalPERS and TIAA-CREF, another U.S. pension fund, appear to be the most developed. CalPERS "invests \$200 million in environmental technology solutions

that are more efficient and less polluting than existing technologies. Technology solutions of interest include alternative and renewable energy and CalPERS working to build a clean energy focused portfolio. It also invested \$75 million in a social index fund managed by Barclays (UNEP 2007, 29). TIAA-CREF has been operating the CREF Social Choice Account since the 1990s. As of 2007 the fund has \$9 billion assets under management and considers social criteria with every investment (UNEP 2007, 69). The management team assesses companies' social performances based on other firms in the same industry.

According to the Friedman philosophy, pension fund managers have a sole responsibility to maximize returns for their clients so these managers are outstepping their boundaries. In other words, the Friedman point of view suggests that only return maximizing financial criteria should be considered when choosing investments to add to a pension fund's portfolio. Friedman's argument is reinforced by the conventional belief that SRIs are likely to yield lower returns, but as Du, Thomas, and Zvingelis (2014) have established, this is not necessarily the case, even in the short run. Therefore, while these pension fund managers are pursuing another bottom line, they are not necessarily jeopardizing profit maximization.

Additionally, long run considerations make some SRI more economically attractive than traditional investments. As companies that qualify as SRIs meet higher standards of ESG, they do less harm to society and the environment. Sethi (2014, 101) notes this benefit of socially and environmentally responsible companies:

In economic terms, these companies minimize negative externalities and accentuate positive externalities. Consequently, these companies also minimize future financial risks emanating from imprudent or unsafe business practices. Thus, companies conducting their operations in a socially responsible manner should be viewed as comparatively better and relatively safer long-term investment choices.

This is the same risk management logic expressed by the pension fund managers who are engaging in socially responsible investment. In their opinion, as mentioned in preceding paragraphs, the failure of short-term profit maximization to account for long-term risks is irresponsible, so considering these neglected factors by including SRIs in the portfolio does adhere to fiduciary duties.⁹

Although pension funds face unique barriers in including SRIs, their influence on the market makes them ideal candidates to popularize ethical investing. As previously mentioned, pension funds hold large shares in individual companies. While this makes divestment difficult, it gives pension funds leverage to change corporate behavior significantly through shareholder advocacy. Sparkes and Cowton (2004, 49) recognize this advantage:

The growth in pension funds adopting SRI techniques and analysis is of the greatest importance for CSR, as they are the majority owners of most quoted businesses. As such they have the power to request, and if necessary instruct corporate executives to include social and environmental guidelines in their business objectives.

This possibility has been realized by the pension funds that use shareholder advocacy to address ESG concerns rather than to divest. Because pension funds have large holdings in

⁹ This claim references the previously mentioned evidence on page 10 provided by Du et. al (2014) and Fulton, Kahn, and Sharples (2012) that SRIs do not necessarily yield lower returns than traditional investments.

individual companies, it is likely companies will listen to their resolutions and requests over other investors. Additionally, because pension funds are collectively the majority owners of many companies, they have the power to affect market trends. If they unite over a given issue, companies would have to respond. For example, if they decide all top salaries should be capped, companies are under pressure to oblige. Therefore, the incorporation of SRIs into pension fund investment strategy is critical in bringing CSR into mainstream business practice. Sethi (2005, 109) also notes that pension funds can play a role in developing metrics in the SRI field by “(a) identifying the important SRI-based attributes on which data should be collected, and, (b) in bringing together individuals and groups, notably the academic community to create measures by which such data should be collected in a manner that its quality and objectivity is assured.” Due to the immense resources available to pension funds, they can invest in filling the gaps to create coherent language or standards for reporting and measuring ESG performance.

Social Responsibility and Mutual Funds

Some mutual fund managers and private equity firms volunteer to incorporate environmental, social, and governance (ESG) criteria into their investment strategy. The Forum for Sustainable and Responsible Investment found that as of 2011, \$3.31 trillion assets are managed under investment strategies that incorporate ESG criteria; \$240 billion of these investments are focused on the environment (US SIF 2012). Although this number is impressive, it raises the question of the effectiveness of ESG screening methods in bringing about impactful environmental and social change. Generous estimates have suggested that U.S. federal spending on energy R&D should triple to \$15 billion per year (Stepp and Nicholson 2013). While additional private investment would

further catalyze the development of climate change solutions, if \$240 billion dollars were successfully invested in environmental solutions, there should be less of a need for governmental investment. The lack of metrics to assess the impact of SRIs may allow for investments that do not effectively address environmental problems to qualify as SRIs.

CHAPTER 3: GREEN MUTUAL FUND CASE STUDIES

Pax World

Pax World has been investing with a social and environmental strategy since its inception in 1971 (Pax World, 2014). As of December 2013, Pax manages \$3 billion assets under across eleven strategies. It applies an ESG screening to all investments and identifies “companies that are leaders in their industries, meet positive corporate responsibility standards and have a clear vision for managing risk and delivering long-term value to shareholders” (Pax World 2013, 13). It also uses shareholder advocacy to promote high standards of sustainability, transparency, and accountability. Pax will open dialogue with companies if concerns arise through shareholder voting or by other means.

Since 2008, Pax World has been managing the Pax World Global Environmental Markets Fund (PGRNX) that focuses on energy efficiency and renewable energy, water infrastructure technologies and pollution control, waste management and environmental support services, and sustainable food, agriculture and forestry and excludes any companies involved with extraction or refinement of fossil fuels (Pax World Global Environmental Markets Fact Sheet Q4 2014). The Fund “seeks to invest in companies with positive environmental performance or whose products or services help other companies and societies improve their environmental performance” (Pax World

Prospectus 2014). Pax assesses a company based on climate change by its efforts to accordingly adapt and to mitigate associated risks (Pax World, 2014). The environmental criteria Pax World includes as part of its ESG screening are air and water emissions, recycling and waste reduction, clean energy and energy efficiency, climate change, and environmental reporting and disclosure (Pax World, 2014). While the prospectus lists several risks, none is specific to its environmental focus, and there is no indication that management expects to underperform the market. As of March 2014, there was \$193 million in the portfolio with 39.5 percent in energy and 43 percent in water. Its top five holdings are Pall Corp, Pentair PLC, Pennon Group PLC, Murata Manufacturing Co., and American Water Works Co. The proceeding paragraphs will examine these companies and question if they are appropriately placed within an environmentally focused fund.

Pall Corporation, in which Pax World Global Environmental fund invests three percent (Pax World Global Environmental Markets Fact Sheet Q4 2014), makes products for liquid filtration (Pall Corporation, 2014). It is a U.S. based multinational large cap company founded in 1946 (Pall Corporation LinkedIn, 2014). Its website claims that it could be considered the original “clean tech” company because its products “enable customers to purify and conserve water, consume less energy, make alternative energy possible and practical, advance medicine, and minimize emissions and waste” (Pall Corporation, 2014). However, some of its products do not seem to have as much environmental relevance as it claims. For example, its filtration systems are used for bottled water technology and distilling spirits. Many investors, even outside of the SRI field, have agreed that investing in alcohol is socially irresponsible. While Pall does not produce alcohol, its products allow for alcohol to be produced and consumed. However,

some of its products do yield environmental benefits. For example, it produces technologies for water desalination that allow regions with water scarcity to meet water demands in a sustainable fashion (Pall Corporation, 2014). In terms of its own operations, Pall shows a clear commitment to environmental stewardship. As per its 2010 sustainability goals, Pall has reduced utilities usage, waste intensity, green house gas intensity and has increased recycling by approximately 20 percent relative to 2006 levels, and it plans on meeting more aggressive reduction goals by 2017 (Pall Sustainability, 2013). Based on its corporate behavior and products, it appears that Pall Company is a viable candidate for investment by an environmentally focused mutual fund, but it is not clear-cut. Some could argue that Pall Company should not be included because its environmental benefits do not outweigh its environmental and social detriments.

Pentair is a large cap company in which Pax World Global Environmental Markets also holds three percent (Pax World Global Environmental Markets Fact Sheet Q4 2014). Pentair is a “global water, fluid, thermal management, and equipment protection partner” that asserts that it combines “global perspective and deep expertise to develop real solutions that help the world get more food, energy, and efficiency from each drop of water” (Pentair 2014). It was founded in 1966 in the United States and today has locations across the globe (Pentair 2014). Pentair creates products for a vast array of industries, including oil and gas. Its projects consciously consider environmental factors. For example, it built an underground oil pipeline around a gulf as to not harm the marine ecosystem, even though it was a less direct route (Pentair 2014). However, this pipeline is transporting crude oil. Pax World Environmental Markets Fund advertises its exclusion of fossil fuel companies, and while Pentair does not extract fossil fuels, its

products directly enable their extraction. On the other hand, Pentair also creates some products that enable production of renewable energy and others that help farmers save water through more efficient irrigation technology (Pentair 2014). In terms of its own operations, Pentair uses its own products to reuse water and commits to a “Zero Waste to Landfill” objective. Even though fossil fuel extraction is currently still necessary, and Pentair is producing environmental benefits, due to its involvement with the fossil fuel extraction process, this investment would be more appropriate in a best-in-class portfolio than in a specifically non-fossil fuel fund.

Pennon Group Plc is a mid cap United Kingdom-based environmental and resource management group founded in 1989 (Pennon Group 2014). Three percent of the Pax World Global Environmental Markets Fund is invested in Pennon Group Plc (Pax World Global Environmental Markets Fact Sheet Q4 2014). Pennon’s core businesses are South West Water Limited, a water and sewerage company, and Viridor Limited, a recycling, renewable energy and waste management business (Pennon Group 2014). South West Water recognizes that water distribution is energy intensive and has been making a conscious effort to reduce its carbon footprint and has set 2015 targets to reduce carbon emissions 18 percent below 2009 levels and to produce 30GWh of energy from renewables (South West Water 2014). South West Water currently operates seven hydroelectric power plants and captures methane gas produced by its nine-wastewater treatment plants (South West Water 2014). It also assesses its supply chain to include only companies that reduce their environmental, social, and ethical risk (South West Water 2014). South West Water is also involved in several climate change research projects, furthering its role as an environmental steward (South West 2014).

Viridor, the second core company of Pennon Group is a waste management company. It converts as much waste as possible into recyclables for re-manufacturing and extracts energy from the non-recyclable waste to create renewable energy (Viridor 2014). Fifty percent of its profits are generated from the re-selling of recovered materials and it is investing more than \$1.5 billion in waste to energy facilities (Viridor 2014). In addition to its sustainable waste management, Viridor incorporates environmental objectives in several other aspects including habitat restoration and carbon reduction. It restores closed landfill sites by re-creating habitats. It asserts that some of its restoration projects have been so successful that certain sites have attracted endangered species looking for refuge (Viridor 2014). It has also reduced carbon use within its operations; one recycling facility has saved 800 tons of carbon a year (Viridor 2014).

The efforts of both Viridor and South West Water to produce environmental benefits may make Pennon Group Plc an appropriate investment for an environmentally focused fund. However, its inclusion is questionable due to its production of hydroelectricity. Although hydropower is a source of renewable energy, “it requires the use of dams, which can greatly affect the flow of rivers, altering ecosystems and affecting the wildlife and people who depend on those waters” (U.S. EPA 2014). Due to the mixed environmental impacts of dams, some might find investment by an environmentally focused fund problematic.

Pax World Global Environmental Markets Fund invests three percent in Murata Manufacturing, a large cap Japanese electronics innovator (Pax World Global Environmental Markets Fact Sheet Q4 2014; Murata 2014). Murata was started in 1944 and has since created electronic devices, particularly those that enhance communication

and media, such as parts for televisions, radios, computers, and phones. Murata also produces technologies for electric automobiles to make them more reliable and high performing (Murata Report 2014, 11). It has also been developing energy systems for smart houses that draw on a mix of traditional energy, solar power, and electric power stored batteries (Murata Report 2014, 20). Most revolutionary to this system is the ability to capture solar energy and store it in a battery to enable reliable use even at night (Murata Report 2014, 20). Murata recognizes that its operations are energy and input intensive and is accordingly mindful about what inputs it uses. For example, it has been developing alternative technologies to reduce the amount of environmentally harmful chemicals needed to create its products (Murata Report 2014, 21). Murata has also been addressing its carbon use in the wasteful practice of compressing air¹⁰ and its efforts have reduced 100 tons of carbon dioxide emitted by this process per year (Murata Report 2014, 22). It also owns and operates several solar power systems and has reduced waste emissions by ten percent since 2012 (Murata Report 2014, 23 and 29). As Murata produces solar energy and renewable energy technology for homes, it aligns with the environmental focus of Pax World Global Environmental Markets fund more than the previously examined companies.

The fifth largest holding of Pax World Global Environmental Markets Fund is American Water Corporation at also three percent (Pax World Global Environmental Markets Fact Sheet Q4 2014). It is the largest publicly traded U.S. water and wastewater utility that serves over forty states and is a large cap company (American Water 2014). American Water makes environmentally conscious decisions throughout its supply chain.

¹⁰ An important source of energy for factories (Murata Report 2014, 22).

In its water treatment process, silt is separated to produce topsoil or fertilizer (American Water 2014). Furthermore, it uses some renewable energy in production and distribution and prioritizes efficiency in design, construction, operation and maintenance. It has committed to reducing greenhouse gas emissions by 16 percent by 2017 (American Water 2014). For supply, American Water offers consumer conservation programs to incentivize efficient use of water at the household level (American Water 2014). To educate the public about the importance of water conservation, American Water has banded together with other firms in the industry to form the Value of Water Coalition and it also partners with public environmental agencies to fund education programs (American Water 2014). Additionally, to ensure that as much water as possible meets the end consumer, American water invests approximately \$1 billion annually in maintenance of its infrastructure (American Water 2014). American Water also funds research and development in wastewater, clean energy, water reuse, and desalination (American Water 2014). Given its commitment to environmental efficiency and education at all levels of operation, American water seems like an appropriate investment for an environmentally focused investor.

Trillium

Trillium Asset Management is another asset management firm that has been integrating ESG criteria into its investment process since its founding in 1982, and it is a certified B Corporation (Trillium 2014). Trillium, an employee owned firm, asserts that companies that fit strong ESG criteria can be more profitable and competitive than traditional investments (Trillium 2014). Its investment strategy includes an ESG

screening and shareholder advocacy through proxy voting and shareholder proposals (Trillium 2014). For its environmental criteria across all strategies, Trillium applies a negative screening and excludes companies that invest more than ten percent in tar sands or coal, five percent in nuclear power, and that have any exposure to coal mining (Trillium 2014). Trillium manages six equity funds and one fixed income strategy and has over \$1.7 billion assets under management as of September 2014 (Trillium 2014). Two of the equity funds have a sustainability focus: Sustainable Opportunities and Fossil Fuel Free Core. Both strategies have no fossil fuel exposure, but Fossil Fuel Free Core simply excludes fossil fuel companies, while Sustainable Opportunities invests in companies that focus on “Green Solutions, Economic Empowerment, and Healthy Living” (Trillium 2014).

Fossil Fuel Free Core was established in 2007 and has \$165 million assets under management as of September 2014 (Fossil Fuel Free Fact Sheet Q3 2014). This strategy invests in a myriad of sectors with the largest holdings in technology, financial services, and health care (Trillium Fossil Fuel Free Core Fact Sheet Q3 2014). There is no reference in the fact sheet to any increased risk assumed by its strict environmental focus and does not indicate non-profit maximization. Trillium does not list the percentages invested per top ten holding, thus the following paragraphs examine the holdings with the largest market capitalization. For Fossil Fuel Free Core the top five largest capped companies are Apple at \$681.71 billion, Gilead Sciences at \$152.54 billion, Cisco Systems at \$139.50 billion, Home Depot at \$128.73 billion, and UnitedHealth Group at \$93.96 billion. First Solar, a small cap company at \$5.11 billion will also be examined despite its size, due to its perceived relevance.

Apple, Gilead Sciences, and Cisco are also among the top five largest capitalized companies in Sustainable Opportunities along with Novartis at \$257.19 billion and Baxter International at \$39.26 billion (Trillium Sustainable Opportunities Fact Sheet Q3 2014). Sustainable Opportunities was established in 2008 and as of September 2014 has \$197 million assets under management (Trillium Sustainable Opportunities Fact Sheet Q3 2014). This fund not only excludes environmentally detrimental fossil fuel companies, but also only invests in sustainable solutions within its three areas of focus. Just like Fossil Fuel Free Core, there is no mention of added risk or non-profit maximization.

Apple is a worldwide electronics company founded in 1976 in the United States (Forbes 2014). Historically, Apple has been criticized for lacking environmental policies. Greenpeace's "Clean our Cloud" campaign, of which Apple used to be a target, advocates for tech companies to source their electricity sustainably (Greenpeace 2014). According to Greenpeace, its protests led Apple to agree to source 100 percent of the electricity for its worldwide data centers from renewable sources in 2012 (McMillan, 2012). In 2013, Apple disclosed information on its energy policy and principles as well as how it sources its renewable energy, which addressed previous transparency concerns (Pomerantz, 2013).

Today, Apple has detailed information about its sustainability efforts available on its website. Apple claims that it recognizes that its operations generate a lot of greenhouse gases and that it is its "big responsibility to leave a smaller footprint" (Apple 2014). 100 percent of the energy for data centers, 73 percent for all facilities, and 86 percent for corporate campuses are sourced from renewable sources much of which

produced by Apple (Apple 2014). Additionally, in early 2015, Apple announced a new investment of \$850 million to purchase power from a solar plant operated by First Solar (Gallucci 2015). Apple has been addressing the energy efficiency of its products in various ways such as programming energy saving features to its software and extending the battery life of its phones (Apple 2014). Furthermore, the iPhone packaging was reduced by 26 percent from 2007 to 2013 and Apple is eliminating a variety of toxins from its products and using resources more efficiently, as the newest Mac Pro uses 74 percent less metal products than the previous model (Apple 2014). Due to its environmentally efforts, particularly its sourcing and producing renewable energy, it is reasonable for Apple to be considered as an investment by Fossil Fuel Free Core and Sustainable Opportunities.

However, Apple has several other environmentally negative factors that are not so fondly displayed on its website. Apple encourages consumers to buy new products even if their older products are fully functional by releasing new models frequently and changing small aspects so newer accessories are not compatible with older products. For example, with the release of the iPhone 5, Apple changed the charger size so all new Apple products were not compatible with old speakers, chargers, etc. This required consumers to either buy new accessories or a converter to make old and new compatible. These factors, in addition to Apple's past negative attitude towards environmental policy, challenge its inclusion in environmentally focused funds. As Fossil Fuel Free Core's mission is only to exclude companies involved in production and extraction of fossil fuels, Apple is a more appropriate investment than for Sustainable Opportunities, which excludes fossil fuels and only invests in environmental solutions. Although Apple's

achievements in renewable energy could be considered a green solution, its products are not solutions.

Gilead Sciences is a global U.S.-based biopharmaceutical company founded in 1987 (Gilead 2014). Gilead does not list any environmental policies or sustainability efforts on its website, which raises the question of why is it included in both Fossil Free Core and Sustainable Opportunities. Perhaps it is due to the social benefits brought about by Gilead as its products include treatments for HIV/AIDS, cancer, and other global health concerns (Gilead 2014). Furthermore Gilead established a foundation in 2005 that “seeks to improve the health and well being of underserved communities around the world. [Its] giving focused on expanding access to HIV and hepatitis education, outreach, prevention, and health services” (Gilead 2014). Its efforts in the medical field and to global health qualify Gilead for investment by Sustainable Opportunities by its “Healthy Living” focus. Also, its irrelevance to the fossil fuel industry make it appropriate for Fossil Fuel Free Core. Gilead would be even more relevant environmentally if Trillium used its shareholder advocacy to encourage it to report on its environmental policies and programs.

Cisco is an information technology company founded in the United States in 1984 (Cisco 2014). Cisco offers a wide range of networking technology products all of which help people to “connect, communicate, and collaborate” (Cisco 2014). According to its 2014 CSR report, the following are highlights. Supply chain management is engaging with suppliers on sustainability measures including emission reduction goals. Cisco has reduced greenhouse gas emissions as well as other negative environmental impacts and has set further reduction goals for 2017. Additionally, it installed and commissioned solar

energy systems at three locations and one cogeneration system at a U.K. location (Cisco CSR Report 2014, 90). Cisco offers detailed information about its sustainability efforts. While these efforts are impressive, the core business of Cisco is irrelevant to environmental progress. Thus, its environmentally responsible operations deem Cisco relevant for investment by Trillium's environmental strategies, but other companies with a greater core environmental focus would be more relevant.

Another large cap company held only by Fossil Fuel Free core is Home Depot, which was founded in the United States in 1978 and has now expanded across North America and to China (Home Depot 2014). As of 2011, Home Depot has assigned each environmental focus group a captain who is responsible for making improvements in the sector and reports on progress at Environmental Council meetings (Home Depot 2014). The focus areas are energy, water information technology, supply chain, stores and packaging (Home Depot 2014). From 2012 to 2013 Home Depot achieved a 289-million kW/h reduction of energy use due to upgrading infrastructure to be more energy efficient and also emitted 124,084 less metric tons of carbon (Home Depot 2014). One highlight of Home Depot's sustainability initiatives is its wood purchasing policy ratified in 1999. 94 percent of its wood is harvested in North America and less than 0.15 percent is from rainforests and it gives preference to wood that has been certified as sustainable by the Forest Stewardship Council¹¹ (Home Depot 2014). Additionally, Home Depot runs a foundation that among other initiatives, helps to rebuild communities after natural disasters strike (Home Depot 2014). Its energy use and emissions reductions are

¹¹ An independent non-profit based in Germany that certifies that wood has been managed and harvested according to strict sustainability guidelines (Home Depot 2014).

commendable, but again Home Depot is lacking the fundamental thematic relevance for an environmentally focused fund.

UnitedHealth Group is a U.S.-based health care company with two core businesses of UnitedHealthcare, which provides health care coverage, and Optum, that provides information and technology-enabled health services (UnitedHealthcare 2014). It is number fourteen of Fortune's 500 and one of the largest capitalized companies in Fossil Fuel Free Core's portfolio (UnitedHealthcare 2014). Similarly to Gilead, UnitedHealth Group does not list any environmental measures on its website, but it does extensive work in social responsibility. It sponsors many volunteer and community service programs and also has two foundations: United Health Foundation and UnitedHealthcare Children's Foundation. Due to its positive social benefit, like Gilead, it fits with ESG criteria, but could be replaced by a more environmentally relevant company.

First Solar is one of the smaller companies in Fossil Fuel Free Core's portfolio, but has particular thematic relevance. First Solar has "developed, engineered, constructed, and currently operates many of the world's largest grid-connected PV power plants in existence" (First Solar 2014a). It operates solar energy projects around the world with more than eight gigawatts installed and has claims to be the most financially stable provider in the industry (First Solar 2014b). First Solar also invests in renewable energy research and development to improve solar innovations and has won two world records for PV efficiency (First Solar 2014b). Additionally, its PV plants have the smallest carbon footprint of all solar technologies with approximately 94 percent reduction of greenhouse gas emissions (First Solar 2014b). Companies such as First Solar that have

thematic appeal, practice environmentally sustainable operations, and are financially viable should be the only companies environmentally focused funds should invest in if substantial impact is desired.

The other two largest capped companies held by Sustainable Opportunities are Novartis and Baxter International. Novartis is a global pharmaceutical company based in Switzerland (Novartis 2014). Baxter International is a U.S. based global healthcare company (Baxter International 2014). However, unlike Gilead, both list their environmental efforts. Novartis sources 92 percent of on-site energy from natural gas and two percent from renewable sources (Novartis HSE 2013). Additionally, most of its non-hazardous waste is recycled and most of its hazardous waste is either recycled or incinerated (Novartis HSE 2013, 24). Novartis has also been addressing environmental concerns across other areas including packaging, air emissions, and water. Baxter International focuses on sustainable supply chain, reductions in carbon footprint and natural resource use, and enhanced environmental stewardship (Baxter International 2014). In 2013, Baxter reduced greenhouse gas emissions by ten percent, increased renewable energy use to 22 percent, and reduced waste by ten percent (Baxter International 2014). Like Gilead, both of these companies fit Sustainable Opportunities' "Healthy Living" focus and their environmental performance efforts make them even more relevant.

Since inception, all three funds have performed comparably to traditional or benchmark investment portfolios. Pax World Global Environmental Markets, a middle growth world stock, has yielded an average return of 4.5 percent in both the institutional and the individual investor classes, which closely tracks its MSCI World Net Index

benchmark which yielded a 5 percent average return over the same time period (Pax World Global Environmental Markets Q3 2014 Fact Sheet). Over a five-year period it has performed comparably to its stock category. Trillium's Fossil Fuel Free Core, has yielded an average return of 8 percent gross of fees since inception which performed comparably to its benchmark, the S&P 500, which yielded an average return of 7 percent over the same time period (Trillium Fossil Fuel Free Core Q3 2014 Fact Sheet). Trillium's Sustainable Opportunities has yielded an average return of 10 percent gross of fees since inception which underperformed comparably to its benchmark, the S&P 1500, by only 2 percent (Trillium Sustainable Opportunities Q3 2014 Fact Sheet). For comparison, Fidelity Select Electronics Portfolio, listed on Bloomberg's "Mutual Fund Leader Board" 2014, has yielded an 11 percent performed comparably to its S&P 500 benchmark (Woolley et al. 2014, Fidelity 2014a). This fund is considered a traditional investment, as it does not have any stated environmental or social focus.

Clean Energy Mutual Funds

While these funds perform very well, others exist that are more environmentally focused. According to a *Renewable Energy World* article, the top twelve mutual funds with the most holdings in renewable energy, listed from highest concentration to lowest, are Firsthand Alternative Energy, New Alternatives Fund Class A, Guinness Atkinson Alternative Energy Fund, Shelton Green Alpha Fund, Calvert Global Energy Solutions Fund, Fidelity Select Environment and Alternative Energy Portfolio, Pax World Global Environmental Markets (previously examined 39-46), Alger Green Fund, Brown Advisory Sustainable Growth, Gabelli SRI, Portfolio 21 Equity, and Green Century

Balanced Fund (Roen, 2015). However, Roen notes that to date, there is no mutual fund that exclusively invests in alternative energy.

Firsthand Capital Management, an investment advisory company founded in 1994 that focuses on technology investments, manages Firsthand Alternative Energy and one other fund with no specific focus beyond technology (Firsthand 2015). The Firsthand Alternative Energy Fund (ALTEX) was established in 2007 and has \$15.2 million assets under management as of September 2014, a significantly smaller fund than those previously highlighted (Firsthand Alternative Energy Fund Fact Sheet Q4 2014). It invests in alternative and traditional energy technology companies around the world and applies no market capitalization restrictions. This strategy invests in a range of sectors, most of which are related to the environment, with the largest holdings in renewable energy at 31 percent and energy efficiency at 7.5 percent. In its prospectus, Firsthand Capital Management notes that the Alternative Energy Fund is subject to a myriad of risks including concentration in the alternative energy sector, which is more volatile than other sectors due to changing legislation, energy prices, and technology changes within the sector (Firsthand Funds Prospectus 2014). It also notes that lack of diversification compared to other funds and tendency to invest in small capitalization companies increase its risk. While this denotes more risk than the average mutual fund, it does not explicitly state a non-profit maximizing objective. This middle blend technology stock, has yielded negative 2 percent in the past five years, which underperformed its category, technology, by approximately 12 percent. Since inception, it has yielded negative 6 percent, outperforming its benchmark, WilderHill Clean Energy Index, which yielded approximately negative 19 percent, but underperforming the S&P 500, which yielded 6.5

percent over the same time period (Firsthand Alternative Energy Fund Fact Sheet Q4 2014).

Its top five holdings are Rockwood Holdings, First Solar, SunEdison, SolarCity, and SunPower Corporation Class B. Albemarle acquired Rockwood Holdings in January 2015 following a merger plan agreed upon in July (PR Newswire 2015). As Firsthand did not invest in Albemarle originally, and it is unknown if the shares were held after merger, this company will not be profiled. Both Rockwood and Albemarle are chemical companies. First Solar is a middle capitalization solar energy company that operates solar energy projects around the world and was profiled in preceding pages (51-52) as Fossil Fuel Free Core also holds it. SunEdison is a middle capitalization solar energy manufacturer and operator founded in 1959, which now has an international presence and a global portfolio of over 4GW of energy (SunEdison 2015). SolarCity is a middle capitalization solar power provider based in the United States and founded in 2006 (SolarCity 2015). SunPower is also a middle capitalization solar manufacturer established in 1985 with more than 18 million MWh of energy (SunPower 2015).

New Alternatives Fund Class A (NALFX) is an independently managed fund established in 1982, making it the first environmental mutual fund (New Alternatives Fund 2015). It seeks companies that produce societal benefits such as alternative energy, recycling, clean air and water, pollution prevention, and conservation. On top of this thematic focus, it applies a positive screening for human rights, labor relations, clean energy, community investment, and the environment in addition to a negative screening for alcohol, animal testing, weapons, gambling, tobacco, oil, coal, and atomic energy (New Alternatives Fund 2015). With \$189 million assets under management as of

February 2015, New Alternatives Fund invests in a range of sectors, the largest being renewable energy at 45 percent followed by energy conservation at 16.5 percent (New Alternatives Fund Semi Annual Financial Report 2014). This fund advertises that it is “affirmatively socially responsible” and that people should invest in the fund if they share its social concerns, and while ethical investing can make a profit, it cannot promise a certain return. The emphasis on investing in the New Alternatives Fund for social purposes over financial gives a strong indication to prospective investors that the social and environmental objectives of this fund override profit maximization. This middle growth world stock has been relatively successful compared to many of the other clean energy funds, yielding 7 percent over the past five years. It has underperformed its stock category, middle growth stocks, by only 3 percent over the same period.

The top five holdings, by a small margin, as its capital its is relatively evenly dispersed across the board, are Brookfield Renewable Energy Partners, Owens Corning, Hannon Armstrong, TerraForm Power, and NextEra Energy Partners. Brookfield Renewable Energy Partners is renewable power platform that invests in renewable energy projects with over 230 renewable assets in its portfolio (Brookfield Renewable 2015). Hannon Armstrong is an asset manager that makes debt and equity investments in sustainable infrastructure projects; established more than thirty years ago, it now has \$2.3 billion assets under management invested in energy efficiency, renewable energy, and sustainable infrastructure (Hannon Armstrong 2015). TerraForm Power, a subsidiary of SunEdison, is a small capitalization renewable energy company that operates solar power portfolios around the globe and took on its first wind acquisition in November 2015 (TerraForm Power 2015). Next Era Energy Partners owns, operates, and acquires

contracted wind and solar projects in North America (Next Era Energy Partners 2015). It appears that New Alternatives Fund A is more of a macro-manager, as most of its top holdings are in asset management companies.

Owens Corning, the second largest holding of New Alternatives Fund will be examined in depth, as its relevance to clean energy is less obvious. Owens Corning is a middle capitalization fiberglass manufacturer established in 1938 that now has a worldwide presence (Owens Corning 2015). On its sustainability page, Owens Corning advertises three goals of economic prosperity, social progress, and environmental stewardship. It upholds an environmental policy to conserve resources and prevent waste and pollution, which inspired its 2020 goals to reduce energy consumption and greenhouse gas emissions by 20 percent, water use by 25 percent, and waste by 70 percent (Owens Corning 2015). By 2013, most of these goals were well on their way to being met except for waste to landfill, which increased by 6 percent. Owens Corning is explicit about having past negative environmental impacts from spills and waste disposal and is now working to remediate nineteen total sites. Similarly to many of the companies held by Pax World and Trillium, Owens Corning is making an effort to act responsibly, however its efforts seem average and there is no direct relevance to clean energy so its inclusion in New Alternatives Fund is questionable.

The Guinness Atkinson Alternative Energy Fund (GAAEX) is managed by Guinness Atkinson Funds, an asset management firm established in 1993 that now manages eight funds (Guinness Atkinson Funds 2015). Its investment slogan is “human progress” and its strategies focus on investment in Asia, energy, and innovation (Guinness Atkinson Funds 2015). Of its two energy-focused funds, only one specifically

targets renewable energy investments. The Alternative Energy Fund was established in March 2006 and has \$14.6 million assets under management as of February 2015. It employs a detailed screening process in which companies must have more than 50 percent of business in alternative energy, be quoted on an investment exchange, and have at least \$100 million in market capitalization to qualify for investment (Guinness Atkinson Renewable Energy Fund Factsheet Q4 2014). Its top industry sectors are all renewable energies, the largest percentages being wind at 50.5 percent and solar at 21 percent. Its prospectus notes a chance of underperformance due to fossil fuel energy prices, renewable energy policy, and lack of diversification due to sector focus. Like Firsthand Alternative Energy, while this does suggest higher risk, there is no explicit statement of non-profit maximization. Since inception, this a small blend equity energy stock, has not performed well, yielding an average of negative 12.5 percent (Guinness Atkinson Alternative Energy Fund Fact Sheet Q4 2014). Over the past five years, it yielded an average of negative 9 percent, which outperformed its benchmark, the WilderHill Clean Energy Index, by approximately three percent (Invesco 2014). However, it underperformed its stock category, equity energy, by 10 percent.

The top five holdings, again by a small margin, are Theolia, Iniziative Bresciane, Northern Power Systems, Good Energy Group, and Mytrah Energy. Theolia is a small capitalization onshore wind electricity producer that, as of December 2013, operates 939MW of energy from wind farms primarily located in Germany, France, Morocco, and Italy (Theolia 2015). Iniziative Bresciane is a small capitalization Italian hydropower generator that operates three hydroelectric plants in Italy (Iniziative Bresciane 2015). Northern Power Systems is a renewable energy company established in 1974 that

operates its patented Permanent Magnet Direct Drive wind turbines around the world (Northern Power Systems 2015). Good Energy Group is a U.K.-based renewable energy utility that serves customers around the United Kingdom (Good Energy Group 2015). Finally, Mytrah Energy Limited is a renewable energy provider focused on India, which was established in 2010 and now has the largest wind bank in India (Mytrah 2015).

The Shelton Green Alpha Fund (NEXTX) is co-managed by Shelton Capital Management and a sub advisor, Green Alpha Advisors. Shelton Capital Management was established in 1985 and now manages \$1.2 billion assets dispersed across eight equity and three fixed-income funds (Shelton Capital Management 2015). The Green Alpha Fund is its only fund with an environmental focus. Green Alpha Advisors was founded in 2007 and focuses only on green investing; it searches for companies in growing environmental sectors that produce environmental solutions as efficiently and profitably as possible (Green Alpha 2015). It independently manages one mutual fund and one index, and co-manages one mutual fund with the Sierra Club, and the Shelton Green Alpha Fund with Shelton Capital Management. The Shelton Green Alpha Fund opened in 2013 and manages \$24 million as of February 2015. Its prospectus recognizes that in order to apply the environmental screening needed to identify companies that fit Green Alpha's criteria, it may forego rewarding investments (Shelton Capital Management Prospectus 2015). This signals to potential investors that the fund is willing to forego profit in an effort to make an environmental impact. The top three sectors invested in are technology at 29 percent, industrial at 28 percent, and utilities at 11 percent. This middle capitalization growth fund has yielded 23.5 percent since inception (Shelton Capital

Management 2015). However, over the past year it has yielded negative 5 percent, underperforming its stock category by 11 percent.

Its top five holdings are First Solar, Sierra Wireless, United Natural Foods, Google, and Qualcomm. First solar is a solar energy company previously profiled, as it is held by Fossil Fuel Free Core and Firsthand Alternative Energy (page 51). Sierra Wireless is a telecommunications company that does not mention sustainability initiatives on its website (Sierra Wireless 2015). United Natural Foods is the largest distributor of natural and organic food products in the United States. Organic food production is far more sustainable than traditional methods, so there is indeed environmental relevance (United Natural Foods 2015). Google is an internet service provider that has a sustainability platform and is a well known innovator of products that may have major positive environmental impact, but its main products and services are not specifically environmental (Google 2015). However, as of early 2015, Google has spent \$1.5 billion on clean energy projects around the world, including a twenty-year power deal with NextEra in California (Gallucci 2015). Qualcomm is a mobile technology company that developed a wireless electric car charging technology (Qualcomm 2015). Most of its other products are not direct environmental solutions.

Calvert Investments, founded in 1976, manages \$13 billion assets spread across 27 mutual funds (Calvert 2015). Calvert has several environmentally focused funds including the Calvert Global Energy Solutions Fund (CGAEX) and it applies an ESG screening across all funds. The Calvert Global Energy Solutions Fund has, as of February 2015, accumulated \$92.87 million assets since its inception in 2007. 80 percent of the fund is invested in companies whose main business is sustainable energy solutions or that

are involved in the sustainable energy solutions sector. Management defines “main business” as 50 percent of revenues from sustainable solutions activities, 50 percent of assets dedicated to sustainable solutions, or it must be included in one of three clean energy indexes (Calvert Prospectus 2015, 35). The prospectus also notes that because the fund is mostly invested in the clean energy sector, it is less diverse than other funds, and therefore subject to more volatility. It also suggests that applying an ESG screening limits the investment universe, which may affect the investment performance positively or negatively. Although this allows for the possibility of underperformance, the intent to not maximize profits is not as clear as with Shelton Green Alpha Fund or New Alternatives Fund, but is more explicit than many of the others. Since inception, this middle capitalization equity energy blend fund has yielded an average of negative 10 percent, which performed comparably to one of its benchmarks, the Ardour Global Alternative Energy, and underperformed the Lipper Global Natural Resources Fund by 7.5 percent. Over the past five years, it has yielded an average of negative 4 percent, which underperformed its stock category by 5 percent.

Its top five holdings are Johnson Controls, Capital Stage AG, Eaton Corp, Quanata Services, and Cosan LTD Class A Shares. Johnson Controls is a technology company that claims to have been committed to sustainability since 1885 when it invented the first electric room thermostat, and in 2014 it was ranked twelfth in Corporate Responsibility Magazine’s annual “100 Best Corporate Citizens” list (Johnson Controls 2015). Though many of its products are not direct environmental solutions, it does produce hybrid and electric batteries. Capital Stage AG is a Germany-based investor in and operator of solar and wind parks (Capital Stage AG 2015). Eaton is a power

management company that provides solutions for electrical, hydraulic, and mechanical power systems (Eaton 2015). On its homepage, Eaton states its commitment to sustainability and notes its provision of hydraulic and installation solutions to traditional and renewable energy providers (Eaton 2015). Quanta Services provides construction, maintenance, and technology services for the electric power and oil and natural gas industries (Quanta Services 2015). Whether or not natural gas is a clean energy source is controversial, thus Quanta's inclusion in the Calvert Global Energy Solutions Fund is questionable. Cosan LTD is a Brazilian conglomerate composed of a logistics services company, a natural gas distributor, a lubricant company, an agricultural land management company, and a sugar, ethanol, and energy cogeneration producer (Cosan 2015). Again, the sustainability of natural gas and ethanol is contentious, thus a more relevant company could be invested in instead.

Fidelity, founded in 1946, manages the Fidelity Select Environment and Alternative Energy Portfolio (FSLEX) along with approximately 200 other mutual funds (Fidelity 2015a). Fidelity manages approximately \$4.9 trillion assets, a far larger conglomerate than any of the previously examined managers. The Fidelity Select Environment and Alternative Energy Portfolio is a large blend industrial stock fund that opened in 1989, and manages \$83.41 million as of January 2015 (Fidelity 2015b). 80 percent of the fund is invested in companies whose business is related to alternative or renewable energy, energy efficiency, pollution control, water infrastructure, waste, and recycling technologies. Its top sectors are energy efficiency by a large margin at 50 percent, followed by pollution control at 11 percent. Fidelity acknowledges that as a sector-focused fund, it is subject to more risk and volatility than a typical diversified fund

and its performance is more sensitive to changes in energy-related government regulations and subsidies, as well as changing supply and demand of fossil fuels. Similar to the Guinness Atkinson Alternative Energy Fund, this suggests there is more risk than the average mutual fund, but does not explicitly state an acceptance of below maximum profits. Since inception, it has yielded an average of 4 percent, which underperformed its S&P 500 benchmark by 6 percent (Fidelity 2015b). No data are available on since inception performance of its other benchmark the FTSE Environmental Opportunities and Alternative Energy Index. Over the past five years, it yielded 9.5 percent, which underperformed the S&P 500 by approximately 7 percent, the FTSE index by 5 percent, and its stock category by 6 percent. Despite the underperformance relative to its benchmarks, this fund has performed reasonably well compared to many of the other clean energy funds.

Its top five holdings are Honeywell International, Praxair, Deere & Company, Cummins, and Delphi Automotive. Honeywell International is a conglomerate company that claims approximately half of its business related to energy efficiency. It asserts that if its “existing technologies were widely adopted today, energy demand in the U.S. could be reduced by 20-25%” (Honeywell 2015). Praxair states its core business is “making our planet more productive;” it produces industrial gases and provides oil and gas services. Although a section of its website is dedicated to its sustainable development, its direct involvement with the oil and gas industry without any direct involvement in renewables should disqualify its inclusion in a clean energy fund. Deere & Company, or John Deere, is a manufacturing company that develops machinery and equipment for agricultural, construction, and other purposes. Deere does boast an environmental stewardship

platform, however many of its machines are involved in the destruction of forests and it produces diesel engines (John Deere 2015). Its core business and strategy seem irrelevant to clean technology. Cummins manufactures and distributes items and services that complement the power industry (Cummins 2015). Similar to many of the other companies, it has a sustainability platform, but its main products and services are not environmental solutions. Delphi supplies technologies for the automotive industry. Of most environmental relevance are its fuel cells and hybrid and electric vehicle products, however it also creates many traditional car products (Delphi 2015).

Alger Management was founded in 1964 and now manages \$22.4 billion across eighteen strategies (Alger Overview 2014). Its Green Fund (SPEGX), established in 2000, is the only environmentally focused fund, also classified as a large capitalization growth stock fund. The fund manages \$80.4 million assets as of February 2015 and invests a minimum of 80 percent in companies that “conduct their business in an environmentally sustainable manner, while demonstrating promising growth potential” (Alger 2015). Its prospectus notes that because the investment criteria limit the investment universe, the fund may underperform those that do not apply such a constraint. Its performance is also at risk because companies that prioritize environmental sustainability may not be as profitable as other companies (Alger Green Fund Prospectus 2014). This serves as sufficient indication that this fund does not seek profit maximization. Its top sectors are technology at 31 percent, consumer cyclical at 23 percent, and industrials at 22.5 percent. Since inception, the Alger Green Fund has yielded 2 percent, which underperformed its benchmark, the Russell 3000 Growth index,

by 2 percent (Alger 2015). Over the past five years it yielded 11 percent has underperformed its stock category by 3.5 percent.

Its top five holdings are Apple, Facebook, Home Depot, Nike, and Starbucks. As these companies are particularly well known and both Apple and Home Depot have been previously profiled they will not be extensively examined. Clean energy technology is not the core business of any of the companies. It is interesting to note that while the Alger Green Fund prospectus indicates the potential profit due to aggressive environmental screening more explicitly, its top holdings are far less environmentally focused than many of the other alternative energy funds.

Brown Advisory is an investment firm established in 1993 that now manages approximately \$34.86 billion assets across thirteen equity funds and six fixed income mutual funds (Brown Advisory 2015). The Sustainable Growth Fund (BIAWX), a U.S. large growth fund, was established in 2012 and now manages \$208.2 million assets as of December 2014 (Sustainable Growth Fund Fact Sheet Q4 2014). It invests in companies that seek environmentally efficient operations or that offer products or services that address environmental issues. Its top sectors are industrials at 34 percent and information technology at 32 percent. Its fact sheet notes that the focus on environmental factors could lead to underperformance compared to funds that do not have a strict focus. Additionally, its prospectus warns against several risks including environmental policy risk and growth company risk. Similarly to many of the other funds, it does not note an expectation to yield below market rates, only that there is a risk of underperformance. Since inception, it has yielded an average return of 17.5 percent, which underperformed its benchmark, the Russell 1000 Growth, by 2.5 percent (Sustainable Growth Fund Fact

Sheet Q3 2014). In the past year it has yielded the same return as its stock category, large growth, of 10 percent.

Its top five holdings are Ecolab, Danaher Corporation, Stericycle, Verisk Analytics, and Nike. Ecolab is a technology and service provider of water, hygiene and energy. It produces many water treatment technologies, which is an environmental solution, but it also produces several technologies for the oil and gas industry that are environmentally irrelevant, and arguably destructive. Danaher Corporation is a science and technology innovator that produces water treatment products and other products (Danaher 2015). Stericycle is a medical and bio-hazardous waste management company, although by nature hazardous waste is unsustainable, it is the work of companies like Stericycle to protect the environment against any hazardous waste that is produced under our current paradigm (Stericycle 2015). Whether or not such work qualifies it for inclusion in a clean energy portfolio is up for debate. Verisk is a data analytics company, the core business of which does not produce environmental solutions, but also does not consume or use any natural materials. It attempts to be energy efficient and seeks properties that are LEED certified (Verisk Analytics 2015). Nike is a popular shoe and sportswear company, the core business of which is not involved in producing environmental solution, but it does have a strong sustainability platform (Nike 2015).

Gamco Investors, established in 1976, manages \$47.5 billion dollars across twenty-seven strategies including the Gabelli SRI Fund AAA (Gabelli 2015). The Gabelli SRI Fund AAA (SRIGX) is not specifically environmental, but it does employ a social screening process when selecting stocks and aims to hold at least 80 percent of stocks that fit this criterion (Gabelli SRI Fact Sheet Q4 2014). These guidelines consist of a

negative screening for the top 50 defense or weapon contractors and any company with more than 5 percent invested in tobacco, alcohol, gaming, defense, weapons, or abortion related products. These criteria are far less ambitious than many of the previously examined funds. As for risk, the prospectus notes that the SRI screening may expose the fund to investments that will affect performance positively or negatively, but does not indicate an expectation for underperformance; thus it holds a profit-maximizing objective. With \$76.5 assets under management as of December 2014, Gabelli SRI is spread across a broad range of sectors, the largest being food at 15 percent and cable and satellite at 11.5 percent. Since inception in 2007, the AAA class category has yielded an average of 6.5 percent, which outperforms its benchmark the MSCI All Country world Index by 4 percent (Gabelli SRI Fund Fact Sheet Q4 2014). Its five-year return is the same as its stock category, large blend world stocks, at 10 percent.

Its top five holdings are Energizer Holdings, ConAgra Foods, Xylem, Nestle, and Johnson Controls. Energizer Holdings is a conglomerate that owns thirty consumer brands, most famous for its Energizer batteries (Energizer 2015). Similar to many other companies, Energizer does have a sustainability platform, but none of its brands is directly responsible for environmental benefits. ConAgra is one of North America's largest food brands offering nearly 50 brands, it does have a sustainability platform, but no products related to clean energy (ConAgra 2015). Xylem is a water technology provider that attempts to solve challenging water systems by developing water treatment solutions, pump systems, and other items integral to the water cycle (Xylem 2015). It offers several pumps powered by renewable energy sources (Xylem 2015). Nestle is the world's largest food company offering numerous brand names. None of its products is

directly related to clean energy, though it does support environmental sustainability initiatives across the supply chain and elsewhere (Nestle 2015). Johnson Controls was profiled under Calvert (page 60).

Portfolio 21 (PORTX) used to be independently managed, but has now merged with Trillium, its long-term collaborator (Portfolio 21 2015). Portfolio 21 seeks “exceptional companies that are able to provide competitive returns for investors while mitigating the environmental impact of their business activity, operating in a manner respectful of society, and implementing strategies to manage their operations within emerging environmental limits” (Portfolio 21 2015). Its intention to “provide competitive returns” implies that it intends to maximize profits. It also mentions its risk mitigation through global, sector, and company size diversification, suggesting it is less risky than many of the other clean energy portfolios. It also applies a negative screening for weapons, tobacco, nuclear energy, fossil fuels, metals and mining, gambling, animal testing, alcohol, and agricultural biotechnology. As of December 2014, the fund manages \$460 million assets across many sectors, the largest being information technology at 20 percent, financials at 20 percent and industrials at 14 percent (Portfolio 21 Fact Sheet Q4 2014). Since inception in 1999, this large growth world stock has yielded 5.5 percent, which outperforms the performance of its benchmark, the MSCI All Countries index, which yielded 4 percent over the same time frame. However, over the past five years it yielded 8 percent, which underperformed its stock category by 2 percent.

Its top five holdings are Google, Novo Nordisk, Roche, MetLife, and TJX Companies. Google was profiled under Shelton Green Alpha (page 59-60). Novo Nordisk is a global health care company specializing in diabetes care. While healthcare provides a

direct social benefit, there is no direct relation to clean energy. However, it does adhere to a triple bottom line of economy, environment, and society (Novo Nordisk 2015). Roche is a pharmaceutical company, which faces the same relevance issues of Novo Nordisk. MetLife is an insurance company that has set many internal environmental goals, but the goods and services it provides are not in the clean energy sector. TJX Companies is a conglomerate of off-price clothing and home goods companies that its core business does not produce environmental benefits, but it does attempt to operate sustainably (TJX Companies 2015).

Summary

Overall, the top five holdings of each of the fourteen environmentally focused mutual funds profiled make significant efforts to operate sustainably. Those that directly produce or invest in companies that produce renewable energy are clearly the most appropriate. However, the core business of most of the companies outside of the clean energy sector has no environmental relevance. While these companies may be harming the environment less than other companies within their industries, they are not producing environmental solutions.

Figure 1 (Appendix A) ranks the mutual funds on a scale from 0-10 based on the environmental relevance of its top five holdings.¹² Companies that either directly produce renewable energy or invest in companies that do were awarded a 2. These investments are ambitious for climate change investment, for example, First Solar. Companies that either produced an environmental solution that was not specifically related to renewable

¹² Please Refer to Appendix B for detailed information on how companies were ranked.

energy or that produced renewable energy products as only a small portion of their business were awarded a 1. Qualcomm scored 1 because of its wireless electric car charging technology and Ecolab also scored a 1 due to its water treatment products, despite its involvement with oil and gas. Companies that were awarded 0s advertised no products or services related to clean energy on their websites, despite many having impressive information on their sustainability platforms. Therefore, these investments are not considered to be ambitious investments for climate change mitigation. Based on this ranking system, Guinness Atkinson Alternative Energy Fund scored the highest at 10 followed by Firsthand Alternative Energy and New Alternatives Fund which each scored 8. Portfolio 21 scored the lowest at 0.

Roen's *Renewable Energy World* article ranks the same list of funds (save for Fossil Fuel Free Core and Sustainable Opportunities) by the concentration of alternative energy investments based on the top 50 percent of the funds' weight or at a minimum, its top ten holdings. It also includes the Green Century Balance Fund (GCBLX), which was excluded from analysis in this thesis due to its exposure to the bond market. Figure 2 (Appendix A) displays his results. While the top three funds remain unchanged, they are ordered differently with Firsthand Alternative Energy in first place. Pax World Global Environmental Markets fell by three marks compared to Figure 1, while Alger Green rose by three. The other funds' rankings remained relatively constant across the two figures.

This analysis is not an attempt to undervalue the work of firms that scored 0 or the funds fell towards the bottom of either figure. However, for the funds on the lower end of the spectrum to market themselves as "green funds" that invest in environmental solutions is inappropriate. As previously mentioned, most of the companies outside of the

clean energy sector do make significant sustainability efforts, but cannot be considered an environmental solution if their core business is unrelated. Furthermore, no clean energy technology breakthroughs will be achieved by funds that qualify companies with a sustainability plan of any kind as an environmental investment. A fund that claims to be green should not hold stocks of companies with no environmental apparent initiative and those that do are providing misleading information. On the other hand, investment in a company with sustainability initiatives of any kind is far superior to investments in companies that give no consideration to sustainability measures.

None of the companies in the top holdings of the funds is a B Corporation. This has several possible explanations. First, that many of these companies have a big name like “Nike” or “Home Depot” and do not need additional certifications to attract customers to their goods and services. Second, for its certification services, B Lab charges \$500 to more than \$50,000 annually depending on the annual sales of the company (B Corp 2014). Bigger companies that are generating enough revenue without the certification process might not see the point of paying for a certification process when their sales are doing well. On the other hand, this might be financially detrimental to some of the smaller clean energy companies that are the most environmentally relevant despite not having the certification.

Teresa Bell, an owner of a small Kentucky-based B corporation, notes that the B Certification actually hurt her business due to the stigma associated with social enterprise, as it is often equated with non-professionalism. She received advice to drop the B certification because it made her company seem amateur. Bell did not concede, and stands by her decision to become B certified, claiming that “being a B means that you as

a customer have proof that our mission is not just self-serving. We want to be held accountable” (Bell 2011). While the certification may guarantee certain corporate behavior to various stakeholders, the stigma associated with the certification Bell faced may dissuade smaller, less branded companies from obtaining the certification. Furthermore, Surowiecki (2014) notes that “to a freemarketeer, a B corp is just a way to waste shareholder money from investors,” thus companies in growth stages that need capital to survive may fear such negative repercussions. Another possible explanation is that B Lab is not marketing its certification process well enough in the private sector to attract high profile clients or smaller firms that would have to consider the financial viability of obtaining the certification process.

In short, in the case of this aggregate portfolio of companies, the lacking B certification provides two insights. First, in the case of companies like Sierra Wireless that provide no clear environmental benefit, they are not the “best for the world” and therefore do not qualify for the certification. Conversely, because companies like First Solar that are extremely environmentally relevant and produce renewable energy do not have a B Certification, perhaps B Lab is not succeeding in its mission to highlight the companies with the most environmental and social benefits.

A possible justification for seemingly unambitious portfolios is the advantage of lowering the risk of the portfolio through sector diversification. Examples would be investing in some companies whose main business is in clean energy and others whose is not, or in companies that make some significant environmental investments, but focus on other products and services as well. This strategy buffers ambitious renewable energy investment by including lower-risk, profit-oriented investments that will secure the

financial sustainability of the fund in case of failure of the riskier investments. The strategy of diversification is made apparent by the many profiled funds that invest very small percentages in each company, even among their top five holdings. It is also important to note that this analysis only examined the top five holdings of each fund, and as the weights are low, there are many more unexamined investments that may be ambitious clean energy investments, and the more profit-oriented top five holdings are used to buffer this risk. The same logic applies at the company level to companies that scored a 1 in the ranking system; these companies produce or invest in renewable energy products, however it is not the core of their business. Therefore, if the higher risk renewable energy products should fail, the company can rely on returns from less risky products to ensure firm sustainability.

Table 1 (Appendix C) lists the performance of all fourteen funds. The two highest performing funds of those that offer since inception data are the Shelton Green Alpha fund and Brown Advisory Sustainable Growth; however, both are young funds that may face lower yields in future years. Of the more mature funds, Trillium Sustainable Opportunities, Fossil Fuel Free Core, and Gabelli SRI Fund AAA performed the best. The top five holdings of these three funds are less environmentally focused than many of the other funds. The first two scored only 1 of 10 in Figure 1 and were not included in Roen's analysis. Gabelli SRI Fund scored tenth of twelve in Roen's metrics and ninth of thirteen in Figure 1. These funds prove that applying a positive or negative screen does not necessarily entail lower profits. However, these are not good examples of funds that take large risks of potential profit loss in order to support companies that are going to make the technological breakthroughs needed for reducing global climate change.

On the other hand, Guinness Atkins Alternative Energy, highest ranked by Figure 1 and third by Roen, performed the worst out of all funds since inception. Therefore, it is possible that Guinness Atkinson Alternative Energy Fund and several of the other highly environmental funds are taking on too much risk to be sustainable in the long run; however, as of now, there is no indication of an intention to close the funds. New Alternatives fund has performed well over the past five years, indicating it is possible to apply a very strict environmental screening and produce an acceptable return; however, its since inception data is not offered to support this result.

Of the fourteen funds, only four explicitly state the intention to prioritize environmental impact over profit maximization: New Alternatives Fund, Shelton Green Alpha Fund, Green Century Balanced Fund, and Alger Green Fund. Interestingly, only New Alternatives Fund, ranked in the top three most environmental funds. Additionally, all of them yielded at least average returns over the five-year period, performing far better than several of the funds that claim to maximize profits. As previously mentioned, Shelton Green Alpha has performed exceptionally well since inception, but it is too young for conclusive performance results to be determined.

Many of the funds that state the intention not to profit maximize have decent returns and perform relatively well in comparison to others that claim to maximize profit. It seems shocking that Guinness Atkinson, Calvert Global Energy, and Firsthand Alternative Energy that continue to yield negative returns do not indicate a non-profit maximizing strategy, suggesting that investors expect market returns. It is possible investors are hoping for future high performance to make up for the previous losses. However, at a certain point, poorly performing funds face the risk that if they do not

change their investment strategy they might close. The next chapter will attempt to identify a profit threshold above which clean energy funds may avoid failing in the long run.

Chapter 4: RISK OF INVESTMENT

Government Policies that Affect Risk

Renewable energy policy is integral to attracting investors to clean-tech projects. As previously established by Reddy and Painuly (2003), the high cost and risk of renewable energy investments require public policy that favors such investment to stimulate the market. However, Wüstenhagen and Menichetti (2012, 5) note that on any given investment, clean-tech-related or not, the actual risk and return of an investment is difficult to accurately estimate. Thus, a policy that would successfully encourage private investment in renewable energy would change the perceived risk and return of clean tech investment. For example, their research identifies a phenomenon known as “path dependence” in which investors perceive familiar investments to be lower risk. Therefore, they conclude that it is not enough to introduce renewable investments into the market and expect for optimal allocation to occur because investors have biases for what they know. Thus, policy is needed to help renewable energy investments infiltrate the market and lower their perceived risk.

In order to maximize investment in renewable energy, the government should introduce a policy package that increases the supply of renewable energy technology and increases their demand. Bürer and Wüstenhagen (2009, 4498) classify policies that catalyze investment in renewable energy into two main categories: technology-push and

market-pull. A technology-push policy increases the supply of clean energy technology, for example to increase government funded renewable energy R&D to mitigate underinvestment in innovation. A market-pull policy increases demand for clean energy technology by removing barriers to entry such as providing tax credits for clean energy investments. Using qualitative and quantitative metrics, Bürer and Wüstenhagen surveyed sixty fund managers and found the most attractive companies to investors are those supported by either the technology-push policy of government grants for demonstration plants or the market-pull policy of feed-in tariffs. A feed-in tariff (or payment) is a mechanism in which energy suppliers offer to pay individuals who generate their own electricity and often offer additional payment for any energy exported to the grid. They note how the technology-push preference reveals the vulnerable transition period between government R&D funded projects and self-sustaining businesses in which venture capital investment is critical.

The surveys also concluded that investors believe the policy platform that would best encourage investment in renewable energy is one that included both technology-push and market-pull components so that investment was stimulated across the entire innovation chain. Thus, in order to help renewable energy infiltrate the market and compete fairly against traditional energy investment given investor bias and “path dependence,” the government should introduce a policy package that includes feed-in tariffs and grants for government demonstration plants. In doing so, the government would be signaling for change in the social dimension of clean energy technology, which Hekkert et. al (2007) note was as critical in sustaining technological innovation.

Many European countries include feed-in tariffs in their energy policy. Haas et. al (2010, 7) found that the feed-in tariffs for specific renewable energy technologies yielded the lowest cost for energy consumers. They attribute its success to the stability of the pricing system as fixed payments are offered per unit of energy generated so the feed in tariff price is separate from the volatile price of energy. This is an example of a market-independent feed-in tariff policy. They note that Spain introduced a less stable system in which a premium was added on top of the electricity price allowing the feed in tariff reward to fluctuate with energy price (Haas et. al 2010, 2). This is known as a market-dependent feed-in tariff policy. Several European countries have adopted variations of these types of feed-in tariff policies. Couture and Gagnon (2010) find several advantages and disadvantages to each version. Market independent options ignore energy demand resulting in increased costs for utilities, however they are the most predictable and therefore the most secure, which best attracts investors (Couture and Gagnon 2010). On the other hand, market dependent options are more uncertain for investors because future payment levels unknown, however they are advantageous because the price varies with market demand giving incentive to produce at high demand when prices are highest (Couture and Gangon 2010). Despite the variations in specificity, Haas et. al conclude that overall, feed in tariffs in Europe have proven to increase investment in new renewable energy generation plants (Haas et. al 2010, 3).

Ringel (2006, 6) points out that in a competitive energy market, feed-in tariffs need further support via market manipulation because consumers will choose the lowest cost energy supplier, which are those with the least green power producers in its grid. This is because operators pay generators the feed-in tariff for providing renewable energy

to the grid, and that cost is transferred to the consumer through electricity prices. Ringel suggests introducing a compensation scheme that distributes the cost among operators rather than to only consumers. For example, Germany requires companies that have below average feed-ins to buy green electricity from those with above average feed-ins (Ringel 2006, 6). This gives a competitive advantage to providers with the greenest electricity. Another important aspect of a successful feed-in tariff system noted by Hass et. al (2010) is an acceptance and willingness to pay of electricity by consumers.

Why do funds close?

When a mutual fund closes, it is either liquidated, meaning it is entirely abolished, or it is merged into another fund. Despite the popularity of actively managed mutual funds, they have not been performing well in recent years. Since 2001, 57 percent of actively managed mutual funds underperformed S&P index funds and in 2011, 84 percent underperformed (AP 2012). Additionally, in the period from 2001-2012, seven percent of all funds failed each year compared to 1960, when only one percent failed (Lenzner 2013). This is in part due to the succession of the dot.com bubble burst and the financial crisis, which pushed investors to move money away from equity funds and into the lower risk index and fixed income fund options (Lenzner 2013). John Bogle, the former chairman of Vanguard, attributes mutual funds' increased failure to the shift towards going public and to increased management by large financial conglomerates that want to maximize revenues from fees (Lenzner 2013). The underperformance of mutual funds can sometimes be attributed to fees because returns to shareholders are reduced by the fee payout to managers and fees have increased recently. Fees are more likely to account for

underperformance when actively managed funds become very large because as Maiello (2009) notes, large funds very closely mirror their indexes.

A 2013 Vanguard study conducted by Schlanger and Philips examines approximately 2,500 funds that Morningstar identifies as closed, roughly 500 of which were liquidated and roughly 2,000 of which were merged. The funds were examined over a fifteen-year time period starting in 1997. The research finds that the main reasons for closure were “sustained poor performance, a failure to gather assets or a combination of performance and operational failure” (Schlanger and Philips 2013). They also found that funds often had negative cash flows leading up to closing meaning “investors most likely responded to the underperformance by selling their holdings, furthering the decline of asset bases and increasing the potential for closure” (Schlanger and Philips 2013, 4). It is clear that many funds that close are because of poor performance, however some may have done well during their lifespan, but had to close for external reasons. Daniel Weiner, editor of a Vanguard publication and CEO of Advisor Investments, suggests that another common reason for closing is short supply or the lack of stocks and bonds suitable for the investment style or objective (Maiello 2009). This final factor is one likely faced by investors who seek to mitigate climate change through investments as that applies a strict environmental focus, which limits the investment universe.

In Schlanger and Philips’ Vanguard study, the highest percentages of funds were liquidated in the categories of middle capitalization value at 17.2 percent, global emerging markets at 15.3 percent, and small value at 12.9 percent. On the other hand, global markets experienced the least liquidations at only 4.7 percent of liquidations. It is

interesting to note that none of the growth fund categories had the most liquidations as growth funds invest in innovative companies which are expected to do very well and grow if they succeed, however they are much higher risk. Investments in renewable energy projects largely fall into growth categories. However, the small growth category did perform the worst in the year before closure, yielding an average of negative 5.62 percent, whereas global emerging markets only dropped to negative 3.27 percent before closing. This suggests there is more of a tolerance for underperformance in the small growth category compared to investments of other stock styles. However, the large growth category yielded negative 2.14 percent a year before closing which was the least negative yield of all the closed stock categories. This suggests a lower tolerance for underperformance. Additionally, only 7.3 percent of funds in the large growth category were liquidated, which is relatively low compared to other stock styles. Middle capitalization growth also fell quite low in the year before closing, yielding negative 5.31 percent, although only 6.7 percent of funds in this category were liquidated. Therefore, it appears there is a tolerance for relative underperformance of both small and mid-size growth stocks. Size certainly plays a role in addition to the style, as small blend and small value both yielded less than negative 5 percent the year before closing.

Terminated Clean Energy Funds

Bloomberg Financial Software identifies twenty-two clean energy funds that have been liquidated. Table 2 (Appendix C) shows the performance of the funds leading to closure. Only one of the funds, Craton Capital Renewable, explicitly states a non-profit maximizing strategy in an effort to maintain strict environmental focus. Therefore, based

on information that the funds have supplied to Bloomberg, the other liquidated clean energy funds give no indication to potential investors that the clean energy screen adds a risk of underperformance, despite yielding as low as negative 35 percent annualized return over three years. Of the funds that survived five years, Smam Mirai Sosei (79313105 JP) yielded the highest annualized return at 9 percent and LODH PREMIA Clean Energy (LOPCLFD LX) yielded the lowest at negative 28 percent. Only four funds of twenty-two yielded higher than 2 percent annualized return over five years.

Compared to the broad mutual fund performance reported by Morningstar as of March 25th, 2015 the liquidated mutual funds were yielding well below market return. The average five-year average annual return was 9 percent, the highest non-sector specific performance being small growth at 15 percent and the lowest being Latin American stock at negative 6 percent.¹³ Latin American Stock, and Equity Precious Metals, were the only two stock categories out of thirty-eight to yield negative returns over a five year period. Vanguard's portfolio, as of February 28th, 2015, shows similar performance data. Vanguard's highest performing non-sector specific fund is Strategic Equity at 19.5 percent. Its energy-sector-focused fund has yielded 4 percent average annual return over five years, however it is energy overall not specifically clean energy, perhaps explaining the outperformance of the liquidated clean energy funds. The lowest five-year average annual return of a mutual fund is Emerging Markets Stock Index Admiral Shares at 4 percent.

¹³ Data displayed in Table 3 Appendix C.

The fund performance of the twenty-two liquidated clean energy mutual funds suggests that there is a threshold at which management decides to terminate the fund due to sustained losses or the declining rationale of maintaining the fund separate from other funds, as annualized performance tends to decrease from 5Y to 3Y to 1Y. However, the data are inconclusive as to any particular threshold. Limited commentary is available online explaining the closure of the funds. Jackson (2012) notes that Lloyd George Management decided to close its Asian Green Fund (LLASGRA ID) because it was no longer economically viable at only \$2.15 million assets under management after losing return since inception. Additionally, Jackson quotes senior analyst Meera Patel explaining that small funds have high total expense ratios which puts a financial burden on investors that justifies closing. It is likely that a similar rationale motivated the liquidation of the other funds that performed comparably, if not worse than the LG Asian Green Fund. These reasons for closure reinforce Schlanger and Philips' 2013 Vanguard Report finding that poor performance and failure to gather assets are the primary causes for closure.

CONCLUSION

While Europe and other parts of the world can rely on their governments to spearhead climate change mitigation, it appears that efforts by the United States government fall short. If the private sector can help boost renewable energy R&D, the United States might be able to become a leader in the renewable energy development race as it once was in the 1980s during the Carter era. There is hope for government involvement with the implementation of the Obama administration's fiscal year 2015

energy plan that increases funds for energy R&D. The government can also help to stimulate private investment in clean energy by introducing an energy policy package that includes a feed-in-tariff, grants for demonstration plants, legislation encouraging companies to engage in CSR, and incentivizing pension funds to invest in SRIs. Many of these strategies have proved to be successful in Europe.

Yet, the efforts of the United States government are not sufficient even if they are increased; one must look to the private sector to fill these gaps. There are mutual funds that channel money into R&D of promising renewable energy technologies. However, it is crucial to note that such funds face difficult financial risks. Thus, it is strongly encouraged that companies structure their portfolios to ensure a consistent flow of money into the fund. It appears that the best strategy is diversification, particularly sector diversification, so that the risk of including companies performing ambitious energy R&D are buffered by less risky, more profit-oriented companies. Such funds do not have to profit maximize to be successful; many of the strong performing environmental funds note that they risk underperformance by applying a strict environmental focus. Funds should explicitly state this intention on their websites. However, the intention not to maximize profit does not relieve the need of the company to maintain decent returns. There is a threshold below which investors no longer will invest, even if they do not seek profit maximization, as indicated by the closure of many clean energy funds after prolonged poor performance.

Companies can better identify themselves to qualify for inclusion in clean energy mutual funds. One way for a company to identify itself in this fashion is the L³C

model that requires a social or environmental mission, and allows for non-profit maximization. Thus far, only one L³C is focused on renewable energy and none of the profiled funds' top holdings is an L³C. While investment in a renewable energy L³C could be less financially rewarding than a standard company, it could serve as the riskier investment likely to achieve technology breakthroughs. More companies that desire R&D breakthroughs should seek L³C designation, and more clean energy funds that do not profit maximize should seek investment in renewable energy L³Cs. The B Corporation certification also could function as an indicator of ambitious renewable energy R&D at the company level, however it is a flawed system due to its inability to measure real impact and its possible difficulty in attracting the companies with the most environmental and social benefits.

At both the company and fund levels, it is imperative to develop a cohesive language with which to describe impact-investing strategies. Of the companies and funds profiled, there is a wide range of terminology used to describe the intention not to profit maximize. Some describe a “triple bottom line,” others state a commitment to “people, planet, and profits,” but most personalize descriptions and use no specific terminology. If uniform language were employed across the board, it would send a stronger signal and help consumers and investors to identify companies and funds that aim to make the biggest impact.

Appendix A – Greenest Mutual Fund Charts

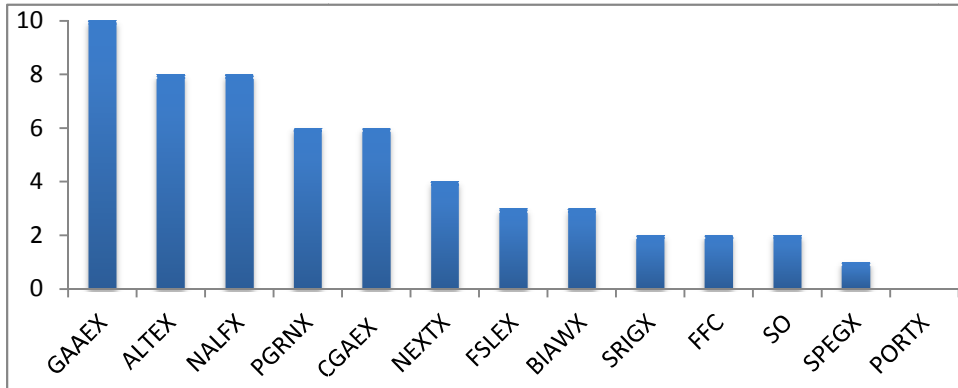


Figure 1. Greenest Funds (company relevance)

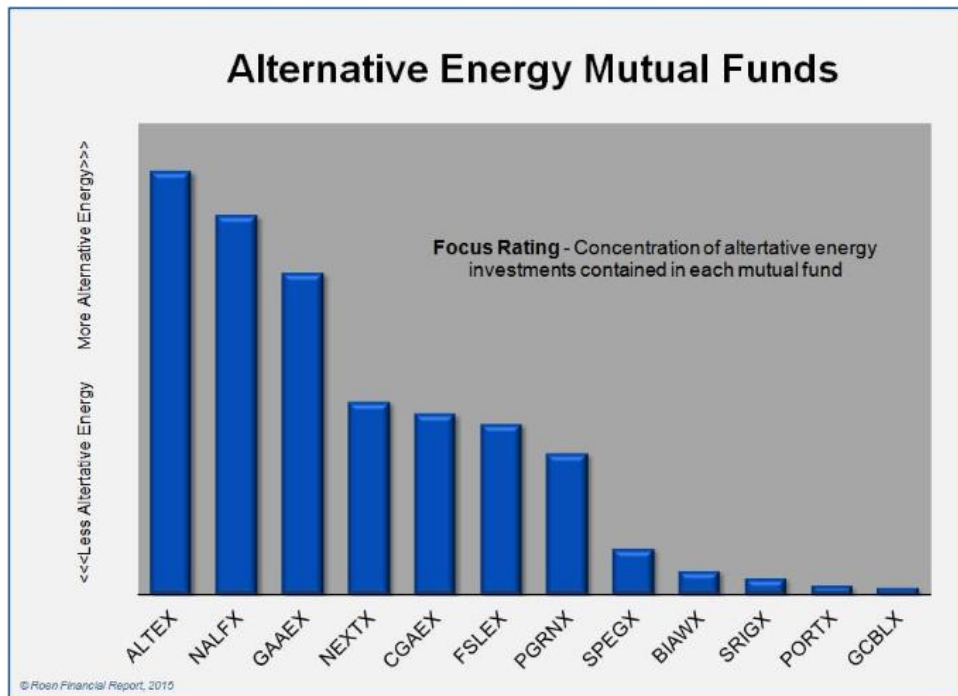


Figure 2. Mutual Funds with the Highest Concentration of Alternative Energy Investment (Roen)

Appendix B- Company Rankings

All of the proceeding information was taken from company websites.

Company Name	Ranking	Industry	Pros	Cons
Pall	1	Industrial	<ul style="list-style-type: none"> - Considered first "clean tech" company - Produces water desalination technologies 	<ul style="list-style-type: none"> - Produces products for distilling alcohol - Makes bottled water
Pentair	1	Manufacturing	<ul style="list-style-type: none"> - Creates products that enable the production of renewable energy 	<ul style="list-style-type: none"> - Produces technology for oil and gas
Pennon Group	2	Waste Management and Water Utility	<ul style="list-style-type: none"> - Operates hydroelectric plant - Produces 30Gwh of renewable energy - Produces energy from waste 	
Murata	2	Electronics	<ul style="list-style-type: none"> - Produces technology for electric cars, energy for smart houses - Owns and operates solar power systems 	
American Water	0	Water Utility		<ul style="list-style-type: none"> - Does not directly produce product/service related to clean energy
PGRNX	6			

Table 1. Top 5 Holding Green Ranking – Pax World Global Environmental Markets

Company Name	Ranking	Industry	Pros	Cons
Apple	1	Electronics	<ul style="list-style-type: none"> - Sources 100% of electricity for data centers renewably - Made largest power purchase in solar industry Feb 2015 	<ul style="list-style-type: none"> - Bad history of aversion to sustainable electricity sourcing - Possibly planned obsolescence
Gilead	0	Biopharmaceuticals	<ul style="list-style-type: none"> - Obvious social/health benefit 	<ul style="list-style-type: none"> - No sustainability information available on website
Cisco	1	Information Technology	<ul style="list-style-type: none"> - Installed and commissioned solar energy systems at 3 locations 	<ul style="list-style-type: none"> - Does not directly produce product/service related to clean energy
Home Depot	0	Home Improvement	<ul style="list-style-type: none"> - Wood certification from non-profit 	<ul style="list-style-type: none"> - Does not directly produce product/service related to clean energy
UnitedHealth Group	0	Health Care	<ul style="list-style-type: none"> - Clear social/health benefit 	<ul style="list-style-type: none"> - No sustainability information available on website
Fossil Fuel Free Core	2			

Table 2. Top 5 Holding Green Ranking – Trillium Fossil Fuel Free Core

Company Name	Ranking	Industry	Pros	Cons
Apple	1	Electronics	- Sources 100% of electricity for data centers renewably - Made largest power purchase in solar industry Feb 2015	- Bad history of aversion to sustainable electricity sourcing - Possibly planned obsolescence
Gilead	0	Biopharmaceuticals	- Obvious social/health benefit	- No sustainability information available on website
Cisco	1	Information Technology	- Installed and commissioned solar energy systems at 3 locations	- Does not directly produce product/service related to clean energy
Novartis	0	Pharmaceuticals	- 92% of onsite energy from natural gas (controversial)	- Does not directly produce product/service related to clean energy
Baxter International	0	Health Care	- Clear social/health benefit	- Does not directly produce product/service related to clean energy
Sustainable Opportunities	2			

Table 3. Top 5 Holding Green Ranking – Trillium Sustainable Opportunities

Company Name	Ranking	Industry	Pros	Cons
Rockwood	9	Chemical	**Recently merged with Albemarle, do not know if ALTEX will continue to hold the stock	
First Solar	2	Renewable Energy		
SunEdison	2	Renewable Energy		
Solar City	2	Renewable Energy		
Sun Power	2	Renewable Energy		
ALTEX	8			

Table 4. Top 5 Holding Green Ranking – Firsthand Alternative Energy

Company Name	Ranking	Industry	Pros	Cons
Brookfield	2	Finance	- Invests in renewable energy projects	
Hannon Armstrong	2	Finance	- Invests in sustainable infrastructure	
TerraForm	2	Renewable Energy		
Nextera Energy	2	Renewable Energy		
Owens Corning	0	Manufacturing		- Past negative environmental impacts - Does not directly produce product/service related to clean energy
NALFX	8			

Table 5. Top 5 Holding Green Ranking – New Alternatives Fund

Company Name	Ranking	Industry	Pros	Cons
First Solar	2	Renewable Energy		
Sierra Wireless	0	Telecommunications		- No sustainability information available on website
United Natural Foods	0	Food + Beverage	- Supports organic food production which is more sustainable than traditional	- Does not directly produce product/service related to clean energy
Google	1	Internet	- Has spent \$1.5 billion on clean energy projects	- Does not directly produce product/service related to clean energy
Qualcomm	1	Technology	- Developed a wireless electric car charging technology	- Most other products are not related to clean energy
NEXTX	4			

Table 6. Top 5 Holding Green Ranking – Shelton Green Alpha Fund

Company Name	Ranking	Industry	Pros	Cons
Johnson Controls	1	Technology	- Produces hybrid and electric batteries - Developed energy efficient AC system in Hong Kong	- Produces conventional battery technology as well
Capital Stage	2	Finance	- Invests in solar and wind projects	
Eaton	1	Power Management	- Provides services to renewable energy providers	- Provides services to fossil fuel industry as well
Quanta Services	1	Construction	- Provides services for natural gas companies (controversial)	- Provides services for fossil fuel industry
Cosan	1	Utilities	- Produces ethanol, energy cogeneration, and natural gas	- Produces lubricants - Supports monoculture cash crops
CGAEX	6			

Table 7. Top 5 Holding Green Ranking – Calvert Global Energy Solutions

Company Name	Ranking	Industry	Pros	Cons
Honeywell International	1	Technology	- Website claims that 50% of products are linked to energy efficiency - Produces natural gas and biofuel technologies, smart grid solutions	- Creates products for oil and gas industry
Praxair	0	Chemical		- Deeply involved with oil and gas industry
Deere	0	Manufacturing	- Provides some hybrid machines	- Seems goal is to not harm environment but does directly produce product/service related to clean energy - Produces machines that are environmentally detrimental ex. Pesticide sprayer
Cummins	1	Industrials	- Produces power from waste and combined heat and power	- Produces diesel engines
Delphi	1	Automotive	- Produces fuel cells, hybrid + electric vehicle products	- Produces auto parts for fossil fuel powered cars
FSLEX	3			

Table 8. Top 5 Holding Green Ranking – Fidelity Select Environment and Alternative Energy

Company Name	Ranking	Industry	Pros	Cons
Apple	1	Electronics	- Sources 100% of electricity for data centers renewably - Made largest power purchase in solar industry Feb 2015	- Bad history of aversion to sustainable electricity sourcing Possibly planned obsolescence
Facebook	0	Social Media		- Does not directly produce product/service related to clean energy
Nike	0	Sportswear	- Developed Nike Materials Sustainability Index that evaluates the sustainability of materials	- Does not directly produce product/service related to clean energy
Starbucks	0	Food + Beverage	- Want to purchase 100% green electricity through RECs	- Does not directly produce product/service related to clean energy
Home Depot	0	Home Improvement	- Wood certification from non-profit	- Does not directly produce product/service related to clean energy
SPEGX	1			

Table 9. Top 5 Holding Green Ranking – Alger Green

Company Name	Ranking	Industry	Pros	Cons
Ecolab	1	Chemical	- Produces water treatment technologies	- Produces products for oil and gas industry
Danaher	1	Industrials	- Produces water treatment technologies and fuel disposal management	- First CSR report from 2014-2015
Stericycle	1	Waste Management	- Protects resources from hazardous waste by disposing of them in a safe way - Triple Bottom Line - Uses hybrid vehicles in their operations	- Does not directly produce product/service related to clean energy
Verisk	0	Risk Analytics		- Does not directly produce product/service related to clean energy
Nike	0	Sportswear	- Developed Nike Materials Sustainability Index that evaluates the sustainability of materials	- Does not directly produce product/service related to clean energy
BIAWX	3			

Table 10. Top 5 Holding Green Ranking – Brown Advisory Sustainable Growth

Company Name	Ranking	Industry	Pros	Cons
Energizer	0	Consumer Goods	- Developed the first recycled AA batteries	- Does not directly produce product/service related to clean energy
ConAgra	0	Food + Beverage		- Does not directly produce product/service related to clean energy
Xylem	1	Water Treatment	- Produces water treatment technologies - Produces several renewable energy powered water pumps	- Does not directly produce product/service related to clean energy
Nestle	0	Food + Beverage		- Does not directly produce product/service related to clean energy
Johnson Controls	1	Technology	- Produces hybrid and electric batteries - Developed energy efficient AC system in Hong Kong	- Produces conventional battery technology as well
SRIGX	2			

Table 11. Top 5 Holding Green Ranking – Gabelli SRI Fund AAA

Company Name	Ranking	Industry	Pros	Cons
Google	1	Internet	- Has spent \$1.5 billion on clean energy projects	- Does not directly produce product/service related to clean energy
Novo Nordisk	0	Health Care	- Triple Bottom Line	- Does not directly produce product/service related to clean energy
Roche	0	Health Care		- Does not directly produce product/service related to clean energy
MetLife	0	Insurance		- Does not directly produce product/service related to clean energy
TJX Companies	0	Clothing + Home Goods		- Does not directly produce product/service related to clean energy
PORTX	0			

Table 12. Top 5 Holding Green Ranking – Portfolio 21

Company Name	Ranking	Industry	Pros	Cons
Theolia	2	Renewable Energy		
Iniziative Bresciane	2	Renewable Energy		
Northern Power	2	Renewable Energy		
Good Energy Group	2	Renewable Energy Utility		
Myrtah	2	Renewable Energy		
GAAEX	10			

Table 13. Top 5 Holding Green Ranking – Guinness Atkins Renewable Energy

Appendix C –Fund Performance Tables

Name	Year of Inception	1Y	3Y	5Y	Since inception	Stock Category Performance (5yr)
NEXTX	2013	-5%	-	-	23.5%**	6%(mid growth)
BIAWX	2012	10%	-	-	17.5%**	10%(large growth)
Trillium Sustainable Opportunities	2008	3.5%**	16%**	12%**	10%**	-
Trillium Fossil Fuel Free Core	2007	13%	21%**	14%**	8%**	-
SRIGX	2007	7%	12.5%	10%	6.5%**	10% (large blend world stock)
PORTX	1999	1%	11%	8%	5.5%**	10% (large growth world stock)
PGRNX	2008	-3%	12.5%	9.5%	4.5%**	9.5% (mid growth world stock)
FSLEX	1989	-1%	15%	9.5%	4%**	15.5% (large blend industrial)
SPEGX	2000	6%	15%	11%	2%**	14.5% (large growth)
ALTEX	2007	-10%	15.5%	-2%	-6%**	14.5% (mid blend technology)
CGAEX	2007	-11	7.5%	-4%	-10%**	1% (mid blend equity energy)
GAAEX	2006	-23%	4.5%	-9%	-12.5%**	1% (small blend equity energy)
NALFX	1982	4.5%	16%	7%	-	10% (mid growth world stock)
Average (unweighted)		-0.5%	13%	6%	4.5%	6%

Note: All performance data taken from Morningstar on March 9, 2015. Some data are average annual return and others are annualized, but the differences do not influence the results.

**Information taken from fund website or factsheet because Morningstar data unavailable

Table 1. Clean Energy Mutual Fund Performance

Fund Name	Year Opened	Year Closed	1Y	3Y	5Y	Stock Category
SMAM Mirai Sosei Technology	2010	2014	5.0%	2.4%	9.3%	Global Technology Equity
Federal Planete Bleue	2008	2013	24.4%	-1.0%	4.3%	European Equity
DWS Global Clean Tech	2007	2013	24.6%	-8.3%	2.5%	Foreign Growth Equity
COMINVEST Green Energy Protect 4/2013	2007	2013	4.9%	3.2%	2.1%	Mixed Allocation European
COMINVEST Green Energy Protect 3/2013	2007	2013	4.2%	2.7%	1.8%	Mixed Allocation European
Craton Capital Renewable	2009	2014	7.3%	-3.5%	1.6%	Global Equity
RMJ AQQUA	2009	2013	0.3%	-1.0%	0.8%	Global Mixed Allocation
Diapson Global Biofuel	2006	2011	13.2%	-4.0%	-0.5%	Global Energy Commodity
Impax Asian Environmental	2009	2013	8.4%	-14.4%	-2.1%	Asian Equity
ARKX Clean Energy Fund	2007	2012	-32.4%	-3.9%	-12.5%	Global Equity
GAIA Fund Clean Energy	2007	2013	-61.7%	-20.1%	-15.1%	Global Equity
LO Funds Clean Tech Fund	2007	2012	-56.8%	-16.8%	-15.1%	Global Equity
LODH PRM Clean Energy	2007	2012	-76.2%	-34.9%	-27.8%	International Equity
Gam Star GEO	2010	2013	-30.4%	-3.9%	-	Global Equity Energy
EIC Solar	2008	2010	30.0%	-3.9%	-	International Energy Equity
Leuthold Global Clean Technology	2009	2012	12.4%	-6.0%	-	Global Equity
LG Asian Green Fund	2008	2011	-37.2%	-10.7%	-	Asian Equity
Hornet Renewable Energy Fund	2006	2009	14.0%	-18.2%	-	International Equity
DWS Global Climate Change Fund	2007	2009	-0.4%	-32.9%	-	Global Equity
Hornet Renewable Energy Fund 2	2007	2010	-55.4%	-34.5%	-	International Energy Equity
BNP Parisbas	2008	2009	0.6%	-	-	Global Mixed Allocation
DWS Asian Solar Plus	2008	2009	-72.9%	-	-	Asian Energy Equity
Average			-12.5%	-10.5%	-3.9%	

*All data taken from Bloomberg Systems

Table 2. Annualized Performance Liquidated Clean Energy Funds

Fund Category Name	1Y	3Y	5Y
Health	31.24	30.57	21.81
Consumer Cyclical	11.62	16.59	16.96
Industrials	8.23	17.85	14.91
Small Growth	5.98	14.61	14.72
Real Estate	23.28	13.59	14.72
Mid-Cap Growth	9.82	14.59	14.25
Consumer Defense	13.61	14.54	14.03
Large Growth	12.60	15.23	13.91
Mid-Cap Value	8.78	16.05	13.63
Mid Cap Blend	8.40	15.43	13.63
Technology	10.57	13.88	13.54
Small Blend	4.75	14.48	13.48
Large Blend	10.51	14.98	12.98
Small Value	3.05	13.91	12.35
Large Value	8.35	14.54	12.28
Utilities	7.55	12.49	12.04
Communications	5.42	11.57	11.12
Global Real Estate	15.78	11.83	10.63
Foreign Small/Mid Growth	0.43	11.22	10.46
World Stock	5.64	11.20	9.74
Foreign Small/Mid blend	-0.40	10.88	9.66
Japan Stock	17.30	10.86	8.69
Financial	3.23	13.81	8.63
Europe Stock	-2.00	10.36	8.08
Foreign Small/Mid Value	-1.56	9.76	7.47
Energy Limited Partnership	3.20	9.33	-
Foreign large growth	4.00	8.74	7.26
Diversified Pacific	13.42	9.84	6.87
India equity	43.46	16.00	6.49
Foreign Large Blend	2.70	8.49	6.39
Pacific/Asia ex Japan	10.13	7.23	6.02
Foreign Large Value	0.35	7.98	5.71
China Region	11.21	7.83	4.67
Miscellaneous Region	-4.15	3.47	2.47
Diversified Emerging Markets	1.34	0.57	1.80
Energy Equity	-19.05	-1.66	1.68
Natural Resources	-14.30	-2.86	1.34
Latin America Stock	-15.67	-11.52	-5.94
Equity Precious Metals	-21.06	-24.35	-12.95
Average	6.10	10.10	9.09

*All data taken from Morningstar on 3/25/2015.

Table 3. Average Annual Performance (%) Fund Category Morningstar

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