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Fossil Fuel Asset Risk Analysis: Clark University Endowment

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Introduction

The environmental and social risks of climate change are well known and perhaps inevitable. The economic and financial risks are less so. Estimates of the annual costs of climate change have been projected from 1-5% of global GDP[1]; in 2013 US dollars, 1% of world GDP equates to $7.5B[2]. Such economic impacts pose serious risks to global markets, threatening corporate profitability, government budgets, and equity markets in both the short and long-term[3]. The many financial risks associated with climate change embedded in endowment portfolio fossil fuel holdings are leading many[4] institutional stakeholders to enter into dialogue and take action. Divestment is emerging as an effective strategy for limiting portfolio exposure and tackling climate change itself.

Approaches & Results

Our team's goals were to assess whether the Clark endowment portfolio faces any of these risks and evaluate the impacts on asset values. Our findings show that the Clark endowment does face these same climate change related portfolio risks where fossil fuel assets are concerned, that those assets represent approximately $37.2M or 12.11% of the endowment, and that continued investment fails to prevent greater harm or risk to Clark. Our analysis and subsequent recommendations will explain the financial risks Clark fossil fuel assets face as well as options to reduce exposure, ensuring the future of the endowment and the University.

The research was done in two phases. Phase One focused on understanding Clark's institutional mission and values, history of shareholder responsibility, and estimating Clark's fossil fuel holdings. This was accomplished through interviews with key Clark administrators and staff, literature review, and analysis of the Clark endowment portfolio for second quarter, 2014. Notable experiences of Phase One include the open engagement and collaboration with staff, and the fiduciary transparency shown by the Clark administration. Phase Two focused on evaluating short and long term risks that Clark fossil fuel assets face, research into actions being taken by institutions with similar exposure, and policy options for trustees. Phase Two included further engagement with key administrators, market research, and analysis of the Clark endowment for fourth quarter, 2014.

Clark Endowment- Fossil Fuel Exposure

One of the principal objectives of the research was to identify the share of Clark's fossil fuel holdings in the investment portfolio. The research team was able to trace 76.3% of the total portfolio to estimate the share of the investment in the fossil fuels. Of the traced portfolio, $37.2M or 12.11% is currently invested in fossil fuel assets[5]. These investments are predominantly concentrated in oil and gas companies, refinery businesses, drilling equipment and gas exploration.

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[1] Projections by Nordhaus et al estimate costs at 2% GDP, Tol projects 2% global GDP, standard deviation of 1%, per 1 degree increase above pre-industrial levels, while Stern projects 5% per annum. The key difference comes from the modeled discount rate chosen by each researcher. Tol 2002, Stern 2006, Nordhaus 2007

[2] World Development indicators database, World Bank, December 2014

[3] Private Equity International, "Clean Energy Investing", June 2012

[4] For a list of institutions committed to fossil fuel divestment see appendix 6.

[5] Sector holdings derived from publicly available data at NASDAQ (http://www.nasdaq.com/), Bloomberg Business Group (http://www.bloomberg.com/)

The Convexity Capital Offshore and RS Global Natural Resources are the funds in Clark's portfolio which have the biggest concentration of our fossil fuel investments at 85% and 50% respectively. Interestingly, these inflation hedging accounts incurred significant losses in the fourth quarter December, 2014, by -11.9% and -20.9%, mainly due to the declining oil prices in the market[6]. The summary of the findings are presented in the below table. For detailed analysis and graphs, refer to Appendix 1.

Figure 1: Clark Fossil Fuel Investment Summary

Type of Fund	Fund Name	% of Total Portfolio	Total Investment	Investment in Fossil Fuel	% of Fossil Fuels	Dec. Quarter Return
Domestic Equity	Large Cap Stocks- Adage Capital* 1	9.6%	$ 38,718,678.00	$ 6,582,175.26	17.00%	3.9%
Domestic Equity	Westfield Capital Mgmt, Small/Mid Cap	8.6%	$ 34,765,408.00	$ 1,992,057.88	5.73%	4.0%
Domestic Equity	Berkshire Hathaway Inc A Stock	4.7%	$ 18,990,050.00	$ 827,966.18	4.36%	9.2%
International Equity	Polaris Capital International Value, L.P.	4.6%	$ 18,589,297.00	$ 1,394,197.28	7.50%	-1.4%
International Equity	Wellington Emerging Markets	3.7%	$ 15,044,042.00	$ 1,513,430.63	10.06%	-3.7%
International Equity	City of London Global Emerging Markets	4.2%	$ 17,053,992.00	$ 1,705,399.20	10.00%	-3.9%
Private Equity	Private Equity and Venture Capital	6.2%	$ 25,014,675.00	$ 2,101,232.70	8.40%	-0.1%
Flexible Capital	Farallon Capital Offshore Investors	5.9%	$ 24,056,462.00	$ 45,707.28	0.19%	-1.4%
Flexible Capital	Baupost Value Partners	10.1%	$ 40,859,988.00	$ 3,187,079.06	7.80%	-0.7%
Inflation Hedging	Convexity Capital Offshore J, L.P. *2	1.5%	$ 4,891,019.00	$ 4,157,366.15	85.00%	-11.9%
Inflation Hedging	RS Global Natural Resources Fund Class Y *3	1.9%	$ 7,492,424.00	$ 3,746,212.00	50.00%	-20.9%
Inflation Hedging	Private Real Assets	8.7%	$ 35,239,870.00	$ 3,574,424.00	10.14%	-0.1%
Fixed Income	Oaktree High Yield Accont *4	5.0%	$ 20,354,633.00	$ 6,106,389.90	30.00%	-1.4%
Flexible Capital	Davidson Kempner Institutional Partners, LP *5	1.6%	$ 6,627,970.00	$ 331,398.50	5.00%	-1.4%
	Grand Total	**76.3%**	**$ 307,698,508.00**	**$ 37,265,036.01**	**12.11%**	**-2.10%**

Risks faced by Clark's Fossil Fuel Holdings

Low-Carbon Governance

Emergent government restrictions on carbon emissions, domestically and globally, may render carbon based energy production cost-ineffective, leaving related assets stranded on company balance sheets. Governments own 50-70% of worldwide coal, oil, and gas resources, collecting royalties and taxes on the rest[7]. Thus it is governments, their citizens, and taxpayers that will bear close to 80% of the $25 trillion difference in value at risk. Realization of this burden has catalyzed government action in recent years.

Domestic Policies

The Presidential Climate Action Plan includes measures to increase building energy efficiency 20% by 2020, develop fuel economy standards for heavy-duty vehicles, permit 10 gigawatts of wind and solar projects on public lands by 2020, and establish carbon pollution standards for new and existing power plants[8]. More recently the President revised the US target to cut emissions by 26-28% by 2025. If successful, each measure will result in reduced demand for fossil fuel energy in US markets.

In June 2014 the EPA released its proposal to regulate CO_2 emissions from existing power plants, the 111-d rule, with the goal of reducing power plant CO_2 emissions 25 % by 2020[9]. The costs of meeting the

[6] Clark University Endowment Portfolio Quarter 2 & 4, December 2014
[7] Climate Policy Initiative, "Moving to a Low-Carbon Economy: The Impact of Policy Pathways on Fossil Fuel Asset Values," 2014
[8] Presidential Climate Action Plan (https://www.whitehouse.gov/climate-change)
[9] Environmental Protection Agency (http://www.epa.gov/)

standards are widely debated, from $5.8 B/yr to $58 B/yr[10], with many analysts concluding that coal-fired generation will be uneconomical without carbon capture and storage, a technology that has not yet been successfully demonstrated. Subsequent cost increase estimates, ranging from 4.1% to 84%, suggest 46-70 gigawatts of coal plant retirements by 2030, representing 4.7-7% total US electricity production. The wide variety of renewable energy and efficiency measures offer alternatives in a rising fossil fuel cost environment caused by increased regulation.

European Union

The EU has made the largest commitments to a low-carbon economy, targeting a 40% reduction in carbon emissions by 2030. This will be accomplished by increasing renewable electricity to 27% of total generation, increasing energy efficiency by at least 27%, tightening the EU Emission Trading System's cap 1.4% annually through 2020, then by 2.2% from 2021 onwards. The ambitious targets are legally binding for union members[11].

China

China uses 48.3% of the world's supply of coal, and 10.7% of the supply of oil. Smog and other environmental externalities in urban centers are accelerating the central government's drive to switch energy sources, as demonstrated by the recent announcement that China will increase total installed solar capacity 60% by the end of 2015. In November 2014, a US-China joint announcement marked the first major commitment by the nation to curb its emissions[12]. The country will target peak CO_2 emissions by 2030, and increase the non-fossil fuel share of its energy generation to 20% by 2030. These commitments signal the impending decline in demand for fossil fuel industry's largest customer.

United Nations

In December, France will host the 2015 UN Conference of the Parties (COP), where the aim is the adoption of an international climate change agreement that will set the transition towards low-carbon economies for its members. The annual COP has become the largest international negotiation platform in human history, with all 193 member states participating in the negotiations annually. Forty-two developed countries have communicated targets under the convention after the 2014 COP in Copenhagen[13]. The goal of the UN Framework Convention on Climate Change (UNFCCC) is to have legally binding emission reduction targets for all of its members. The UN's Intergovernmental Panel on Climate Change (IPCC) comprises the world's foremost experts and scientists spanning all disciplines. Various IPCC working groups have concluded that a 2 °C temperature increase limit be met to avoid catastrophic consequences, and that binding CO_2 emission targets be set to avoid the limit. An international climate deal would mean that fossil fuel markets would be limited world-wide, seriously devaluing projected capitalization of reserves.

Demand Risks by Commodity

The shift to a low-carbon economy is likely to be disruptive for market valuations. Traditionally long-term carbon emission targets have not been considered when evaluating assets, creating an over-investment in fossil fuels. Financial institutions such as HSBC have begun analyzing the effects the shift

[10] American Coalition for Clean Coal Electricity, "Survey of Clean Power Plan Impact Studies," Feb 2015
[11] European Union, 2030 framework for climate and energy policies, (http://ec.europa.eu/clima/policies/2030/index_en.htm)
[12] White House Press Release, Nov 11, 2014 (http://wh.gov/ixRtO)
[13] United Nations Framework Convention on Climate Change, 2015 (http://unfccc.int/2860.php)

to a low-carbon economy will have, estimating that 40 to 60 % of coal, oil, and gas valuations are at risk[14].

Thermal Coal

Key findings show that future demand and price levels for thermal coal may fall short of industry expectations[15]. Coal accounts for approximately 80% of the emission reduction target in the International Energy Agency's (IEA) low-carbon scenario[16]. Coal industry's asset valuations are compromised by greater energy efficiency, cheaper alternatives, and emerging pollution regulation domestically and internationally. With demand falling in OECD[17] member countries and peak demand in China imminent, oversupply of the market will further weaken asset values. High production costs related to exploration and extraction deem additional capital expenditures risky, especially for unexploited reserves.

The downward trend of coal is already evident in the Bloomberg Global Coal Equity Index which has lost half of its value over the last three years despite a 30% increase in broad market indices such as MSCI[18]. Retail coal prices, returns, and share prices are each down, signifying a structural decline in the thermal coal market. Zack's Industry Ranking put the coal industry at 232 out of 259 in its industry classification on July 2013[19], far below the acceptable ranking of 169, denoting a significant negative outlook for investors.

The discouraging economics of coal have led investors to diversify geographically into emerging "seaborne" markets, however in a low-demand scenario these chronically oversupplied markets chase a demand that is likely to remain stagnant well below industry expectations. This is an important implication for international equities, such as those in Clark's portfolio, which will likely increase exposure as investment shifts away from domestic equity.

Crude Oil

In the IEA's low-carbon scenario, oil accounts for close to 75% of the fossil fuel asset value at risk in the low-carbon transition. This is largely due to crude oil's increasingly high marginal production costs and high profit margins. Demand for oil is affected by a range of factors which includes supply costs, technological advances, air quality standards and carbon regulation. An estimated $1.1 trillion has been earmarked by companies large and small for high cost oil projects, requiring a market price of over $95 a barrel through 2025[20]. Exposure to unconventional sources such as deepwater, Arctic, shale oil, and oil sands faces immediate risks. The recent drop in oil prices, to as low as $47 a barrel,[21] is causing these high cost ventures to operate at a significant loss. The current approach of most major companies is to replace reserves at any cost, leaving them exposed to price shifts for the sake of volume and not value. In the face of such price volatility and decreasing demand, the ability of large companies to maintain both capital expenditure and dividends is being questioned, signaling reduced profitability for investors.

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[14] International Institute for Sustainable Development (IISD), "Integrating Environmental Risks into Asset Valuations: The potential for stranded assets and the implications for long-term investors,"
[15] Carbon Tracker Initiative (CTI), "Carbon supply cost curves: Evaluating financial risk to coal capital expenditures," September 2014
[16] U.S. Energy Information Administration (EIA), "EIA Annual Energy Outlook 2014 with projections to 2040," April 2014
[17] Organisation for Economic Co-operation and Development
[18] MSCI World is a stock market index of 1612 "world stocks." It is maintained by MSCI Inc., formally Morgan Stanley Capital International, and is used as a common benchmark for world or global stock funds.
[19] Zack's Research Industry Rank (http://www.zacks.com/stocks/industry-rank)
[20] CTI, "Carbon supply cost curves: Evaluating financial risk to oil capital expenditures," May 2014
[21] Bloomberg WTI & Brent price projections, see Appendix 2

Natural Gas

The application of hydraulic fracturing techniques to natural gas extraction and the subsequent increase in supply, has driven the recent shift in US electrical generating capacity since 2010[22]. The "fracking" revolution has brought a period of inexpensive natural gas domestically, however gas export terminals will soon come on line in 2015 and 2016, fueling international demand and driving prices back up. Natural gas investors look forward to the imminent entrance into international markets, but this supply source is a product of techniques with a questionable future. The injection of proppants and other toxic chemicals into the shale along with millions of gallons of water may have unintended environmental consequences[23]. Methane emitted into the atmosphere is another side effect of natural gas extraction that is gaining attention due to methane's potency as a greenhouse gas.

Advances in Renewable Energy

Advances in alternative energy reduce demand for coal, oil, and gas. Such shifts in demand will devalue fossil fuel assets, damaging asset holders. Resource-based fuels such as coal and oil inevitably face rising supply costs, whereas innovation-based fuels such as renewables will soon meet price parity with the incumbent regime and fall beyond[24]. There are signs that this is already happening. Biomass, hydropower, geothermal, and onshore wind are already competitive with or cheaper than coal, oil and gas-fired power plants, even without financial support and despite falling oil prices. Solar photovoltaics are leading the cost decline, with solar PV module costs falling 75% since the end of 2009 and the cost of electricity from utility scale projects falling 50% since 2010. (See Appendix 4)

In 2015 alone, electric generating companies intend to add more than 20 gigawatts (GW) of utility-scale generating capacity to the power grid, 76% of which is non-fossil fuel based. This is to offset the 14GW of generating capacity that is expected to retire in 2015, 81% of which is coal-fired generation[25]. These values reflect reported additions and retirements, not projections. The large number of coal-fired plant retirements are primarily due to the implementation of the EPA's Mercury and Air Toxics Standards regulations this year.

Penetration of no-carbon generation has increased by 12% in recent years in Europe, as European Union countries work toward renewable energy and greenhouse gas emission targets[26]. France, Iceland, Norway, Sweden, and Switzerland each generated more than 90% of their net electricity from no carbon sources in 2012, and eight other countries had no-carbon electricity accounting for at least 50% of their generation.

Fossil Fuel Price Volatility

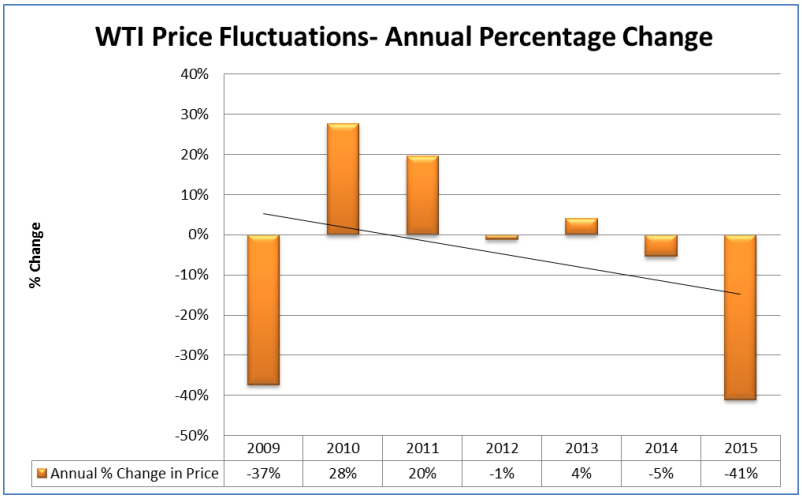
According to the historical oil price data generated from the Bloomberg terminal, oil prices have been subject to substantial fluctuations during the years 2008-2015. For instance, during year 2009, oil prices dropped by an average of 37%. The year 2015 has also been highly volatile as the market prices for crude oil fell by 41% from the previous year. Oil prices have continued to be highly volatile for at least the last

[22] Jacquelyn Pless, National Conference of State Legislatures, "Natural Gas Development and Hydraulic Fracturing," June 2012
[23] Natural Resource Defense Council, "Unchecked Fracking Threatens health, Water Supplies," 2014
[24] International Renewable Energy Agency, "Renewable Power Generation Costs report," January 2015
[25] EIA, "Scheduled electricity generation capacity additions and retirements in 2015," Mar 2015
[26] EIA, "European nations are increasing electricity generation using no-carbon sources," September 2014

four decades[27]. For instance, the global recession in 1974-1975 was triggered by the tripling of the oil prices following the oil embargo. During 1990-1991, US recession was partly caused by the spike in the oil prices after Iraq's invasion of Kuwait. There was also a sharp increase in the oil prices during 2001 following the California energy crisis and the political tensions in the Middle East.

The current West Texas Instrument price index (WTI) is $48.38 with a one year high and low of $98.87-$44.03. According to the Bloomberg forecast, the oil prices will remain within the range $60-$77 for next five years. The following graph highlights the major deviations in the oil prices during 2008-2015. For detailed analysis, including price projects through 2021, please refer to Appendix 2.

Figure 2: Oil Price Fluctuations 2008-2015



Stranded Assets

"Stranded Assets" is a phenomenon that has recently come to the forefront of the climate change discussion. In order to prevent a rise in global temperature of 2°C, certain assets such as coal, oil fields, and shale gas will be unburnable; that is, companies will be unable to capitalize on resource reserves due to emission limits[28]. Current estimated global fossil fuel reserves represent 2,795 gigatons of CO_2 ($GtCO_2$), of that only 884 $GtCO_2$ worth can be burned until 2050[29]. Stranded assets include both resource and physical assets, such as power plants, extraction equipment and other related technologies. Stranding goes beyond an asset simply ceasing to operate; it is also considered a loss of value due to changes in policy, market, technology and social conditions. Asset stranding can also degrade a company's ability to secure financing for new investments. In the face of stranding, companies will seek capital to retool equipment and adapt operations to new regulatory and market demands, however losses in equity will create a negative outlook by the financial system. Clark's fossil fuel holdings are at risk as such changes take place during the shift to a low-carbon economy.

[27] Roubini, Setser, "The effects of the recent oil price shock on the U.S. and global economy," August 2004
[28] Climate Policy Initiative, "Moving to a low-carbon economy: The impact of policy pathways on fossil fuel asset values," October 2014
[29] University of Oxford, "Stranded assets and the fossil fuel divestment campaign: what does divestment mean for the valuation of fossil fuel assets," 2014

Three things must occur for an individual, business, or government to face asset stranding.

> The investor must own or rely on the output of an asset or resource for future profits.
>
> The value of the asset or resource must change, because the price for the output changes or because the output is no longer needed.
>
> The change in value must not be reflected in current asset valuations.

For Clark fossil fuel holdings, the first and third asset characteristics clearly apply. Although UN climate negotiations for a carbon budget are underway, nothing legally binding has been passed, thus stranding risk is not reflected in current valuations. Concerning the second characteristic, it is true that prices for fossil fuel outputs have recently dropped, but it is not the case that the outputs are no longer needed. However, this is changing. As discussed in preceding sections, innovations in renewable energy technologies and energy efficiency measures are being commercialized on a wider scale, reducing the need for fossil fuels and related technologies. In addition, various policies that suppress demand are being implemented at all levels, increasing Clark's stranded asset risk.

Carbon Risk Valuation Tool

The Bloomberg Carbon Risk Valuation Tool (CRVT) is a recently developed financial model that assesses the impact of price fluctuations and stranded asset risk on the share price and earnings of fossil fuel companies. The widely agreed upon 2°C temperature increase limit may turn two-thirds of global fossil fuel reserves into stranded assets, an assumption that is built into the Bloomberg model.

Achieving the 2°C limit would require a reduction of global CO_2 emissions to a cumulative total of 884 $GtCO_2$ until 2050 from a total of 2795 $GtCO_2$ based on the current level of proven fossil fuel reserves[30]. This will cause 1,911 $GtCO_2$ worth of fossil fuel reserves to become unmarketable if we are to meet our carbon budget.

Considering the assumption that earnings will decrease by 80% starting from year 2020 until 2035 due to prompt de-carbonization and that 80% of the fossil fuel reserves will stay in ground as per the Bloomberg standard assumption[31], we have analyzed the share price of the top five US companies in terms of market capitalization with and without the stranded asset effect. The summary of the analysis is presented in the below table. According to the CRVT model and the assumptions mentioned above, the companies' share price will drop by on average by 68%. A detailed analysis is provided in Appendix 3.

Figure 3: Share Price Analysis of Five Major Oil Companies

Price/Company	Exxon Mobil Corp	Chevron Corp	ConocoPhillips	Occidental Petroleum Corp	EOG Resources Inc
Current Share Price	$ 83.76	$ 104.32	$ 62.91	$ 72.89	$ 90.48
Estimated w/out Stranded	$ 58.69	$ 36.48	$ 34.08	$ 37.58	$ 23.59
Change	-30%	-65%	-46%	-48%	-74%
Estimate w/ Stranding	$ 41.07	$ 14.15	$ 19.44	$ 36.67	$ 14.29
Change	-51%	-86%	-69%	-50%	-84%

[30] UNFCCC, concluding agreement, 2009 (www.unfccc.int/meetings/copenhagen_dec_2009/meetings/6295.php)
[31] CTI has concluded that two-thirds of fossil fuel assets will become stranded, however the Bloomberg CRVT model assumes 80% will become stranded. We attribute this difference to variation in the methodology of the two sources.

Clark University holds investments in all five companies through multiple intermediaries. Adage Capital manages 9.6% of the Clark endowment; Adage has $3.6 billion directly invested in ExxonMobil, and $2.3 billion directly invested in Chevron Corp[32]. Clark has invested 4.7% of its endowment in Berkshire Hathaway Inc. A stock, which holds Vanguard Group Inc., Bank of New York Mellon Corp, and State Street Capital in its top 25 holdings. The latter three companies appear as the top 10 institutional holders for all five fossil fuel companies under examination, often appearing in the top 3 positions. Although these are Clark's clearest connections to these companies, they are certainly not the only.

Conclusion

Our findings show that the Clark endowment faces climate change related portfolio risks where fossil fuel assets are concerned, and that continued investment fails to prevent greater harm or risk to Clark. The emerging risks associated with fossil fuel assets jeopardize the financial position of those investors caught unaware. Investors can choose to be beneficiaries of the emerging low-carbon economy but must realize that fossil fuel assets are quickly becoming unacceptably high in risk, with recovery unlikely due to shifting landscapes. Investors will need to take anticipatory action to divert capital from high risk areas before the carbon bubble bursts.

Fiduciaries for endowments of universities, foundations, or other institutions are charged with the 'duty of care'[33]. The American Law Institute's (ALI) 1991 Restatement of Trusts, Third, Section 227 states:

> "This standard requires the exercise of reasonable care, skill and caution, and is applied to investments not in isolation but in the context of the ...portfolio and as a part of an overall investment strategy, which should incorporate risk and return objectives reasonably suitable to the [purposes of the endowment]".

The ALI Introduction states that "The rules ... are intended to reflect the lessons derived from modern experience and research, without either endorsing or excluding any particular theories of economics or investment."

The primary mandate of the Clark University endowment is to ensure institutional longevity through the creation of financial returns, however the extent to which this goal is achieved sustainably is at Trustee discretion. At Clark, Trustees are directed to "assure maximum income while preserving the safety of the endowment; and, assure that investment policies reflect a concern for the mission and principles of the university[34]." Although compliance with the latter directive is notably important, it falls outside the scope of this brief, as do other considerations we uncovered during our research, see Appendix 7. Recommended policies focus on ensuring the long-term safety of the endowment by reducing exposure to increasingly high risk fossil fuel assets.

[32] NASDAQ terminal 2015
[33] Longstreth, "The Financial Case for Divestment of Fossil Fuel Companies by Endowment Fiduciaries," 2014
[34] Clark University Board of Trustees Shareholder Responsibility Committee Guidelines and Procedures for Review of Shareholder Issues, 2005

Recommendations

We recommend that the Clark University Board of Trustees consider adopting a fossil fuel free investment policy on the principal that fossil fuel investments present unacceptably high risk given the shifting economic and political landscape. The implementation of which may take on a two phased approach with six stages:

Phase 1.

Formation of a sub-committee tasked with researching alternative investment strategies for the University endowment and engaging with institutional partners.

Negotiate with direct investment partners through proxy voting and shareholder resolution where reasonable business alternatives exist. Request that fund managers divert capital investments from financial packages diversified with fossil fuels to fossil free products. If institutional partners are unable to offer fossil free portfolios, plan for reinvestment when current investment contracts expire.

Identify low volume commodities in the portfolio, such as coal, and divest immediately.

Phase 2.

Practice impact investing through support of regional clean energy projects, i.e. solar partnerships.

Adoption of negative screening policy when evaluating future investments, foregoing investment in Fossil Free Indexes' top 200 fossil fuel companies. This index's rankings are based on calculated carbon emissions data using reserves reported as of Oct 31, 2014 (see Appendix 5).

Adoption of a positive screening policy with an Environmental Social Governance (ESG) and Socially Responsible Investing (SRI) criteria. Performance of such portfolios have proven to yield similar and better returns than traditional fossil fuel diversified portfolios, see Appendix 8 for a detailed analysis by Edward Snook Jr., dual-degree MBA/MS ES&P candidate, 2016.

Appendix 1

Exhibit 1.1- Summary of Clark's Investment Portfolio

Type of Funds	Market Value	% of Portfolio	10 Yr Return
Total Fund	**$ 404,420,179.0**	**100.0%**	**10.1%**
Domestic Equity	$ 92,474,136.0	22.9%	10.4%
International Equity	$ 84,961,765.0	21.0%	12.0%
Private Equity and Venture Capital	$ 25,014,675.0	6.2%	15.7%
Flexible Capital	$ 126,822,076.0	31.4%	9.3%
Inflation Hedging	$ 48,623,314.0	12.0%	7.2%
Fixed Income	$ 25,616,809.0	6.3%	8.1%
Other- Unmanaged Assets	$ 889,404.0	0.2%	0.0%

Exhibit 1.2- Portfolio Composition by Type of Fund

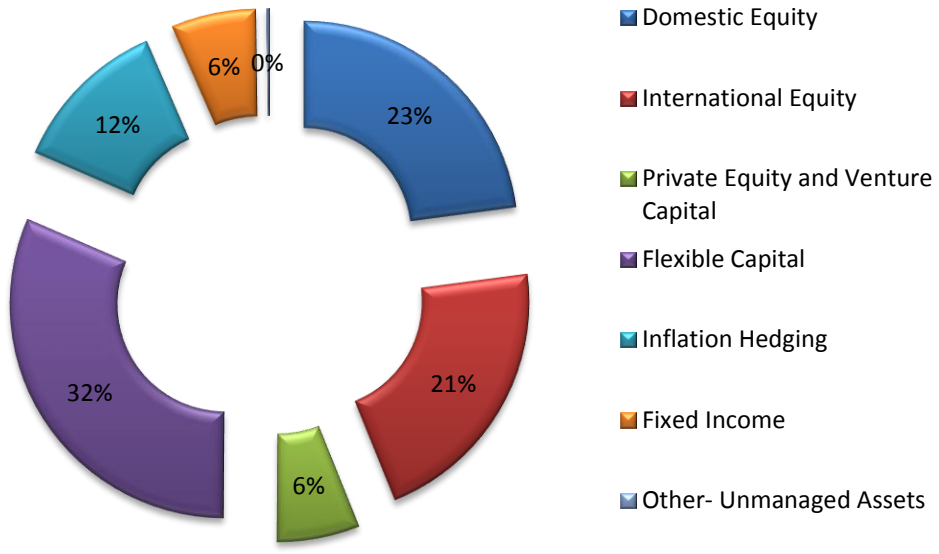


Exhibit 1.3- Endowment Performance (in millions $)

Year	Ending Market Value
1996	$ 75.90
1997	$ 107.60
1998	$ 111.70
1999	$ 149.00
2000	$ 160.20
2001	$ 158.00
2002	$ 152.30
2003	$ 182.60
2004	$ 206.80
2005	$ 215.00
2006	$ 265.20
2007	$ 295.60
2008	$ 223.80
2009	$ 253.80
2010	$ 300.80
2011	$ 293.80
2012	$ 337.80
2013	$ 389.70
2014	$ 403.50

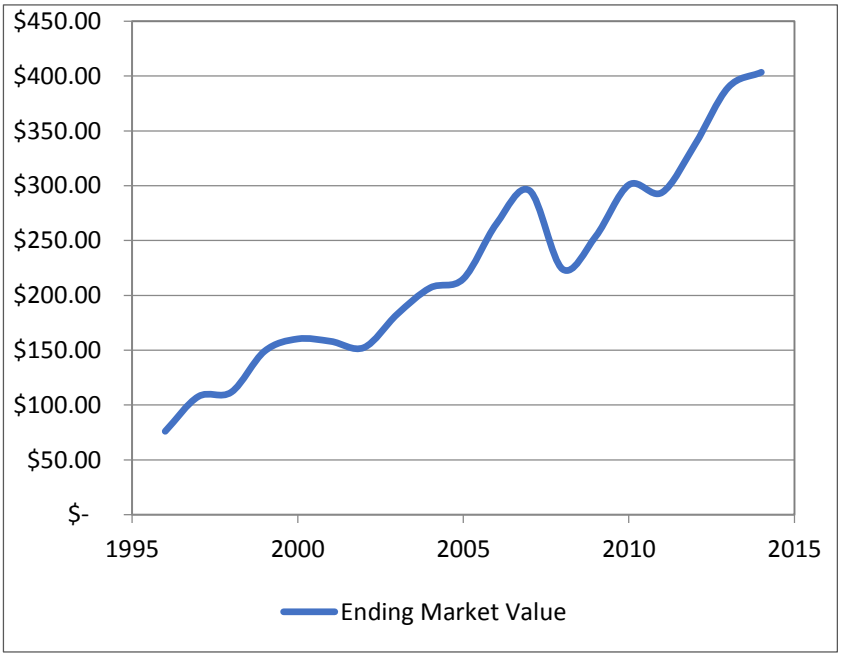


Exhibit 1.4- Segment Level Performance (% rate of return)

Type of Funds	1 Year Return	Index Return	5 Years Return	Index Return	10 Year Return	Index Return
Total Fund	18.2%	15.8%	15.0%	11.7%	10.1%	8.0%
Domestic Equity	25.1%	25.2%	21.5%	19.3%	10.4%	8.2%
International Equity	22.4%	21.8%	15.2%	11.1%	12.0%	7.7%
Private Equity and Venture Capital	25.8%	24.6%	18.4%	18.8%	15.7%	7.8%
Flexible Capital	15.7%	9.0%	13.3%	6.5%	9.3%	7.8%
Inflation Hedging	8.6%	11.2%	7.9%	9.7%	7.2%	8.6%
Fixed Income	8.5%	7.8%	11.0%	9.8%	8.1%	7.1%

Exhibit 1.5- Comparison of 10-Year returns with Index Returns by Type of Funds

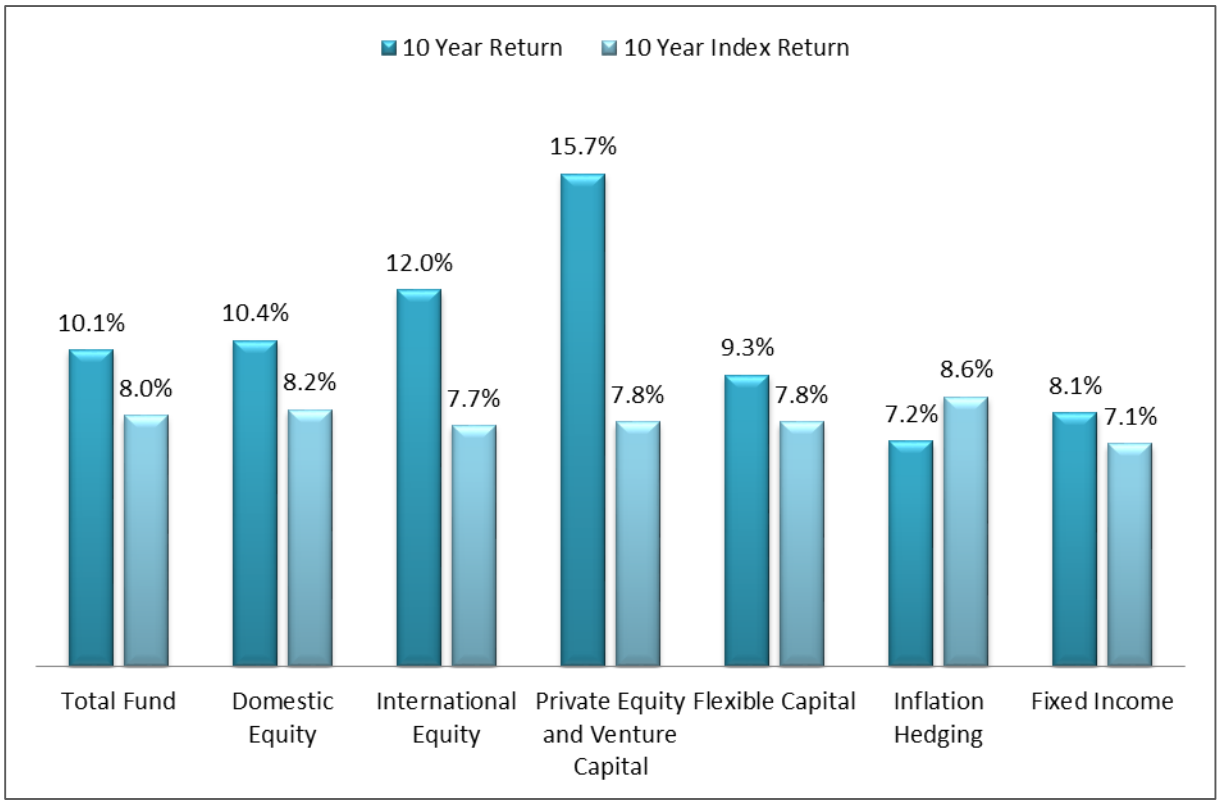
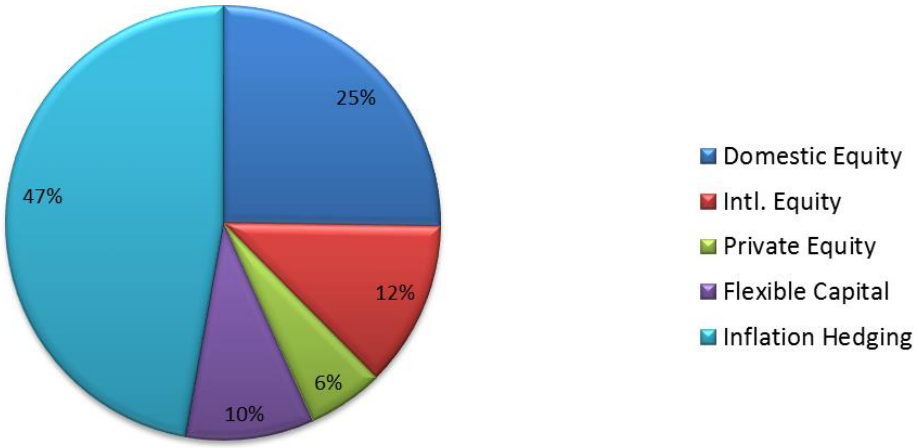


Exhibit 1.6- Estimated Fossil Fuel Holdings of Clark

Type of Fund	Fund Name	% of Total Portfolio	Total Investment	Investment in Fossil Fuel	% of Fossil Fuels	Dec. Quarter Return
Domestic Equity	Large Cap Stocks- Adage Capital* 1	9.6%	$ 38,718,678.00	$ 6,582,175.26	17.00%	3.9%
Domestic Equity	Westfield Capital Mgmt, Small/Mid Cap	8.6%	$ 34,765,408.00	$ 1,992,057.88	5.73%	4.0%
Domestic Equity	Berkshire Hathaway Inc A Stock	4.7%	$ 18,990,050.00	$ 827,966.18	4.36%	9.2%
International Equity	Polaris Capital International Value, L.P.	4.6%	$ 18,589,297.00	$ 1,394,197.28	7.50%	-1.4%
International Equity	Wellington Emerging Markets	3.7%	$ 15,044,042.00	$ 1,513,430.63	10.06%	-3.7%
International Equity	City of London Global Emerging Markets	4.2%	$ 17,053,992.00	$ 1,705,399.20	10.00%	-3.9%
Private Equity	Private Equity and Venture Capital	6.2%	$ 25,014,675.00	$ 2,101,232.70	8.40%	-0.1%
Flexible Capital	Farallon Capital Offshore Investors	5.9%	$ 24,056,462.00	$ 45,707.28	0.19%	-1.4%
Flexible Capital	Baupost Value Partners	10.1%	$ 40,859,988.00	$ 3,187,079.06	7.80%	-0.7%
Inflation Hedging	Convexity Capital Offshore J, L.P. *2	1.5%	$ 4,891,019.00	$ 4,157,366.15	85.00%	-11.9%
Inflation Hedging	RS Global Natural Resources Fund Class Y *3	1.9%	$ 7,492,424.00	$ 3,746,212.00	50.00%	-20.9%
Inflation Hedging	Private Real Assets	8.7%	$ 35,239,870.00	$ 3,574,424.00	10.14%	-0.1%
Fixed Income	Oaktree High Yield Accont *4	5.0%	$ 20,354,633.00	$ 6,106,389.90	30.00%	-1.4%
Flexible Capital	Davidson Kempner Institutional Partners, LP *5	1.6%	$ 6,627,970.00	$ 331,398.50	5.00%	-1.4%
	Grand Total	**76.3%**	**$ 307,698,508.00**	**$ 37,265,036.01**	**12.11%**	**-2.10%**

*1 Dec. Report P. 45
*2 Source: Jim Collins
*3 Source: Jim Collins
*4 Source: Jim Collins
*5 Dec. Report P. 50

Exhibit 1.7- Fossil Fuel Investment by Major Funds



Appendix 2

Exhibit 2.1- Historical Oil Price Analysis

WTI [USD/bbl]

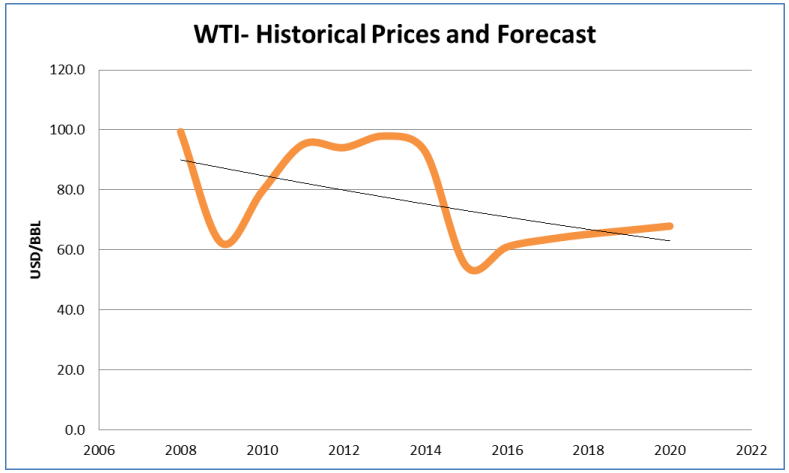
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4	Cal	% Chan
2008	93.1	95.3	105.4	112.5	125.5	134.0	133.5	116.7	103.8	76.7	57.4	42.0	98.5	124.8	116.9	57.5	99.4	0%
2009	41.9	39.3	48.1	49.9	59.2	69.7	64.3	71.1	69.5	75.8	78.1	74.6	43.5	60.4	68.4	76.0	62.3	-37%
2010	78.4	76.5	81.3	84.6	74.1	75.4	76.4	76.7	75.5	82.0	84.3	89.2	78.9	77.8	76.1	85.5	79.6	28%
2011	89.6	89.7	103.0	110.0	101.4	96.3	97.3	86.3	85.6	86.4	97.2	98.6	94.8	102.1	89.4	94.4	95.2	20%
2012	100.3	102.3	106.2	103.3	94.7	82.4	87.9	94.2	94.6	89.6	86.7	88.2	103.2	92.6	92.4	88.2	94.1	-1%
2013	94.8	95.3	93.0	92.1	94.8	95.8	104.7	106.5	106.2	100.6	93.9	97.9	94.3	94.3	105.9	97.5	98.0	4%
2014	94.9	100.7	100.5	102.0	101.8	105.1	102.4	96.1	93.0	84.3	75.8	59.3	98.8	103.2	96.8	72.1	92.7	-5%
2015	47.3	50.7	50.4	52.3	53.6	54.7	55.8	56.6	57.2	57.9	58.4	58.9	49.5	53.6	56.6	58.4	54.6	-41%
2016	59.3	59.7	60.1	60.4	60.7	60.9	61.2	61.4	61.7	61.9	62.1	62.3	59.7	60.7	61.4	62.1	61.0	12%
2017	62.5	62.6	62.9	63.1	63.3	63.4	63.6	63.8	64.0	64.2	64.4	64.5	62.7	63.3	63.8	64.4	63.5	4%
2018	64.6	64.7	64.8	65.0	65.1	65.2	65.3	65.4	65.6	65.7	65.9	65.9	64.7	65.1	65.4	65.9	65.3	3%
2019	66.0	66.1	66.2	66.3	66.4	66.4	66.6	66.7	66.9	67.1	67.2	67.3	66.1	66.4	66.7	67.2	66.6	2%
2020	67.4	67.5	67.6	67.7	67.8	67.9	68.0	68.1	68.2	68.4	68.5	68.5	67.5	67.8	68.1	68.5	68.0	2%
2021	68.6																	
Average	73.5	74.6	77.6	79.2	79.1	79.8	80.5	79.2	77.8	75.4	73.8	72.1	75.5	79.4	79.1	73.7	76.9	-1%

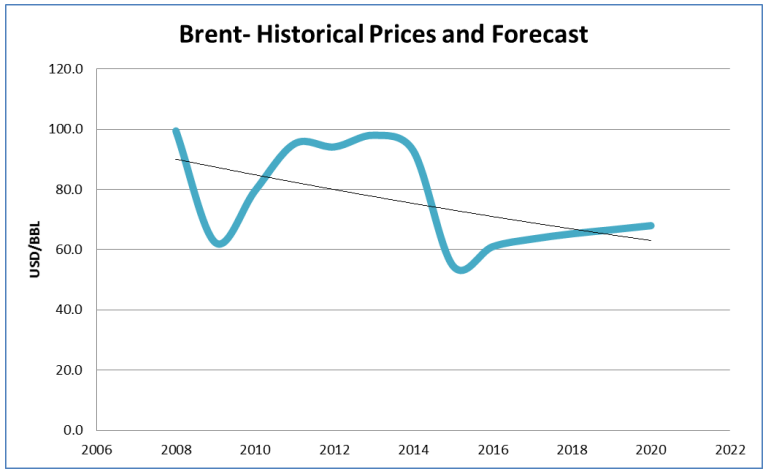
Brent [USD/bbl]

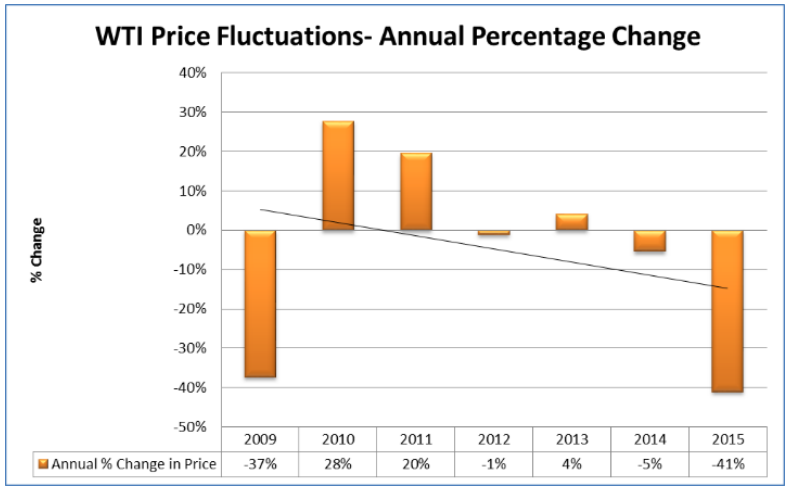
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4	Cal	% Chan
2008	92.0	94.7	102.9	110.4	124.7	133.7	134.6	115.2	100.8	73.7	54.7	43.1	97.0	123.8	115.6	56.1	98.1	0%
2009	45.7	43.9	47.4	51.4	58.6	69.3	65.8	73.1	68.1	73.9	77.6	75.2	45.8	60.5	68.9	75.5	62.9	-36%
2010	77.0	74.8	79.9	85.8	77.0	75.7	75.4	77.1	78.4	83.5	86.2	92.3	77.5	79.2	77.1	87.7	80.3	28%
2011	96.9	104.0	114.7	123.1	114.5	113.9	116.8	109.9	109.9	108.8	110.5	107.7	105.9	116.9	112.0	108.9	110.9	38%
2012	111.5	119.1	124.5	120.5	110.3	95.9	102.7	112.7	113.0	111.5	109.5	109.2	118.8	107.9	109.8	110.0	111.6	1%
2013	112.3	116.1	109.5	103.4	103.3	103.3	107.4	110.4	111.3	109.4	107.9	110.7	112.4	103.3	109.8	109.5	108.8	-3%
2014	107.1	108.8	107.7	108.1	109.2	112.0	108.2	103.4	98.6	88.0	79.6	63.3	107.9	109.9	103.0	75.9	99.2	-9%
2015	49.8	58.8	60.1	60.3	61.1	61.9	62.7	63.4	64.0	64.6	65.0	65.4	56.5	61.2	63.4	65.1	61.6	-38%
2016	65.9	66.5	66.8	67.1	67.5	67.9	68.2	68.5	68.7	69.0	69.2	69.5	66.4	67.5	68.5	69.2	67.9	10%
2017	69.7	70.0	70.2	70.3	70.5	70.7	70.8	71.0	71.1	71.3	71.5	71.6	70.0	70.5	71.0	71.5	70.7	4%
2018	71.8	72.0	72.1	72.3	72.4	72.6	72.7	72.8	73.0	73.1	73.3	73.5	72.0	72.4	72.9	73.3	72.6	3%
2019	73.7	73.9	74.1	74.3	74.4	74.5	74.6	74.6	74.7	74.8	75.0	75.1	73.9	74.4	74.6	75.0	74.5	3%
2020	75.3	75.4	75.6	75.7	75.9	76.0	76.2	76.3	76.5	76.6	76.8	76.9	75.4	75.9	76.3	76.8	76.1	2%
2021	77.0																	
Average	80.4	82.9	85.0	86.4	86.1	86.7	87.4	86.8	85.2	82.9	81.3	79.5	83.0	86.4	86.4	81.1	84.3	0%

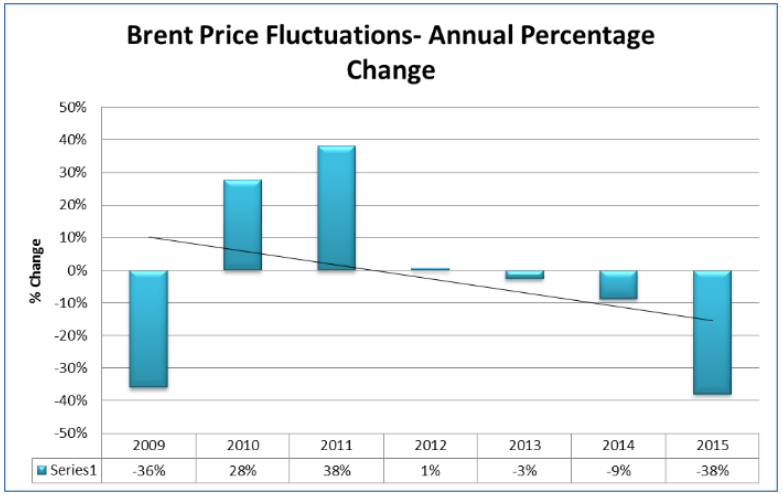
Source: Bloomberg

Exhibit 2.2- WTI and Brent Crude Oil Prices (2008-2020)







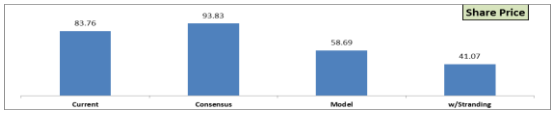


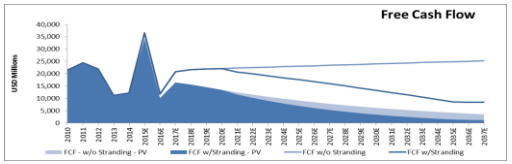
Appendix 3

Exhibit 3.1- Carbon Risk Valuation Tool Analysis- Risk Assessment of Top 5 Fossil Fuel Companies

Exxon Mobil Corp

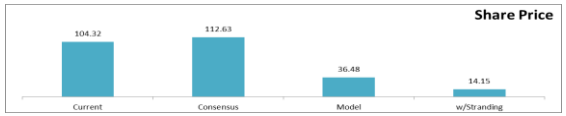
	Current	Consensus	Model	w/Stranding
Share Price	$ 83.76	$ 93.83	$ 58.69	$ 41.07
Price change		12%	-30%	-51%
EV/EBIT	17.09	17.09	8.84	6.48
P/E	15.23	15.23	10.68	7.47

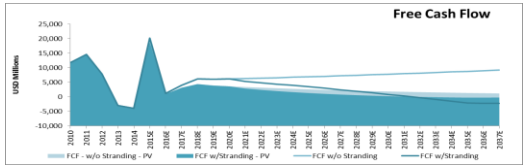




Chevron Corp

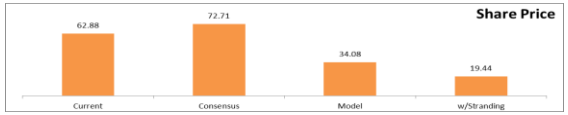
	Current	Consensus	Model	w/Stranding
Share Price	$ 104.32	$ 112.63	$ 36.48	$ 14.15
Price change		8%	-65%	-86%
EV/EBIT	31.91	31.91	8.01	4.02
P/E	15.71	15.71	5.49	2.13

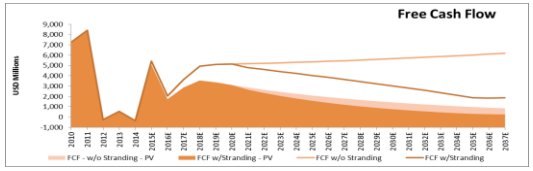




ConocoPhillips

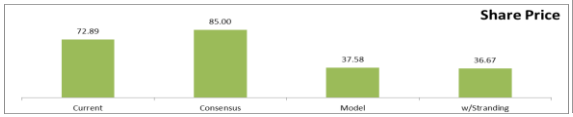
	Current	Consensus	Model	w/Stranding
Share Price	$ 62.91	$ 72.71	$ 34.08	$ 19.44
Price change		16%	-46%	-69%
EV/EBIT	55.26	55.26	27.52	19.23
P/E	19.68	19.68	10.66	6.08

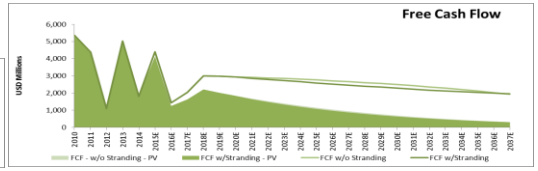




Occidental Petroleum Corp

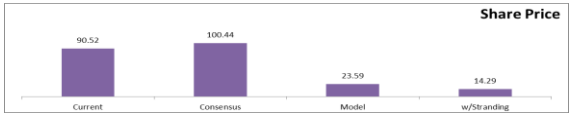
	Current	Consensus	Model	w/Stranding
Share Price	$ 72.89	$ 85.00	$ 37.58	$ 36.67
Price change		17%	-48%	-50%
EV/EBIT	44.71	44.71	13.04	12.76
P/E	21.76	21.76	11.22	10.94

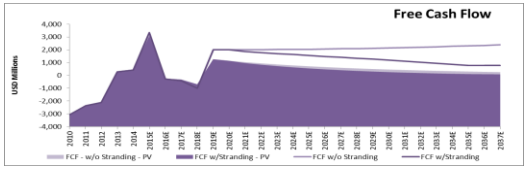




EOG Resources Inc

	Current	Consensus	Model	w/Stranding
Share Price	$ 90.48	$ 100.44	$ 23.59	$ 14.29
Price change		11%	-74%	-84%
EV/EBIT	72.79	72.82	21.92	15.25
P/E	43.66	43.68	11.38	6.90





Appendix 4

Exhibit 4.1- 2015 Changes in US Generation Capacity

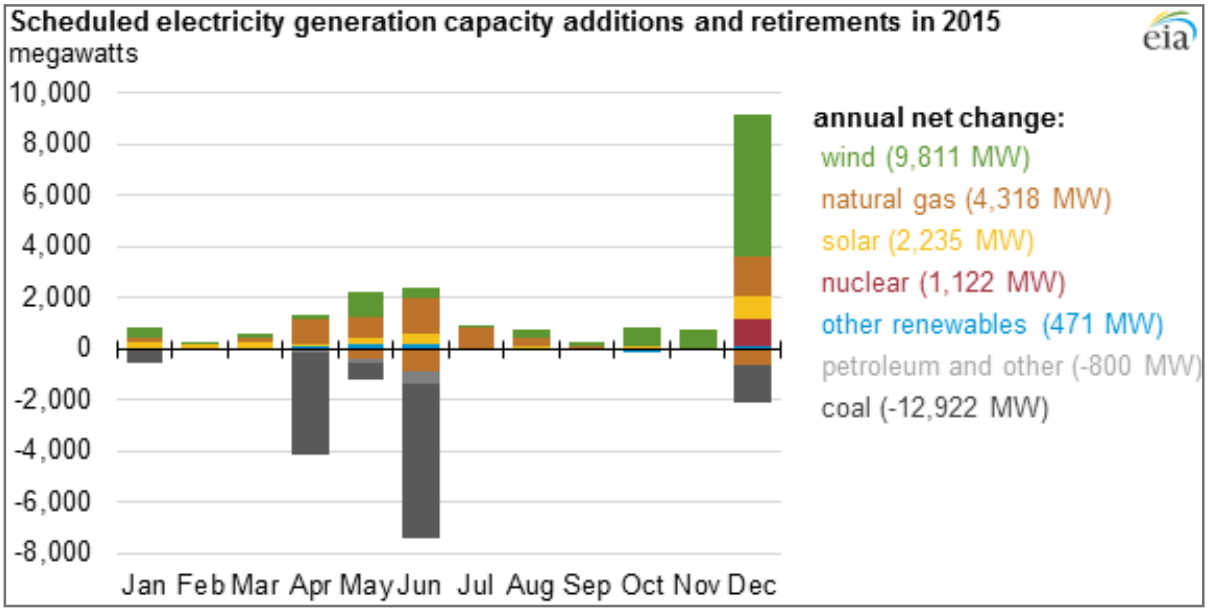
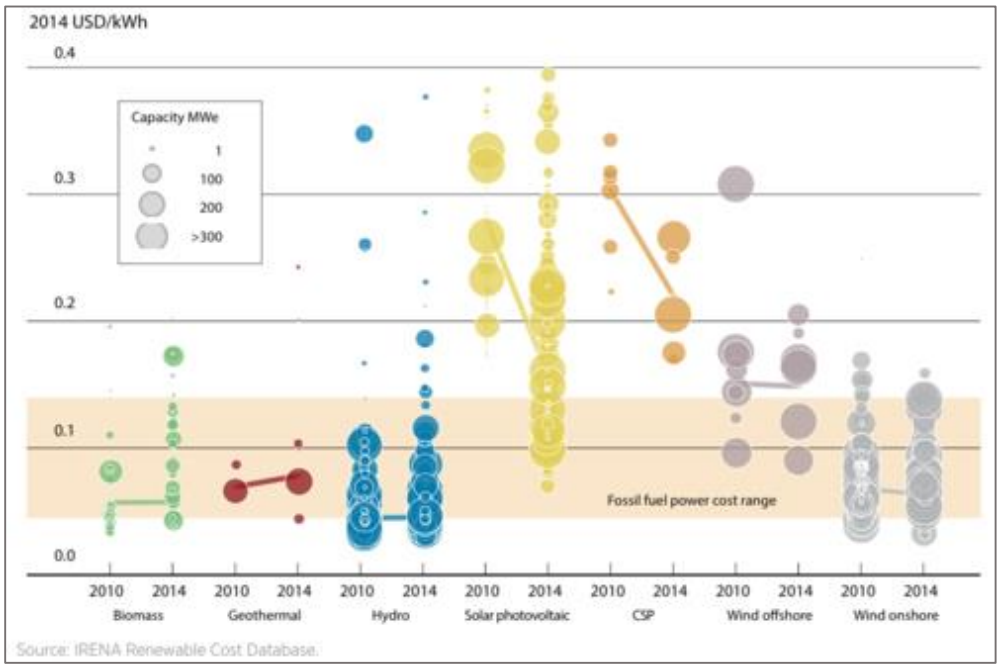


Exhibit 4.2- Levelized Cost of Electricity from Utility Scale Projects



Appendix 5

Exhibit 5.1- Fossil Fuel Index's Top 200 (Year 2015)

Rank	Coal Companies	Coal Gt CO2	Rank	Oil and Gas Companies	Oil Gt CO2	Gas Gt CO2	Total O&G Gt CO2
1	Coal India	57.722	1	Gazprom	6.749	37.166	43.915
2	China Shenhua	36.807	2	Rosneft	10.666	2.558	13.224
3	Adani	25.383	3	PetroChina	4.790	3.801	8.591
4	Shanxi Coking	18.445	4	ExxonMobil	4.307	3.916	8.223
5	Anglo American	13.488	5	Lukoil	5.699	1.288	6.988
6	BHP Billiton	12.351	6	BP	4.214	2.506	6.719
7	Yitai Coal	12.223	7	Petrobras	4.707	0.724	5.432
8	Datang Intl	12.206	8	Royal Dutch Shell	2.229	2.315	4.544
9	China Coal	12.103	9	Chevron	2.485	1.588	4.073
10	Peabody Energy	11.484	10	Novatek	0.497	3.356	3.853
11	Glencore Xstrata	10.698	11	Total	2.002	1.800	3.802
12	Datong Coal	10.281	12	ConocoPhillips	1.687	1.111	2.798
13	Yanzhou Coal	9.788	13	Tatneft	2.556	0.064	2.620
14	DEH	9.339	14	ONGC	1.594	0.862	2.457
15	Exxaro	8.793	15	ENI	1.366	0.990	2.356
16	Yangquan Coal	7.298	16	Statoil	0.981	1.004	1.985
17	Mechel	6.739	17	Sinopec	1.340	0.381	1.722
18	Arch Coal	6.513	18	CNOOC	1.175	0.373	1.548
19	Alpha Natural Resources	5.458	19	Occidental	1.024	0.303	1.327
20	EVRAZ	4.855	20	BG Group	0.533	0.588	1.122
21	Mitsubishi	4.738	21	Canadian Natural Resources	0.788	0.208	0.995
22	Vale	4.401	22	Anadarko Petroleum	0.482	0.502	0.984
23	Raspadskaya	4.084	23	Apache	0.569	0.400	0.969
24	Rio Tinto	3.696	24	Chesapeake Energy	0.269	0.639	0.909
25	Asia Resource	3.181	25	Inpex	0.541	0.367	0.908
26	Rusal	3.081	26	Bashneft	0.892	0.000	0.892
27	Neyveli Lignite	3.035	27	Devon Energy	0.381	0.507	0.889
28	Pingdingshan	3.023	28	BHP Billiton	0.333	0.521	0.854
29	Cloud Peak	2.753	29	Repsol	0.271	0.551	0.823
30	Sasol	2.731	30	Ecopetrol	0.607	0.167	0.774
31	Tata Steel	2.709	31	EOG Resources	0.497	0.275	0.772
32	AGL	2.704	32	Suncor Energy	0.713	0.003	0.715
33	Teck	2.603	33	Marathon Oil	0.538	0.146	0.683
34	Severstal	2.577	34	Hess	0.457	0.108	0.565
35	Coalspur	2.545	35	Imperial Oil	0.527	0.025	0.552
36	Kuzbass Fuel	2.504	36	Encana	0.081	0.467	0.548
37	Polyus Gold	2.294	37	Noble Energy	0.173	0.318	0.490
38	Energy Ventures	2.184	38	BASF	0.134	0.348	0.483
39	Whitehaven Coal	2.055	39	EQT	0.037	0.412	0.449
40	Banpu	2.040	40	Range Resources	0.134	0.309	0.443
41	Bayan	1.957	41	Continental Resources	0.312	0.113	0.426
42	RWE	1.943	42	OMV	0.269	0.151	0.420
43	Consol Energy	1.887	43	Antero Resources	0.042	0.368	0.410
44	WHSP	1.851	44	KazMunaiGas EP	0.382	0.018	0.400
45	Westmoreland	1.835	45	YPF	0.250	0.139	0.389
46	Resource Generation	1.818	46	Southwestern Energy	0.000	0.380	0.380
47	Churchill Mining	1.745	47	Cenovus Energy	0.326	0.048	0.374

48	NTPC	1.740	**48**	Linn Energy	0.199	0.164	0.364
49	Adaro	1.607	**49**	Woodside Petroleum	0.049	0.311	0.360
50	Nacco	1.557	**50**	Husky Energy	0.215	0.128	0.343
51	Idemitsu Kosan	1.530	**51**	PTT	0.106	0.211	0.317
52	ARLP	1.468	**52**	Consol Energy	0.000	0.312	0.312
53	Huolinhe Opencut	1.387	**53**	Pioneer Natural Resources	0.198	0.104	0.302
54	Golden Energy	1.354	**54**	Cabot Oil & Gas	0.011	0.289	0.300
55	Mitsui & Co	1.344	**55**	WPX Energy	0.072	0.203	0.275
56	CoAL	1.339	**56**	SK Innovation	0.263	0.000	0.263
57	NLMK	1.288	**57**	Whiting Petroleum	0.219	0.025	0.244
58	Tata Power	1.062	**58**	Murphy Oil	0.179	0.063	0.242
59	MMK OJSC	1.046	**59**	QEP Resources	0.094	0.139	0.233
60	Wesfarmers	1.011	**60**	Newfield Exploration	0.134	0.090	0.223
61	Kazakhmys	0.998	**61**	Dragon Oil	0.159	0.043	0.202
62	New World Resources	0.972	**62**	Sasol	0.115	0.085	0.201
63	MMC	0.903	**63**	Ultra Petroleum	0.014	0.186	0.200
64	Itochu	0.878	**64**	Santos	0.027	0.167	0.195
65	Cockatoo	0.800	**65**	Concho Resources	0.130	0.064	0.194
66	Shanxi Meijin Energy	0.784	**66**	Denbury Resources	0.164	0.027	0.190
67	Jizhong Energy	0.742	**67**	Freeport-McMoRan	0.152	0.031	0.183
68	Bandanna	0.731	**68**	Maersk Group	0.174	0.000	0.174
69	Polo Resources	0.726	**69**	MEG Energy	0.173	0.000	0.173
70	Allete	0.723	**70**	SandRidge Energy	0.081	0.076	0.157
71	CLP Holdings	0.696	**71**	Crescent Point Energy	0.146	0.011	0.157
72	Aspire	0.670	**72**	GDF SUEZ	0.044	0.111	0.155
73	Marubeni	0.568	**73**	Pacific Rubiales Energy	0.124	0.030	0.154
74	China Resources	0.567	**74**	SM Energy	0.084	0.065	0.148
75	Walter Energy	0.556	**75**	JX Holdings	0.146	0.000	0.146
76	Coal Energy	0.503	**76**	Cimarex Energy	0.074	0.070	0.144
77	Indika	0.485	**77**	Mitsui & Co	0.048	0.095	0.142
78	Arcelor Mittal	0.464	**78**	Penn West Petroleum	0.100	0.036	0.137
79	FirstEnergy	0.458	**79**	Polish Oil & Gas	0.033	0.100	0.132
80	Black Hills	0.431	**80**	MOL	0.076	0.055	0.131
81	Wescoal	0.430	**81**	Energen	0.088	0.039	0.128
82	Grupo Mexico	0.420	**82**	TAQA	0.066	0.057	0.123
83	ARM	0.383	**83**	Oil Search	0.026	0.088	0.114
84	Shanxi Coal	0.376	**84**	Oil India	0.062	0.051	0.113
85	Capital Power	0.367	**85**	ARC Resources	0.046	0.066	0.112
86	PTT	0.359	**86**	Genel Energy	0.107	0.000	0.107
87	Shanxi Lanhua Sci-Tech	0.338	**87**	Canadian Oil Sands	0.102	0.000	0.102
88	Fortune	0.328	**88**	Energy XXI	0.076	0.020	0.096
89	Cardero	0.323	**89**	PDC Energy	0.055	0.040	0.095
90	Zhengzhou Coal	0.319	**90**	Oasis Petroleum	0.084	0.010	0.094
91	SAIL	0.307	**91**	Tourmaline Oil	0.014	0.079	0.093
92	JSPL	0.301	**92**	Rosetta Resources	0.056	0.037	0.093
93	Shougang Fushan	0.299	**93**	RWE	0.030	0.063	0.093
94	Jingyuan	0.297	**94**	National Fuel Gas	0.018	0.071	0.088
95	Stanmore	0.287	**95**	Peyto E&D	0.008	0.079	0.088
96	Prophecy Coal	0.272	**96**	Xcite Energy	0.086	0.001	0.088
97	Cliffs Natural Resources	0.247	**97**	Tullow Oil	0.077	0.010	0.087
98	James River	0.195	**98**	Energi Mega Persada	0.016	0.069	0.085
99	CESC	0.185	**99**	Breitburn Energy Partners	0.053	0.028	0.081
100	Alcoa	0.180	**100**	Enerplus	0.043	0.037	0.080

Appendix 6

Exhibit 6.1- Colleges and Universities that have committed to fossil fuel divestment

Sl.	Colleges and Universities
1	College of the Atlantic, ME, USA
2	Foothill-De Anza Community College Foundation, CA, USA
3	University of Glasgow, United Kingdom
4	University of Bedfordshire, United Kingdom
5	Green Mountain College, VT, USA
6	Hampshire College, MA, USA
7	Naropa University, CO, USA
8	Peralta Community College District, CA, USA
9	Pitzer College, CA, USA
10	Prescott College, AZ, USA
11	San Francisco State University Foundation, CA, USA
12	Stanford University, CA, USA
13	Sterling College, VT, USA
14	Unity College, ME, USA
15	University of Dayton, OH, USA
16	Humboldt State University, CA, USA
17	Victoria University, Wellington, NZ
18	Chico State University, California, USA
19	College of Marshall Islands, Marshall Islands
20	Goddard College, Vermont, USA
21	Chalmers University of Technology, Göteborg, Sweden
22	California Institute of the Arts, Valencia, California
23	University Of Maine System, Maine, USA
24	The New School, NY, USA
25	Pacific School of Religion, CA, USA
26	Brevard College, NC, USA

Appendix 7

Drawbacks of Fossil Fuel Divestment

This research group acknowledges drawbacks that exist and the limitations that will result by implementing divestment action, however overall the gains are much more promising and strengthens the social, ethical and economic credibility of the University. These drawbacks are listed below as arguments with counter arguments;

The Clark endowment is not a tool to push political and social agendas; however, the university risks being seen as supporting a destructive industry.

Clark will have lower flexibility in investment choices and options; however, emergent ESG/SRI portfolios offer previously unavailable investment opportunities.

Fossil fuel divestment will have additional transaction costs; however, loss risks far outweigh potential transaction costs.

The timing of asset sales may result in significant losses; however, we do not suggest immediate divestment, but a strategic phased approach.

Divesting from fossil fuels sets a precedent for arguments against other controversial industries; however, the preceding analysis is based on shifting economic landscape, not moral controversy.

Fossil fuel divestment may lead to increased scrutiny of investment practices and institutional policies; however, where there are not reasonable alternatives, Clark does not risk being misaligned with institutional values (i.e. lack of operational alternatives for electricity consumption.

Appendix 8

Fossil Fuel Divestment: A Financial Argument

Edward Snook
10/27/14
IDCE398: Internship
Professor Downs

1. Introduction

The discussion around fossil fuel divestment has grown in the past few years as a response to our most urgent environmental challenge: climate change. Climate change has important implications for our environment, our economy, and our population. Divestment has become a viable—and potentially crucial—investment strategy. The financial divestment movement grew out of the sustainable and responsible investment (SRI) movement. SRI has always been a combination of exclusionary divestment and active investment. From religious value investing that avoids the sin industries, e.g. tobacco, firearms, and gambling, to present day fossil fuel divestment, SRI has always been a divestment from some sector, industry, or company (Scholtens, 2014). SRI's popularity surged through the 1970's, 1980's, and 1990's due to its divestment from companies that produced the Vietnam War's napalm supply and companies that supported apartheid in South Africa (Berry, 2013). While these examples used divestment to cause a change, they were also a sound financial strategy. For instance, if consumers had begun boycotting goods or services provided by companies that operated in apartheid in South Africa, then divestment from those companies would be a logical financial decision to decrease risk and exposure. Moreover, these companies' "brands" would have been devalued and investors would react accordingly, cutting investments. Since the emergence of climate change as the most urgent environmental issue, divestment has been viewed as a potential and partial response. However, as with South African apartheid divestment, the argument for fossil fuel divestment goes beyond the moral or socially just argument. Divestment is currently a financially profitable and economically secure investment strategy.

In order to assess the potential financial feasibility of fossil fuel divestment, this report will examine previous literature's analysis of SRI vehicles' performance prior to the 2008 financial crisis and recession. In many of these analyses, divestment strategies were pursued by SRI funds. Additionally, many of these SRI funds and indexes have at least semi-divested fossil fuel holdings, meaning that either these funds have lower exposure than non-SRI mutual funds or have divested from certain types of fossil fuels (van Renssen, 2014). Subsequently, an analysis of fossil fuel-divested mutual funds' performance and risk in lieu of the 2008 recession and its aftermath will demonstrate the effects of the growing divestment movement and the strength of divested portfolios. Nevertheless, investments are about the future, not the past. While past performance plays a role in analyzing future investment, a business's future performance is better measured by examining its internal investments and growth potential along with future market conditions. Thus, this report will examine the fossil fuel sector's supply and demand as well as fossil fuel-based firms' internal investment and potential exposure. Divested portfolios' past performance and fossil fuel companies' risky future outlook could tip divestment to become a leading strategy for mitigating and adapting to climate change.

2. Literature and Historical Review

Many researchers and investors have examined the performance and risk of SRIs over the time period spanning the 1990's and early-to-mid 2000's. The results of these analyses are mixed with conclusions showing market-exceeding returns, market-equivalent returns, and below-market returns. In many cases, the timeframe of study, number of firms surveyed, benchmarks, and metrics were different and difficult to compare. These differences ultimately play a role in each study's outcome. Nevertheless, understanding the financial position and history of SRI vehicles entering the 2008 recession will aid in a better understanding of the financial context in which the fossil fuel divestment movement emerged.

An examination of European sustainability indexes between 1998 and 2004 showed that 4 of the

6 sustainability indexes outperformed the benchmark indexes (Vermeir et al., 2005). This timeframe, spanning the 2000 to 2003 economic slowdown, highlights SRI's lower susceptibility to market downturns and more conservative nature. Further evidence can be found in Schueth's 2003 study of US mutual funds from 2000 to 2002 wherein which he remarked, "…investors need not sacrifice performance when investing in a socially responsible manner. Investors no longer need to separate good fortune from good will" (Schueth, 2003). His analysis found that 64% of the 53 SRI mutual funds examined received top rankings from at least one of the independent analysis and review organizations, Lipper and Morningstar (Schueth, 2003). Comparatively, only about 40% of the total mutual fund market warrants a top rank from Lipper, and only about 32% of the mutual fund market earns a top rank from Morningstar (Schueth, 2003). These two studies show SRI mutual funds performing above the market during an economic downturn, illustrating that SRIs have lower risk and higher returns during these periods.

However, some research has found SRIs to perform below benchmark standards. The results of a performance study of 89 Australian SRI funds between 1986 and 2005 found that the market was outperforming investments constrained by social, environmental, and ethical criteria (Jones et al., 2008). However, during the study period, the Australian stock market (ASX) outperformed many of the major international indexes, including the FTSE 100, S&P 500, and several Asian markets. A majority of this performance was driven by the energy sector's reaction to high oil prices (Jones et al., 2008). Thus, SRI funds with significant international exposure or little to no energy sector holdings underperformed compared to the ASX (Jones et al., 2008). This scenario is a common theme throughout SRI and fossil fuel divestment strategy. High oil prices generally signal strong performance for the energy sector, and thus, slight underperformance for divested funds compared against market benchmarks (van Renssen, 2014). The oil price-returns dichotomy and its implications on future fossil fuel investment will be discussed in more detail later.

In addition to the positive and negative research conclusions regarding SRIs past performance, a large share of the research has found SRI fund performance comparable to market benchmarks. A study of more than 50 academic papers examining French SRI fund performance from 2004-2007 found that the majority of these papers' results demonstrated that SRI fund performance is not significantly different relative to a benchmark indexes (Capelle-Blancard and Monjon, 2012). The period studied falls during France's economic response to the early-2000's recession. From 2004-2007, France's economy (measured by GDP) grew by about 20% with SRI funds following the market trend (Trading Economics, 2014). This study suggests that SRI funds can compete with the market during periods of sustained growth. Moreover, another review of 16 SRI fund performance studies with research spanning multiple countries and decades (1981-2003) found that in 14 of 16 studies, SRI strategies did not have a significant impact on fund performance (Renneboog et al., 2008). Similar to the results of the French review, as the world economy more than tripled between 1981 and 2003, the SRI's performance followed along with this economic growth (International Monetary Fund, 2014). Thus, overall the differences in performance and risk between SRI funds and market benchmarks appears be insignificant in the lead up to the 2008 financial crisis. The previously discussed literature has shown SRI funds can be less risky investments during economic downturns and equally robust in periods of growth.

3. Analysis of Fossil Fuel Divested Mutual Funds (FFDMF)

A. Methods

In order to assess how FFDMFs reacted to market conditions during and following the 2008 financial crisis, one must examine these funds in terms of returns and risks as well as in relation to market benchmarks. A FFDMF is one that does not hold any companies that extract or process fossil fuels. A SRI

firm operates each fund to which SRI principles and strategies are applied. However, specific investment strategies and environmental, social, and governance (ESG) criteria may differ. This study concentrates on funds with majority equity exposure in order to compare invest vehicles with and without fossil fuel holdings. The S&P 500 is a leading indicator of US equities and reflects the risk and return characteristics of large-capitalization companies (S&P Dow Jones Indices, 2014). Its value is the average stock price of its holdings weighted by size (S&P Dow Jones Indices, 2014). As would be expected, in the market, companies are not of equal size and do not have equal influence on the market. This analysis also employs the Dow Jones Sustainability US Composite Index (AASGI) in order to compare SRI investment vehicles with and without fossil fuel exposure. The Oil and Gas sector make up about 17% of AASGI with Exxon Mobil and Chevron accounting for more than 10% of the index (S&P Dow Jones Indices and RobecoSAM, 2014). The index is composed of US sustainability leaders, the top 20% of the Dow Jones Sustainability North American Index, as identified through a sustainability assessment (S&P Dow Jones Indices and RobecoSAM, 2014). As with the S&P 500, its holdings are weighed by market capitalization (S&P Dow Jones Indices and RobecoSAM, 2014). US-based benchmarks have been employed because about 75% of the total equities held by this portfolio are US equities.

The portfolio of FFDMFs includes seven different mutual funds from five different capital management firms. In order to understand some of the funds' basic characteristics, this study employed the Morningstar Style Box's definitions. The Style Box defines three size categories (small, mid, and large capitalization) and three style categories (value, growth, and blend). In order to determine the style, Morningstar compares the growth and value characteristics for each of the funds' stocks to ones with similar capitalization and then scores them on a 100-point scale. The resulting stock's number is classified as growth or value depending on certain thresholds. Morningstar uses a flexible system to determine capitalization. Capitalization is defined by the portion of the market that a stock represents (large: top 70% of the market; mid: middle 20%; and small: bottom 10%). Equity funds are the aggregation of their holdings[1]. All but two of the funds are large cap, and only one is blended fund. Moreover, only one of the funds is not a balanced fund with some green bond exposure. For more information about fund characteristics, see Figure 1 below.

Investors use standard deviation (SD) to measure and assess fund risk, and the percent change between 7/1/2007 and 7/1/2014 is used to measure fund performance. SD measures an investment's volatility and helps gauge an investment's expected volatility and risk (Maginn et al., 2007). Using Morningstar's analysis of the past 10-year and 5-year periods' SD, an average 7.5-year SD was calculated and used for comparison. In the event that average risk is incalculable due to unavailable data, the 5-year average was used for the overall average. This analysis uses a start date about six months prior to the start of the 2008 recession because the aim is to analyze the reaction and response of these funds to the financial crisis. A chart analysis of this fossil fuel free portfolio ("the Portfolio") and its benchmark will allow investors to better understand how fossil fuel divested portfolios act over different investment climates. Thus, in order to assess the returns for an investor from these FFDMFs, this analysis uses the change in the funds' price over time. This analysis will employ a return to risk ratio in order to determine the amount of return per unit of risk. These figures have been calculated using equal weighting across each of the funds.

The Portfolio's Mutual Funds' Characteristics[35]

Mutual Funds	**Morningstar Style**	**Fund Type (% equities)**
Green Century (GC) Balanced Fund	Large Growth	Balanced (68)
GC Equity Fund	Large Blend	Equity (99)
Parnassus Endeavor Fund	Large Growth	Equity (89)
Pax World (PW) Growth Fund	Large Growth	Equity (97)
Portfolio 21 Global Equity Fund	Large Growth	Equity (98)
Shelton Green Alpha Fund	Mid Growth	Equity (100)
PW Global Environmental Markets Fund	Mid Growth	Equity (100)

Fig. 1 – A list of the Portfolio's funds and their characteristics in regard to style and type

B. Results[36]

The Portfolio increased by 37.61% since 7/1/07, almost 12% higher than the S&P 500 and 77% higher than the AAGSI over the same time period (p-value = .57 and .05, respectively). The Portfolio's constituents had a wide range (STDEV: 52.8) of performance outcomes in relation to the S&P 500; Portfolio 21 Global Equity Fund (PORTX) finished the 7-year period at about 58% less than the S&P 500, while the Parnassus Endeavor Fund (PARWX) outperformed the S&P 500 by over 94%. In terms of risk, the Portfolio (14.09) was slightly riskier than the S&P 500 (13.94). The difference in risk between the S&P 500 and the Portfolio is not statistically significant (p-value = .85). In order to assess the returns and risk together, this analysis employs a Returns-Risk ratio (R/R). This ratio allows investors to understand the growth of an investment while holding risk equal. As would be expected, the Portfolio's R/R ratio (2.67) was about 11% higher than the S&P 500's R/R ratio (2.41). Thus, seeing as risk is about equal, the Portfolio has outperformed its benchmark, the S&P 500.

[35] Information found on Morningstar.com

[36] Note: Results employ data spanning an unusual and anomalistic period of economic recession due to rapid changes in the US housing market. This unusual economic event has the potential to skew data.

The Portfolio's Performance and Risk[37]

	Performance (as of 7/5/14)		Risk (STDEV)				
Mutual Funds	% Δ in price from 7/1/07*	% Diff. from .INX	10 yr.	5 yr.	Avg.	% Diff. from .INX	Return/ Risk Ratio
GC Balanced	34.03	1.25	11.09	9.42	10.26	-26.43	3.32
Green Century (GC) Equity	33.95	1.01	12.88	14.45	13.67	-1.97	2.48
Parnassus Endeavor	65.29	94.26	-	14.89	14.89	6.81	4.38
Pax World (PW) Growth	31.25	-7.02	16.84	14.89	15.87	13.81	1.97
Portfolio 21 Global Equity	14.02	-58.29	15.63	13.94	14.79	6.06	0.95
Shelton Green Alpha	62.02	84.53	-	-	17.16	23.10	3.61
PW Global Env. Mrkts	22.73	-32.37	-	16.14	16.14	15.78	1.41
Portfolio Totals	37.61	11.91	14.23	13.96	14.09	1.08	2.67
S&P 500	33.61	N/A	14.69	13.19	13.94	N/A	2.41
Vanguard Energy Index	38.32	14.01	-	19.32	19.32	38.59	1.98
Dow Jones Sustainability US Composite Index	21.23	-36.83	-	-	-	-	-

*or inception

Fig. 2 – Performance and risk results of the Portfolio, its mutual funds, S&P 500, and VGENX

C. Chart Analysis[38]

(1) Performance

While the Portfolio outperformed its benchmark over the 7-year period studied, it is useful to examine the Portfolio's funds' performance during to the late 2000's recession and the funds' response as the economy turned around in the following years. At the deepest part of the recession in early 2009, the S&P 500 had lost just over 51% of its value (since this study's start date); meanwhile, only two of the six active funds in the Portfolio had lost higher percentages of their value over the same time period. The

[37] Historic values and data from Google Finance (google.com/finance) and Morningstar (Morningstar.com)

[38] Using Google Finance's comparative chart analysis tool (https://www.google.com/finance?chdnp=1&chfdeh=0&chdet=1405627200000&chddm=702576&cmpto=INDEXSP:.INX;MUTF:GCEQX;MUTF:GCBLX;MUTF:PARWX;MUTF:PXWGX;MUTF:PORTX;MUTF:NEXTX;MUTF:PGRNX&cmptdms=0;0;0;0;0;0;0&q=INDEXSP:.INX,MUTF:GCEQX,MUTF:GCBLX,MUTF:PARWX,MUTF:PXWGX,MUTF:PORTX,MUTF:NEXTX,MUTF:PGRNX&ntsp=0&ei=0gRAVKioCtLhqAH894DICw)

S&P 500 recovered faster to its pre-recession value than three of the funds. The Green Century Balanced Fund (GCBLX), PARWX, and the Pax World Growth Fund (PXWGX) all recovered faster than the S&P 500. The GCBLX and PARWX are the most balanced funds in the Portfolio, investing in some bonds. Lower equity exposure (68% exposure for GCBLX and 89% exposure for PARWX) could be partially responsible for the higher resilience to a domestic and global recession. GCBLX and PARWX also only lost 37.46% and 45.27%, respectively, of their initial value at the deepest part of the recession compared to the S&P 500's 51.07%. The other fund with a market-beating response to the recession, PARWX, exploded after reaching a low point, realizing its initial value by mid-2011. GCBLX did not reach this point until Q4 of 2012, while the remaining funds and the S&P 500 did not permanently break even until mid-2013. These results show that a balanced portfolio can help protect against recessional losses. However, FFDMFs do not appear to be more or less susceptible to economy-wide recessions compared to other equities.

Since the recession's low point in early 2009, the S&P 500 has grown by 162.44%. Only the Green Century Equity Fund (GCEQX) (162%), PARWX (163.65%), and PXWGX (171.03%) have grown by amounts similar to the S&P 500. However, the Portfolio's other funds underperformed the S&P 500 since the low point of the recession. These results illustrate that FFDMFs can outperform, underperform, and follow the market. Overall, the Portfolio's response was relatively equal to its benchmark and the economy as a whole. Excluding the Pax World Global Environmental Markets Fund's (PGRNX) 2014 stagnation, the funds have generally followed the market. With an equally weighted portfolio, the increase in performance of the Portfolio over the S&P 500 can be partially attributed to results of PARWX outperforming the benchmark more than PROTX's underperformance of the benchmark.

(2) Risk

While the average, equal-weighted risk of the Portfolio was almost equal to the S&P 500's risk over the same time period, the distribution suggests that FFDMFs may be slightly riskier than the market average. In the Portfolio, five of the seven funds had standard deviations higher than the S&P 500's standard deviation. Nonetheless, all of the Portfolio's funds are at least 11% less risky than the energy sector, measured by the Vanguard Energy Fund, or VGENX (p-value $< .001$). The VGENX has exposure to fossil fuel industry through extractors, producers, and refiners of oil, natural gas, and coal (Vanguard Group, 2014). Logically, risk should increase as diversification decreases. Because FFDMFs are inherently less diverse than the market, risk is expected to be slightly higher, as observed with most of the funds in the Portfolio. However, the Portfolio as a whole has shown that divestment does not significantly increase risk over the studied period.

(3) R/R Ratio

With no significant difference between the S&P 500's and the Portfolio's risk, the R/R Ratio demonstrates that the Portfolio is producing higher returns for the same level of risk. For every unit of risk, the Portfolio is outperforming the S&P 500 and the energy sector. While the energy sector has outperformed the benchmark and the Portfolio, the energy sector's higher risk pulls down their R/R ratio. The Portfolio's funds had a wide distribution of R/R ratios with four funds above the market average and three funds below the market average. Overall, the Portfolio's higher R/R ratio illustrates a divested portfolio's capability to best the market in terms of risk-adjusted returns.

4. The Carbon Future

While past performance can help inform decisions about investments, investing is about the future. Examining the fossil fuel industry and the energy sector's future will allow investors to understand the potential downfalls. A carbon bubble may exist around potential regulation and the climate crisis. Moreover, the interaction between fossil fuels' supply and demand, the energy sector's capital expenditure, and pricing has the potential to produce adverse investment conditions. A bleak forecast for the fossil fuel industry will lead investors to divest from fossil fuel companies.

A. Carbon Math

Bill McKibben's new math, along with contributions from the IPCC (Intergovernmental Panel on Climate Change) and the EIA (Energy Information Administration), has led to a new outlook on the world's carbon budget in relation to climate change. According to the 2013 IPCC's climate change report, there is a 95% to 100% probability that anthropomorphic activities are partly responsible for rising global temperatures as a result of greenhouse gasses (GHG) emissions (Stocker et al., 2013). About 60% of the world's countries signed the 2009 Copenhagen Accord, agreeing that global increase in temperature above 2°C will bring dangerous risks for the future of civilization (Copenhagen Accord, 2009, McKibben, 2012). The IPCC report continues by stating that in order to have a 50% probability, holding rising temperatures to at or below 2°C, civilization must limit CO_2 concentrations in the atmosphere to 450 parts per million (ppm) (Stocker et al., 2013). In order to remain below 450 ppm, scientists estimate that humans can only pump about 565 more gigatons (Gt) of CO_2 into the atmosphere by 2050 (McKibben, 2012). Unfortunately, the Carbon Tracker Initiative (CTI) estimated in 2012 that private fossil fuel companies as well as nationalized fossil fuels' reserves are over 5 times as high as the 565-Gt carbon budget (Carbon Tracker Initiative, 2014a, McKibben, 2012). The discrepancy of these numbers creates potential risk for fossil fuel companies, investors, partners, and the world economy as a whole. The application of this carbon budget would result in a substantial amount of stranded assets, due to a significant loss in value of carbon assets before their anticipated use (Generation Foundation, 2013). Enforcement of the carbon budget could occur in one of two forms: government regulation or private-social forces (Generation Foundation, 2013). In the first scenario, government regulation, assets could become stranded if authorities create a direct cap on carbon emission or indirectly regulate through mandates on renewable energy adoption and efficiency standards (Generation Foundation, 2013). Even the threat of regulation creates uncertainty for long-lived carbon-intensive assets. In this second scenario, stranded carbon assets could result from market forces, such as economically-competitive renewable technologies, or social pressures; business always aims to reduce costs and increase efficiency, which would include using less and less energy (Generation Foundation, 2013). Similarly, social pressures could create a scenario in which carbon-intensive businesses' reputations and brand become devalued by consumers and demand for fossil fuels decline (Generation Foundation, 2013). Currently, the atmospheric CO_2 concentrations are at 395.3 ppm and have been increasing over the last decade by about 2 ppm per year[39]. Continuing along the current trajectory over the next 35 years will leave the globe well beyond 450 ppm. As the world closes in on an atmospheric CO_2 concentration of 450 ppm, the urgency and necessity for action will become increasingly apparent. In order to avoid these long-term risks and exposure to this bubble, investors should seek fossil fuel divestment strategies. Because investors seek capital appreciation over the long term, investments should be aimed at areas of potential growth, not devaluation.

[39] As of 10/27/14, data from CO2Now.org

B. The Cost of Carbon

In addition to the external influences on the fossil fuel sector mentioned above, a closer examination of fossil fuel companies' operations, investments, and ventures reveals some important information about the potential direction of these companies. Fossil fuel companies have grown tremendously over the previous half-century, but recent changes in their business landscape have the potential to create devastating consequences for their future cash flows. CTI has done extensive research into the oil industry and the key role it will play in the energy sector's future. The oil industry accounts for about 40% of the globe's total carbon reserves; unlike the emerging natural gas industry or the declining coal industry, the oil industry exists in a mature state in the midst of a transition from conventional energy resources to unconventional resources (Carbon Tracker Initiative, 2014a). Before the turn of the century, the oil industry's profits had been based on the extraction and processing of conventional, underground or shallow offshore oil fields (Carbon Tracker Initiative, 2014a). This relatively inexpensive method of exploitation created huge profits, market-beating returns, and an opportunity to energize investors with dividends and to reinvest in future growth (Hodel and Deitz, 1994). However, the decline in conventional oil reserves has forced the oil industry to explore other, more unconventional approaches and methods to locating, extracting, processing, and delivering oil to their customers and consumers.

Presently, the oil industry is transitioning away from conventional oil resources and exploring unconventional oil resources, such as ultra-deepwater, shale oil, oil sands, and extra heavy oil (Carbon Tracker Initiative, 2014a). The major issue with these unconventional reserves is the cost of developing them. According to CTI, "worldwide capital expenditures (capex) related to oil and gas production increased from $250 billion in 2000 to nearly $700 billion in 2013 (both figures in 2012 US dollars)" (Carbon Tracker Initiative, 2014b). Capex is the amount of money spent on acquisitions or upgrades of physical assets such as the discovery, purchase, and development of oil reserves (Pogue, 2010). As conventional oil reserves are reaching exhaustion and new, high-cost unconventional oil reserves are required to sustain the global oil supply, the oil industry has been forced to invest more and more capital for a similar level of production (see Figure 3 in Appendix A). Since 2005, about 88% of the increase in net global oil production has been the result of unconventional resources (Carbon Tracker Initiative, 2014b). However, the increase of this investment has resulted in significantly smaller increases in the global oil supply (Carbon Tracker Initiative, 2014b). The eleven largest publicly traded oil companies' capex has quintupled, while cumulative production has remained approximately constant over a period between 2000 and 2012 (Carbon Tracker Initiative, 2014b). Barclays Investment Bank estimates that the oil industry's capex per barrel of oil has increased annually by about 11% between 1999 and 2013, more than ten times faster than in the previous 14-year period (Kopits, 2014). Furthermore, the staggering increase in the oil industry's capex is expected to continue to increase over at least the short-term future and probably in the long term (Carbon Tracker Initiative, 2014b). In the US, unconventional oil resources are expected to remain the chief source of new oil, keeping capex and capex per barrel on the rise (CTI).

The increase in capex and capex intensity has important implications for shareholders and investors. First, expected returns from these future projects have fallen to around the oil industry's long-term hurdle rate of 12% to 13% (Carbon Tracker Initiative, 2014b). The hurdle rate is the minimum rate of return on the capex investments required by an oil companies' management to compensate for risk (Pogue, 2010). The oil industry's average rate of return on future projects has decreased from about 21% in 2008 to about 12% in 2013 (Carbon Tracker Initiative, 2014b). Because upstream returns account for approximately 75% of earnings, an oil company's returns generally mirror upstream returns (Carbon Tracker Initiative, 2014b).

According to Citi's analysis of oil industry's cash returns, returns have dropped below 11%, the oil industry's 30-year average, meaning future cash generations will most likely be insufficient in support of current capex investment and dividends payments (see Figure 6 in Appendix A) (Carbon Tracker Initiative, 2014b). This potential cash shortage would force companies to either decrease capex or forego dividends. Both options would hurt investors: a decrease in dividends would directly take money away from investors, and lower capex would signal lower future oil returns. In order to remain cash flow neutral and leave investors unharmed, oil prices will need to be high enough to cover this new oil's higher costs. Goldman Sachs has researched and analyzed the breakeven oil prices for oil companies to be cash flow neutral after capex and dividends. They estimate that the majority of major oil companies have cash-neutral oil prices of between $100 and $120 per barrel (Carbon Tracker Initiative, 2014a). This is an increase from the estimated breakeven price of about $80 per barrel from 2008 to 2011 (Carbon Tracker Initiative, 2014a). Thus, the oil industry's transition from conventional to unconventional oil resources and the accompanying higher costs create risks and uncertainty surrounding these oil companies' future value, earnings, and dividend distributions.

Nevertheless, to further examine the oil industry's future potential to investors, an analysis of future oil prices is crucial. For example, booming future oil prices could result in extraordinary performance of the oil industry, while lower prices could spell disaster for these companies and their investors. According to basic microeconomic theory, in order to operate a profitable business or at the very least breakeven, the price of oil must be equal to or higher than the total cost of producing the barrel of oil (Mankiw, 2014). While the supply of oil has been previously discussed, alterations in demand can also have a significant impact on the global oil price and, consequently, oil companies and their investors. While projections of oil demand are varied and complex, the IEA (International Energy Agency), CTI, and the oil Majors (BP, Chevron, ExxonMobil, Shell, Total, ConocoPhillips, and ENI) have scenarios for the status quo, the adoption of new stricter carbon policies, and the carbon budget. In order for the global average temperature's increase to remain below 2°C, the carbon budget must be enforced. This scenario assumes a decrease of 1% in the annual growth rate of oil demand, a decrease by approximately 9.2 million of barrels per day (MBPD) over about the next 20 years (International Energy Agency, 2013). This scenario is vastly different than projections using current carbon policies–1% annual growth rate and an increase of 22.6 MBPD demanded–or the average 20-year demand growth projected by the Majors (e.g. BP, Chevron, ExxonMobil, Shell, Total, ConocoPhillips, and ENI), an approximate 19.5 MBPD in demand growth (International Energy Agency, 2013). The moderate, new carbon policy scenario assumes that new regulations will result in an annual demand growth rate of 0.6% and projects a 14 MBPD increase in oil demand (International Energy Agency, 2013). See Figure 4 in Appendix A below.

These demand scenarios illustrate the potential risk to oil companies and their assets. The BEOP represent the minimum price required to make the capex investment economic, a critical indicator for companies' and investors' economic risk in relation to future demand scenarios (Carbon Tracker Initiative, 2014a). In these scenarios, the BEOP is less than the market oil price required for development investment because a $15-per-barrel contingency is added to the BEOP to account for risks (Carbon Tracker Initiative, 2014a). Projects with a BEOP at or below $60 per barrel represent a level of oil demand under CTI's oil-specific carbon budget; the Organization of Petroleum Exporting Countries (OPEC) owns a majority of the oil at this level due to OPEC's mainly low-cost, conventional production sources (Carbon Tracker Initiative, 2014a). Should regulation or market forces conspire to enforce the 2°C limit oil-specific carbon budget, the non-

OPEC oil assets will be most vulnerable. Oil investments contain added risk as the carbon bubble looms. The next price band, a BEOP of $60 to $80 per barrel, is the level at which most conventional non-OPEC oil production becomes economic; however, in order to reach this price and demand, more government regulation and slower Chinese economic growth would be required (Carbon Tracker Initiative, 2014a). A BEOP between $80 and $100 per barrel is the band of pricing that most oil companies use for planning and project-analysis purposes; this range represents projects that would be viable under the current polices demand scenario (Carbon Tracker Initiative, 2014a). The profitability of these projects is susceptible to increased regulation or regional or global economic slowdown. Higher price bands of BEOP, above $100 per barrel, will require extremely high demand. A BEOP above $100 per barrel (especially as the BEOP nears $150+ per barrel) exceeds most oil companies' planning assumptions and forecasts; these projects are even riskier than others in lower bands as these BEOPs are least unlikely to be reached (Carbon Tracker Initiative, 2014a).

As discussed above, a project's risk increases as its required BEOP approaches and exceeds $100 per barrel. Nevertheless, oil companies continue to spend capex on projects that have at the very least minor risk attached with BEOPs above $80 per barrel and extraordinary risk at above $150 per barrel (see Figure 5 in Appendix A). Globally, 29% of the projects representing the global oil supply will require a BEOP of above $80 per barrel and 12.3% of the projects will require a BEOP above $120 per barrel (Carbon Tracker Initiative, 2014a). The private oil industry will bear a large portion of this risk with 41% and 21% of private oil projects requiring a BEOP above $80 and $120 per barrel, respectively (Carbon Tracker Initiative, 2014a). For example, one of the economically riskiest projects, the Alberta Canada oil sands project, will require 44% of the project's oil to be produced above a BEOP of $80 per barrel, more than for any other unconventional source (Carbon Tracker Initiative, 2014a). Unconventional projects create greater risk and potentially lower returns for these oil companies and their investors.

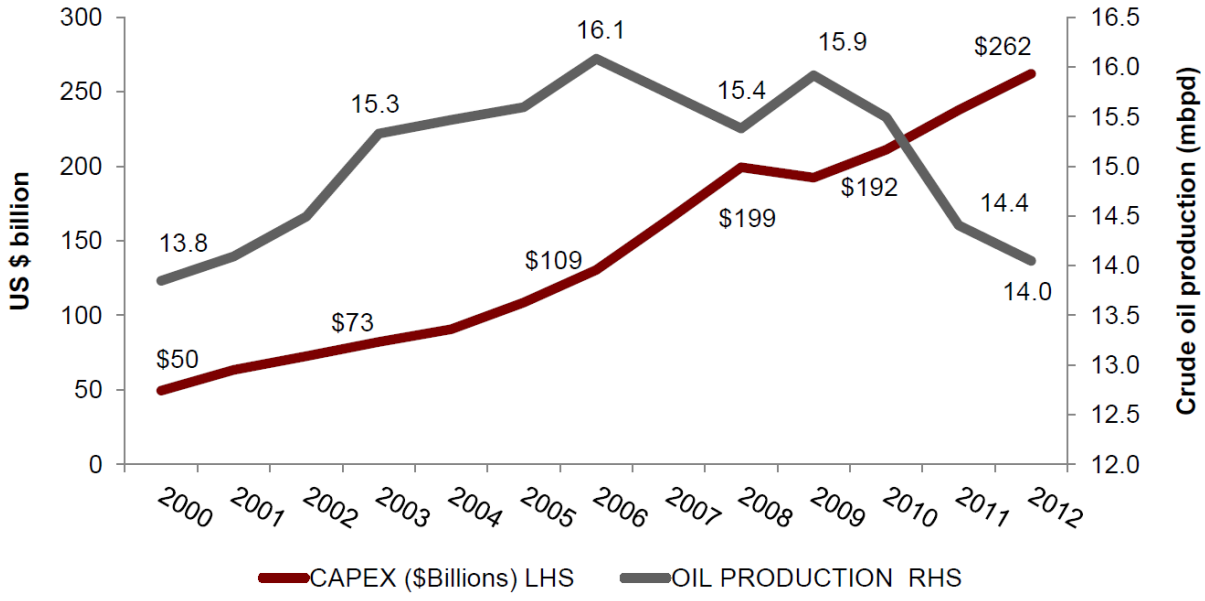
5. Conclusion

As we have seen throughout this analysis, divestment is an investment strategy that can provide at least market-equivalent returns as well as reduce recessional vulnerability and other risks. Moreover, recent activity within the fossil fuel industry, especially the oil industry, has created some potential risk and areas of concern for prudent investors. Declining capex productivity could constrain future cash flows, hurting both company growth and investors. Additionally, the approaching carbon bubble's influence on future demand scenarios could create an inhospitable environment for many unconventional fossil fuel projects, leading to stranded assets and the devaluation of fossil fuel companies. As an investor, one must examine his or her personal fossil fuel holdings. Whether through hedge fund, mutual fund, pension, 401k, or another private individual investment, investors should set portfolio-wide thresholds with respect to a company's future demand exposure (Carbon Tracker Initiative, 2014a). In order to better access information about risk and evaluate companies, investors must require transparent disclosure of the future demand and price scenarios used in capex investment planning (Carbon Tracker Initiative, 2014a). Investors should plan to move investments away from riskier fossil fuel companies as the planet approaches its carbon budget.

Appendix A

Figure 3

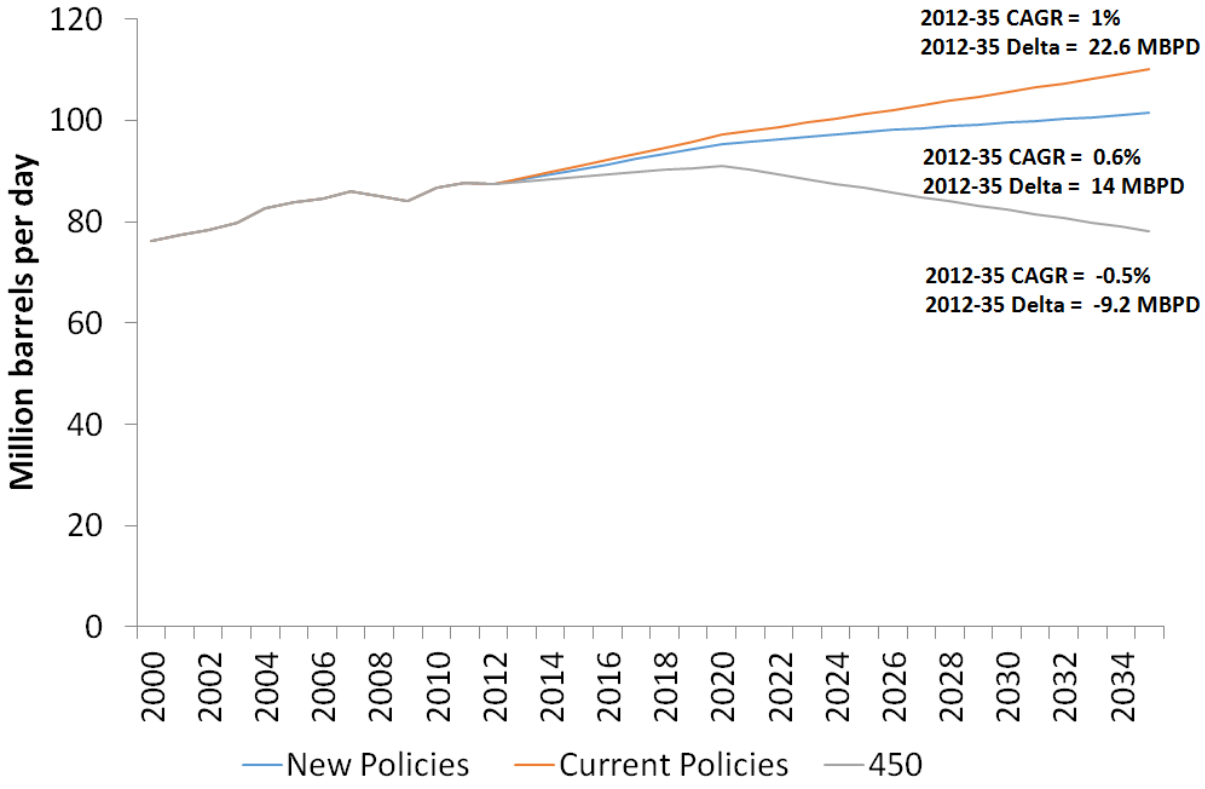
Combined Capex and production data for BG, BP, COP, CVX, ENI, OXY, PBR, RDS, STO, TOT, XOM



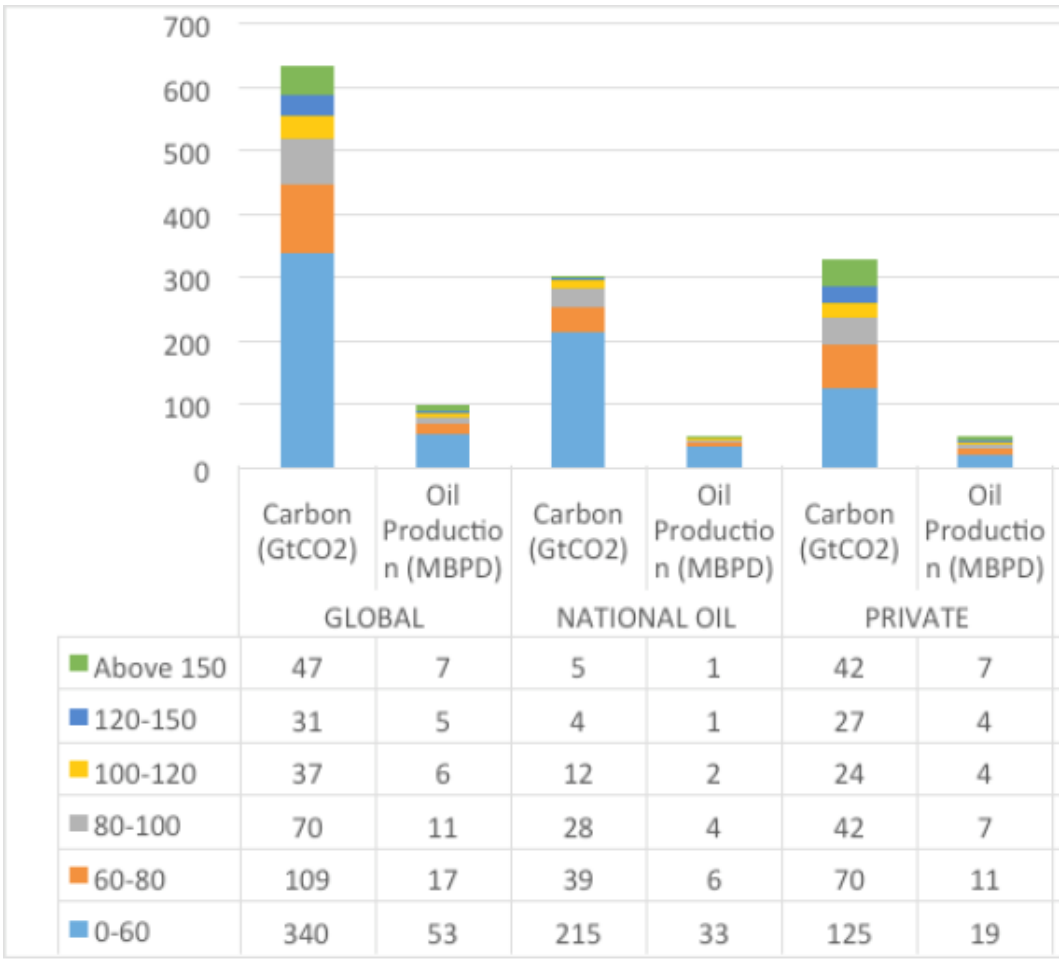
Source: Carbon Tracker Initiative (2014b) From Capex Growth to Capital Discipline? - Cost, Risk, and Return Trends in the Upstream Oil Industry. IN Carbon Tracker Initiative (Ed. Online, Energy Transition Advisors

Figure 4

EIA's Oil Demand Scenarios 2014-2035: Current Policies, New Policies Scenario, and 450 Scenario



Source: Carbon Tracker Initiative (2014a) Carbon Supply Cost Curves: Evaluating financial risk to oil capital expenditures. Online, Energy Transition Advisors.



	GLOBAL		NATIONAL OIL		PRIVATE	
	Carbon (GtCO2)	Oil Production (MBPD)	Carbon (GtCO2)	Oil Production (MBPD)	Carbon (GtCO2)	Oil Production (MBPD)
Above 150	47	7	5	1	42	7
120-150	31	5	4	1	27	4
100-120	37	6	12	2	24	4
80-100	70	11	28	4	42	7
60-80	109	17	39	6	70	11
0-60	340	53	215	33	125	19

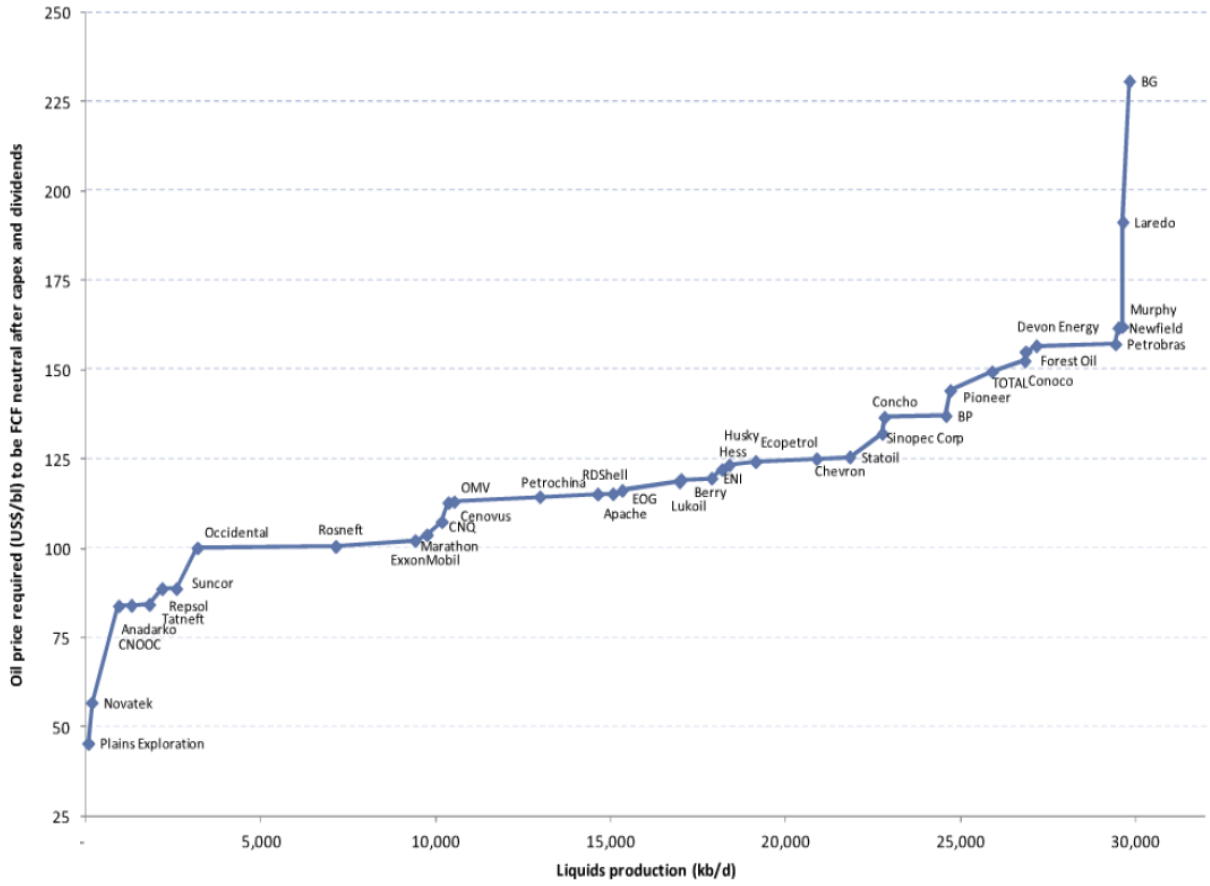
Figure 5

Carbon and Oil Production by company category and BEOP level: 2014-2050

Source: Carbon Tracker Initiative (2014a) Carbon Supply Cost Curves: Evaluating financial risk to oil capital expenditures. Online, Energy Transition Advisors.

Figure 6

Oil Price Required to be Cash Flow Neutral after Capex and Dividends by Oil Company



Source: Carbon Tracker Initiative (2014b) From Capex Growth to Capital Discipline? - Cost, Risk, and Return Trends in the Upstream Oil Industry. IN Carbon Tracker Initiative (Ed. Online, Energy Transition Advisors

Appendix B – Statistical Significance

Figure 7

P-value Table

		.INX		VGENX		AAGSI	
	SD	*t-stat*	*p-value*	*t-stat*	*p-value*	*t-stat*	*p-value*
Performance - %Δ	17.755	0.596	0.573	0.105	0.920	2.441	0.050
Performance - Risk	2.082	0.191	0.855	6.645	0.001	NA	NA

Works Cited

Berry, M. (2013) *History of socially responsible investing in the U.S.* Thomson Reuters, Online. Available http://sustainability.thomsonreuters.com/2013/08/09/history-of-socially-responsible-investing-in-the-u-s/. (accessed Oct. 27 2014).

Capelle-Blancard, G. & Monjon, S. (2012) The performance of socially responsible funds: does the screening process matter? *European Financial Management*.

Carbon Tracker Initiative (2014a) Carbon Supply Cost Curves: Evaluating financial risk to oil capital expenditures. Online, Energy Transition Advisors.

Carbon Tracker Initiative (2014b) From Capex Growth to Capital Discipline? - Cost, Risk, and Return Trends in the Upstream Oil Industry. IN Carbon Tracker Initiative (Ed. Online, Energy Transition Advisors

Copenhagen Accord (2009) Decision 2/CP. 15 Copenhagen Accord. IN UNFCCC (Ed. Online, UNFCCC.

Generation Foundation (2013) Stranded Carbon Assets: Why and How Carbon Risks Should Be Incorporated in Investment Analysis. Online, Generation Foundation

Hodel, D. P. & Deitz, R. (1994) *Crisis in the Oil Patch: How America's Energy Industry Is Being Destroyed and What Must Be Done to Save It*. Regnery, Washington, DC.

International Energy Agency (2013) World Energy Outlook 2013. Online, OECD.

International Monetary Fund (2014) World Economic Outlook Database *World Economic Outlook 2014.* Online, International Monetary Fund.

Jones, S., van der Laan, S., Frost, G. & Loftus, J. (2008) The investment performance of socially responsible investment funds in Australia. *Journal of business ethics,* **80** (2)**,** 181-203.

Kopits, S. (2014) Oil and Economic Growth: A Supply-Constrained View. Online: Center for Global Energy Policy, Columbia University - School of International and Public Policy.

Maginn, J. L., Tuttle, D. L., McLeavey, D. W. & Pinto, J. E. (2007) *Managing Investment Portfolios Workbook: A Dynamic Process*. John Wiley & Sons, Hoboken.

Mankiw, N. (2014) *Principles of Economics*. Cengage Learning, Stamford.

McKibben, B. (2012) Global warming's terrifying new math. *Rolling Stone,* **2**.

Pogue, M. (2010) *Corporate Investment Decisions: Principles and Practice*. Business Expert Press, New York.

Renneboog, L., Ter Horst, J. & Zhang, C. (2008) Socially responsible investments: Institutional aspects, performance, and investor behavior. *Journal of Banking & Finance,* **32** (9)**,** 1723-1742.

S&P Dow Jones Indices (2014) Equity - S&P 500. IN McGraw Hill Financial (Ed. Online S&P Dow Jones Indices.

S&P Dow Jones Indices and RobecoSAM (2014) Dow Jones Sustainability United States Index Fact Sheet. IN S&P Dow Jones Indices and RobecoSAM (Ed. Online, S&P Dow Jones Indices and RobecoSAM,.

Scholtens, B. (2014) Indicators of responsible investing. *Ecological Indicators,* **36** (0)**,** 382-385.

Schueth, S. (2003) Socially responsible investing in the United States. *Journal of business ethics,* **43** (3)**,** 189-194.

Stocker, T. F., Qin, D., Plattner, G.-K., Tignor, M., Allen, S. K., Boschung, J., Nauels, A., Xia, Y., Bex, V. & Midgley, P. M. (2013) Climate Change 2013. The Physical Science Basis.

Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change-Abstract for decision-makers. Groupe d'experts intergouvernemental sur l'evolution du climat/Intergovernmental Panel on Climate Change-IPCC, C/O World Meteorological Organization, 7bis Avenue de la Paix, CP 2300 CH-1211 Geneva 2 (Switzerland).

Trading Economics. (2014) *France GDP*. Trading Economies Online Available http://www.tradingeconomics.com/france/gdp. (accessed Oct. 27 2014).

van Renssen, S. (2014) Investors take charge of climate policy. *Nature Clim. Change,* **4** (4)**,** 241-242.

Vanguard Group. (2014) *Vanguard Energy Fund Investor Shares (VGENX)*. Vanguard Group, Online. Available https://personal.vanguard.com/us/funds/snapshot?FundId=0051&FundIntExt=INT. (accessed Oct. 27 2014).

Vermeir, W., Van de Velde, E. & Corten, F. (2005) Sustainable and responsible performance. *the Journal of Investing*, **14** (3)**,** 94-101.