

The Donald R. Bren School of Environmental Science and Management
University of California at Santa Barbara



Developing a Climate Leaders Investment Fund

Assessing the value of climate disclosure in the stock market

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Caitlin Crafts

Gabe Brown

Theodore Ehlert

Luna Fakhouri

Amy Kidd

The mission of the Donald Bren School of Environmental Science & Management is to produce professionals with unrivaled training in environmental science and management who will devote their unique skills to the diagnosis, assessment, mitigation, prevention, and remedy of the environmental problems of today and the future. A guiding principle of the school is that the analysis of environmental problems requires quantitative training in more than one discipline and an awareness of the physical, biological, social, political, and economic consequences that arrive from scientific or technological decisions.

The Group Project is required of all students in the Master's of Environmental Science and Management (MESM) program. It is a three-quarter activity in which small groups of students conduct focused, interdisciplinary research on the scientific, management, and policy dimensions of a specific environmental issue. The final Group Project report is authored by MESM students and has been reviewed and approved by:

Faculty Advisor Charles Kolstad, Ph.D

Dean Ernst Ulrich von Weizsäcker, Ph.D

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EXECUTIVE SUMMARY

Background

Climate change is rapidly becoming a significant factor in investment decisions on an international level and investors are increasingly concerned with the financial risks and opportunities associated with climate change. Demand is growing for investment prospects that address and mitigate these risks and/or take advantage of their corresponding opportunities while simultaneously providing competitive financial returns.

Problem Statement

To assess the potential success of such an investment product and in response to investor demand, this project investigates the relationship between a company's climate performance and its share price. We examine whether a portfolio based solely on climate performance – screened using data from the Carbon Disclosure Project – will produce financial returns that differ from the market as a whole. Our null hypothesis for the project is as follows:

H_0 : The pre-expense average monthly return over a ten year period on a portfolio screened for climate performance is the same as the return to the Market (measured by proxy using the MSCI World Index). ($r_p = r_m$)

Results not in agreement with this null will allow us to reject it and conclude that a correlation exists – positive or negative – between a company's climate performance and its stock price performance.

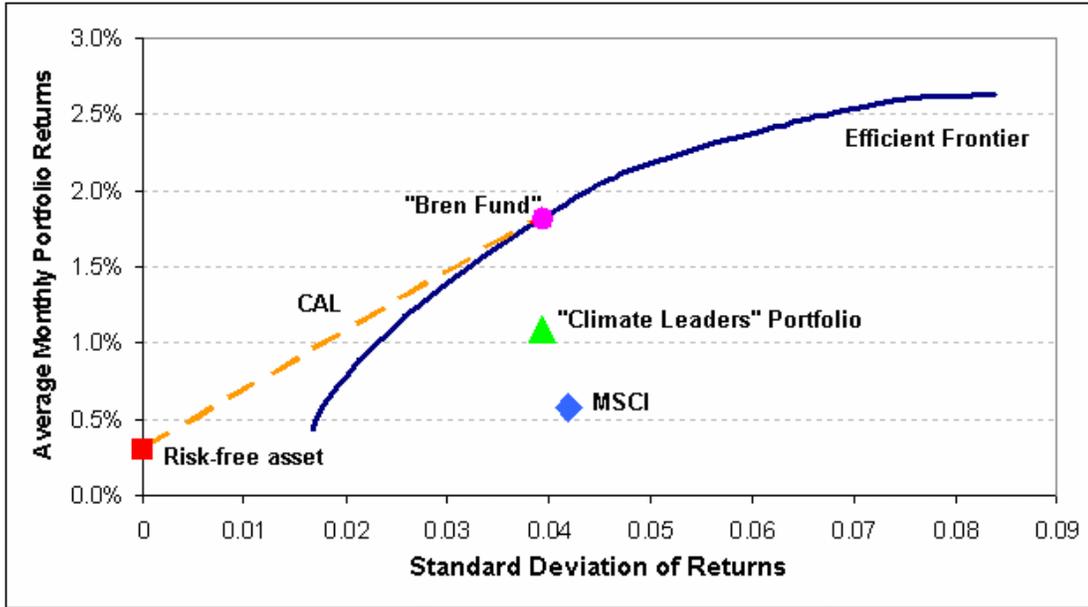
Approach

We chose the 2006 Carbon Disclosure Project (CDP) Report as our central data source, because it is the most comprehensive publicly available resource for climate performance data. The 2006 CDP provides survey response summaries and quantitative climate scores for 326 of the world's 500 largest companies by market capitalization.¹ We established a "Climate Leaders" Portfolio, consisting of every company that received a score higher than one standard deviation above the mean CDP score. We acquired monthly stock return data over a ten year period for every company in the universe, as well as for our chosen benchmark, the Morgan Stanley Capital International World Index (MSCI).

Mean monthly returns and the standard deviation of the returns were calculated for each company in the investment universe. We calculated the mean monthly return for

¹ These companies are listed on a non-commoditized index, the Financial Times FT500.

the “Climate Leaders” Portfolio using a weighted summation of monthly company returns and calculated the Portfolio standard deviation using a variance-covariance matrix. The Portfolio was optimized to create a fund that delivered the maximum return on investment over the ten-year investment horizon, which we named the “Bren Fund.” Monthly returns for the Portfolio and “Bren Fund” were regressed separately on the monthly returns for the market to derive Alphas, Betas, excess return, tracking errors, Sharpe ratios, and information ratios for one-, five-, and ten-year investment horizons.



“Climate Leaders” Portfolio Efficiency (1997-2007)

We determined the efficient frontier for the “Climate Leaders” Portfolio by maximizing mean monthly returns for a specified level of risk. As the figure above shows, the “Climate Leaders” Portfolio has a higher return on investment over ten years for a relatively equivalent level of risk, and the “Bren Fund” delivers substantially higher returns over ten years for a lower level of risk. Combining the “Bren Fund” with a risk-free security – in this case a 91-day U.S. Treasury Bill – can produce an even higher rate of return than investing in the Fund alone. The returns possible from combining these assets are plotted along the Capital Allocation Line (CAL) at varying degrees of risk. The composition of the “Bren Fund” is presented in the following figure, which includes CDP scores and the proportion of the Fund’s assets invested in each company (“Weight”).

"Bren Fund" Composition

Company	Industry	Location	Region	Weight	CDP Score
<i>Suncor Energy Inc</i>	Energy	Canada	North America	0.301	85
<i>National Grid plc</i>	Utilities	UK	Europe	0.223	85
<i>Novo Nordisk</i>	Health Care	Denmark	Europe	0.15	85
<i>Iberdrola</i>	Utilities	Spain	Europe	0.063	85
<i>Baxter International</i>	Healthcare	US	North America	0.059	90
<i>Scottish Power</i>	Utilities	UK	Europe	0.058	85
<i>POSCO</i>	Materials	South Korea	Asia	0.04	85
<i>Centrica</i>	Utilities	UK	Europe	0.032	85
<i>Siemens</i>	Industrials	Germany	Europe	0.027	90
<i>BHP Billiton</i>	Materials	Australia / UK	Asia	0.019	90
<i>Tesco</i>	Consumer Staples	UK	Europe	0.018	85
<i>EnCana</i>	Energy	Canada	North America	0.003	85

Key Findings

In the short run, our climate-focused investment strategy involves a greater risk than investing in a market portfolio. The table below shows that the “Climate Leaders” Portfolio and “Bren Fund” Betas are significantly larger than one for both one- and five-year investment horizons. Over ten years, the “Climate Leaders” Portfolio volatility is not significantly different from the market; however, the “Bren Fund” is significantly less volatile than the market. The latter finding follows the expectations for more stable returns, because the “Bren Fund” invests primarily in value stocks, as shown the preceding “‘Bren Fund’ Composition” table.

	10 Years (1997 – 2007)			5 Years (2002-2007)			1 Year (2006-2007)		
	“Bren Fund”	“Climate Leaders”	MSCI	“Bren Fund”	“Climate Leaders”	MSCI	“Bren Fund”	“Climate Leaders”	MSCI
Monthly Volatility ($\bar{\sigma}_r$)	3.95%	3.94%	4.18%	4.19%	3.71%	3.58%	3.58%	2.73%	2.07%
Monthly Return (\bar{r})	1.62%	0.84%	0.54%	1.94%	0.88%	0.72%	3.44%	2.14%	1.46%
Alpha (95% confidence)	1.10 ± 0.798%	0.242 ± 0.468%	-	1.20 ± 0.97%	-0.069 ± 0.05%	-	0.43 ± 1.75%	0.243 ± 0.711%	-
SE	3.56×10^{-3}	2.39×10^{-3}	-	4.95×10^{-3}	2.63×10^{-3}	-	8.92×10^{-3}	3.63×10^{-3}	-
t-stat	3.15	1.01	-	2.41	-0.26	-	0.483	0.66	-
p value	0.002	0.31	-	0.018	0.79	-	0.63	0.51	-
Beta	0.67 ± 0.161	1.04 ± 0.111	-	1.03 ± 0.026	1.32 ± 0.142	-	1.91 ± 0.729	1.35 ± 0.288	-
SE	8.19×10^{-2}	5.68×10^{-2}	-	1.33×10^{-2}	7.27×10^{-2}	-	3.72×10^{-1}	1.47×10^{-1}	-
t-stat	8.18	18.3	-	7.78	18.14	-	5.13	8.81	-
p value	3.71×10^{-13}	3.94×10^{-36}	-	1.28×10^{-10}	8.21×10^{-26}	-	3.25×10^{-4}	2.57×10^{-6}	-
R²	0.36	0.73	-	0.51	0.84	-	0.71	0.86	-
Information Ratio	0.139	0.198	-	0.148	0.007	-	0.228	0.125	-

Results from the Least Squares Regression – “Bren Fund” vs. “Climate Leaders” Portfolio vs. Market

“Climate Leaders” Portfolio Alphas for both one- and ten-year investment horizons, as well as the “Bren Fund” Alpha for a one-year investment, are not statistically different from zero. These Alpha values indicate that no hidden cost or premium

associated with a climate-focused investment strategy exists. However, the “Climate Leaders” Portfolio has a significant, marginally negative Alpha for the five-year period, whereas the returns-optimized “Bren Fund” Alphas for the five- and ten-year periods are significantly positive. These mixed results suggest that in the long run, our investment strategy may deliver significant, abnormal returns and beat the market by a substantial margin. Due to the lack of consistency, however, we do not feel it appropriate to make this assertion; additional study is necessary.

Conclusion

Without consistent results for portfolio Alphas, we lack sufficient evidence to reject our null hypothesis, and we conclude that no positive or negative correlation between climate performance and excess returns on investment exists. Nonetheless, our findings may provide encouragement to those who wish to invest in climate-friendly companies; apparently, they can do so without sacrificing returns, and only accepting moderately higher risk over the short-run. As neither our “Climate Leaders” Portfolio nor our “Bren Fund” are actively managed, our findings further suggest that a climate-based investment strategy differs little from any other investment approach, in that it relies heavily on the abilities of a portfolio manager to exceed expectations and generate higher returns than the market.

Recommendations for Future Research

From an investment standpoint, risks that are better understood can be more easily and effectively managed. Investor concerns about the implications of climate change on financial returns have prompted a global appeal for companies to thoroughly disclose their climate change related risks and opportunities.

Present-day market pressures resulting from climate change will have significant financial implications in the future. As the demand for publicly available climate performance information grows, we anticipate that data sources like the CDP will continually improve their climate change valuation models to address these risks. In an effort to stay abreast of the changing market landscape with regards to climate change, we recommend investors using the CDP consider the following, when making future investment decisions.

1. Long term climate performance

As future CDP reports are published, investors will be able to examine the correlation between company stock price and CDP score over a longer timeframe, as well as the correlation between a company’s climate performance and its financial performance.

2. Actual emissions intensity

The CDP score is an evaluative measure of disclosure – not of the intensity of actual greenhouse gas emissions. Investors should understand

that the levels of CO₂ emissions disclosed in the CDP are a biased view of carbon risk exposure. Investors should thus supplement the CDP with any available third party verified CO₂ emissions data.

3. Firm engagement

Many firms will find ways to benefit from climate change and thus gain an advantage over their competitors. Investors should monitor those companies that performed poorly from a climate perspective in the past, but now make greater marginal changes to their business practices compared to their competition, as a result of stakeholder engagement. Companies that improve their climate performance faster than their competition are actively mitigating their carbon risk and quite possibly their financial risk. Because the CDP is a publicly available resource, it can continually pressure firms to account for the business impacts of climate change via investor awareness.

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1 INTRODUCTION AND SIGNIFICANCE

1.1 Introduction

1.1.1 Conceptual Framework

Institutional and retail investor concerns act as an increasingly important compass for corporate action on climate change. In the last 20 years, globalization has become the driving force behind corporations' actions, while the influence of the state has become increasingly marginalized (von Weizsäcker 2006). Investor expectations exert substantial influence over companies – perhaps even more than any government regulations – and consequently serve as an ideal instrument with which to address corporate climate performance. Our project involves the creation of an investment fund of companies that demonstrate superior climate performance. Our fund will provide investment opportunities for investors concerned with the business implications of climate change and investment in our fund could act as a “reward” to companies that outperform their competitors from a climate perspective, while providing an incentive for climate performance laggards to improve.

Our project seeks to answer the following questions. First, will a mutual fund based on climate performance produce financial returns that differ from the market as a whole? Second, should a difference exist, will the returns on the fund be greater or less than that of the market? And finally, will this difference be statistically significant? Positive statistically significant returns could potentially make our fund appeal to a wide range of investors, including those who may not initially consider climate performance as a factor in their investment decisions or socially responsible investing.

Socially responsible investing (SRI) refers to an investment concept that integrates social and environmental concerns into investment decisions. Pollution prevention, human rights, and fair labor practices are just some of the causes that come under the SRI umbrella, and are used to screen companies on factors other than financial performance. Our fund, based on climate performance, would be considered a form of SRI, because SRI treats climate change as a societal risk, as well as an investment risk.

1.2 Climate Change Risks and Opportunities

A changing climate is neither a new nor necessarily alarming phenomenon. Throughout the earth's history, the climate has been in constant flux – both warming and cooling. Contemporary climate change concerns revolve not around the fact the climate is changing, but rather around the anthropogenic contribution to climate shifts (Karl and Trenberth 2003). In 1998, under the auspices of the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), an international group of world renowned scientists formed the Intergovernmental Panel on Climate Change (IPCC). The IPCC seeks to assess the

science and technical aspects of climate change in order to analyze the impacts and options for adaptation and mitigation (IPCC 2007a). The IPCC devised the following definition for climate change:

Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC 2001, 367).

In the draft of its Fourth Assessment Report (FAR), the IPCC projected that on a global average, surface air temperatures will increase between 1.8°C and 4.0°C, sea levels will rise 0.18 to 0.59 meters, and surface ocean pH will decrease by 0.14 to 0.35 units, further acidifying the world's oceans – all by the end of the 21st century. The IPCC draft report also stressed that the rate of atmospheric CO₂ increase in the past century is unprecedented – at least when considering the past 20,000 years. The IPCC's most notable conclusion, however, was that the present atmospheric CO₂ increase can largely be attributed to anthropogenic emissions of CO₂, three-quarters of which are from the burning of fossil fuels (2007b).

Though the future impacts of climate change are neither completely known nor definitively predictable, it is a global issue with impacts that will be felt on a worldwide scale. Businesses have identified the future risks and opportunities associated with climate change and are taking measures to adapt their operational practices, products, and services to account for the future impacts (Llewellyn 2007). Climate change will have a profound and potentially disruptive impact on the financial performance of companies and portfolios across sectors, markets and securities (David Gardiner 2007). In addition, from an investment standpoint, the better climate risks are understood, the better they can be dealt with – to minimize the potential impact on a portfolio through diversification, or the adjustment of valuation models. Similarly, companies better positioned to create new products and enter into the markets arising in the context of climate change may be more valuable than their poorly positioned counterparts (Innovest 2006).

1.3 Evaluating Climate Performance

Institutional and retail investors are beginning to demand deeper analyses and broader disclosure of companies' financial risks associated with climate change. The financial risks arising from climate change can be categorized into four dimensions: physical, regulatory, competitive, and reputational. Some sectors are already affected by these risks, particularly electric utilities and integrated oil and gas. Companies in these climate-vulnerable sectors are or will be exposed to GHG regulations and may be affected by future shifts in consumer demand away from carbon-intensive processes. Companies in other market sectors also struggle with the uncertainties related to the rate of global warming and resultant impacts on their operations (Innovest 2006).

In addition to presenting financial risks, climate change also creates substantial commercial opportunities. Global climate change is changing the structure of the global economy, and companies within all sectors seek to benefit from this changing structure. Companies have begun to offer energy-efficient products to mitigate their carbon emissions, thus decreasing their sensitivity to rising energy costs and future GHG regulations. Other emerging market opportunities include renewable energy providers, clean technologies, and carbon credits. Proactive companies alleviate the risks posed by climate change to their financial performance and are positioned to enjoy a competitive advantage over their more poorly prepared competitors, especially when the risks of climate change materialize (Innovest 2006).

“The Business of Climate Change,” a February 2007 report by John Llewellyn, Senior Economic Policy Advisor for Lehman Brothers, explains the benefits of capitalizing on opportunities posed by climate change and by diverting the corresponding risks. Table 1 provides his inventory of business opportunities and risks.

Table 1 Opportunities and Risks associated with Climate Change

	Opportunities	Risks
Regulatory	<ul style="list-style-type: none"> • Achieve a positive public image by engaging in environmentally friendly business practices. • Avoid regulatory compliance costs. 	<ul style="list-style-type: none"> • Suffer higher operational costs and costs associated with infrastructure changes in the short run, by proactively addressing climate issues.
Physical	<ul style="list-style-type: none"> • Prepare for natural disasters or severe weather, by creating contingency plans. 	<ul style="list-style-type: none"> • Suffer damage to operations that result from changing weather patterns.
Competitive	<ul style="list-style-type: none"> • Launch new climate-friendly products and services. • Reduce operational costs by implementing energy efficient manufacturing practices, and thus gain a competitive advantage. 	<ul style="list-style-type: none"> • Lose one’s cost advantage and market share by operating inefficiently. • Set incorrect product or service prices by failing to factor in risks and the higher costs of doing business.
Reputational	<ul style="list-style-type: none"> • Enhance community relations and public image. 	<ul style="list-style-type: none"> • Lose clients or customers. • Suffer a hostile regulatory environment.

SOURCE: Llewellyn, John. 2007. *The Business of Climate Change: Challenges and Opportunities*. London: Lehman Brothers, 63-64.

The investment community seeks evaluative tools to identify those companies implementing proactive climate change management strategies. An evaluative tool

must have the capacity to differentiate between the companies exposed to climate change risks and those in a position to seize the corresponding opportunities. The Carbon Disclosure Project (CDP) is an effective tool for the investment community to assess climate performance. The CDP, initiated in 2004, “provides a secretariat for the world’s largest institutional investor collaboration on the business implications of climate change.” It gathers reported emissions from over 1,000 companies and surveys them about their risks and opportunities related to climate change, and has consequently become the world’s largest repository of corporate greenhouse gas emissions and an appropriate evaluative tool for investors (CDP 2007).

1.4 Objectives

This project examines how a fund based exclusively on climate-related criteria will perform in the global marketplace relative to an international benchmark. We hope to determine whether such a fund would appeal to investors concerned with the business risks and opportunities associated with climate change. Should our fund provide statistically significant returns in excess of our benchmark, we would investigate the extent to which our fund and others like it might be used to influence the climate performance of global companies.

1.5 Overview of Approach

1.5.1 Defining Climate Leaders

Establishing a framework for effectively evaluation of a company’s climate performance is a fundamental element of this project. Evaluation criteria must be general enough to apply to a global set of companies, yet sufficiently focused for us to extract useful information. Overall environmental performance of companies is typically evaluated by professional research firms, such as KLD Research and Analytics and Innovest Strategic Value Advisors, as well as the academic community. In many cases, criteria used to judge environmental performance are industry-specific and preclude the analysis of companies outside these industries (Cohen et al. 1997). Where climate-related criteria have been included in screening processes, they have been only a mere subcomponent in determining an overall environmental score.

In December 2004, the Carbon Disclosure Project (CDP) launched the largest climate performance survey to date. Since its 2004 inception, the CDP has sent its survey to every company in the Financial Times 500 Index (FT500) on an annual basis. Focusing exclusively on climate change, the survey utilizes ten criteria to evaluate a company’s climate performance, including climate risk, governance, and carbon emissions. These ten criteria allow for the comprehensive assessment of a company’s climate performance – both individually and relative to its industry group (Innovest 2006). The annual results of the survey are available to the general public through the CDP website, and provide the data necessary for constructing a portfolio of climate leaders.

Responses to the CDP questionnaire were compiled by Innovest Strategic Value Advisors, an investment research and advisory firm. Innovest assigned numerical scores to each company's responses to create a "Climate Leaders Index" (CLI). The CLI comprises the companies that obtained the highest scores within their industry groups. Our project uses CDP scores as the basis for our rankings.

1.5.2 Addressing Limitations

Because our climate-focused investment fund would fall under the umbrella of SRI, it faces many of the same limitations as SRI funds. One of the major critiques of SRI is that it relies heavily on highly selective and not easily quantifiable information. SRI also faces the difficulty of selecting which criteria best determine the extent to which a company meets a social objective. A common SRI approach, exclusionary screening, involves screening large indexes, such as the S&P 500 or the MSCI World Indices to exclude companies that participate in "socially undesirable" industries, namely alcohol and tobacco production, weapons manufacturing, adult entertainment, and gambling. Exclusionary screening does not assess the internal workings of individual companies, rather only the industries in which they operate. Other screening techniques use actual performance measures like compliance history, for example, fines based on waste management violations (KLD 2002). Screening criteria are to varying degrees subjective, and may not take all factors relevant to a specific social or environmental issue, into account.

Skeptics argue that companies performing well in one social or environmental category may under-perform in another; as a result, their level of sustainability or social responsibility may be misrepresented or inflated. In 1996 for example, Odwalla Inc., a California based juice company, received high marks from KLD for its socially responsible practices, and was included in its Domini Social Index.² Later, Odwalla was found criminally negligent in the death of a child who drank apple juice contaminated with bacteria as a result of the company's poor health and safety practices (Entine 2003).

Because the companies themselves provide much of the information used for their individual assessments, determining a company's level of social responsibility is notoriously viewed as difficult and controversial. Company responses to specific survey questions range widely – from varying interpretations of questions themselves to the substance of the answers. In addition, standards for auditing such information are either limited or completely nonexistent. Reporting protocols, such as the Global Reporting Initiative (GRI), may indicate the types of data that must be disclosed, such as water use or energy consumption but do not address the verification of these measurements (GRI 2006).

² The Domini Social Equity Index Fund, now known as the Domini Social Equity Fund, is a diversified large cap equity fund managing \$1.5 billion in assets. It is screened on the basis of social and environmental standards, and seeks to avoid companies involved with tobacco, alcohol and gambling (Domini Social Investments 2006).

Progress has been made in defining assurance standards for environmental and social reporting data, such as the creation of the *AccountAbility AA1000 Assurance Standard* (ISEA 2006) and the *ISO 14064 Standards for Greenhouse Gas Accounting and Verification* (ISO 2006). These standards, however, are designed either for a company's internal use or to attest to the accuracy of published sustainability reports and thus do not directly address information obtained from survey responses. Accordingly, the analysis of company responses must often be taken at face value, because in the absence of from follow-up inquiry with the companies themselves, scores are based entirely on unverified information.

Because our fund is derived from the Financial Times 500 Index (FT 500) and focused solely on the issue of climate change, we can address several of the concerns mentioned above. The FT 500 consists of the world's 500 largest companies based on market capitalization. As it is non-exclusionary, companies are not disqualified based on their industrial classifications. Neither the CDP nor our project refers to any of the analyzed companies as either "socially responsible" or "sustainable." Such a distinction would require the assessment of numerous operational components of a company and suffer the pitfalls described above. Our project instead relies on the CDP's determination of "climate leaders." The CDP uses a robust set of criteria to evaluate climate performance; these criteria were chosen based on research conducted by Innovest Strategic Advisors Inc., as well as on feedback from CDP signatories and individual investors.

Our analysis of climate performance ultimately relies on data derived from the CDP questionnaire. Raw overall scores, as well as individual category scores are based solely on voluntary company responses and as such are subject to the interpretation of a reviewer. Rather than reexamine the over 300 detailed responses to the CDP questionnaire, we have elected to use the scores assigned by Innovest, based on its use of a predetermined scoring methodology that includes scoring guidelines for each criterion (Innovest 2006). Innovest's methodology provides an effective means for scoring disclosure among companies from different industries and geographic locations.

2 BACKGROUND

2.1 Socially Responsible Investing

Socially responsible investing is a strong and growing force in the global investment industry. According to the Social Investment Forum, in the United States alone, more than ten percent of assets under professional management – a total of \$2.29 trillion – are involved in a socially responsible investment (2006, 1).

Socially Responsible Investment (SRI) refers to an investment strategy that integrates social and environmental concerns into the construction and management of investment portfolios. SRI investors, both retail and institutional, seek to align their investment portfolios with their value systems by avoiding investment in companies that fail to meet certain social or environmental standards. These investors thereby encourage socially and environmentally responsible business practices. Through the analysis of social and environmental factors, specifically those that impact the bottom line, socially responsible investors can identify companies they believe have superior long-term financial performance.

2.1.1 History of SRI

The Social Investment Forum, a non-profit membership organization that aims to promote SRI, suggests that though the origins of SRI can be traced back hundreds of years to Jewish, Christian, and Islamic traditions, it was first formally practiced in colonial America by the Quakers and Methodists. Quakers and Methodists avoided investing in “sinful” companies – those involved in gambling or the production of alcohol or tobacco. More recently, however, SRI’s roots can be traced back to the civil rights campaigns of the twentieth century and especially to the politically heated 1960s. During the 1960s, social and environmental movements raised public awareness and shaped the public’s perception of corporate responsibility. In 1969, the Council on Economic Priorities became the first organization to rate companies’ social and environmental performance for the purpose of providing an evaluative tool for social investors (Social Investment Forum 2003).

Changes in social awareness and social concerns continue to guide the focus of SRI strategies. In recent years, incidents such as the Chernobyl disaster and the Exxon Valdez oil-spill have made environmental concerns a main focus of SRI decision-making. With the recent increase in information about global warming, mounting support for the Kyoto Protocol, and the devastation caused by severe weather events like Hurricane Katrina, global climate change’s importance in SRI strategies is growing.

SRI is predicted to experience substantial growth in the next decade, as investors increasingly include the analysis of non-financial issues such as climate change into the investment process. In addition to the conventional environmental risks associated with pollution, many investment analysts and fiduciaries now evaluate the risks associated with broader environmental concerns, namely, global warming (Strandberg

2005). Our project aims to determine the value added to a firm by disclosing its climate change related risks and opportunities by comparing the average monthly returns of a fund of companies with superior climate performance to the average monthly returns of a benchmark index.

2.1.2 Mechanics of SRI

The SRI process fundamentally requires the evaluation of business practices. Of the various evaluation strategies, “screening,” the practice of including, excluding, or evaluating publicly traded securities of companies on social and/or environmental criteria, is the most widely implemented. Screening identifies those companies that meet or exceed certain standards of corporate management or that stand out as an industry’s “best-in-class.” Some screening methods exclude certain securities from investment consideration altogether – such as those involved in the production of alcohol, tobacco, and firearms; positive screening, on the other hand, actively supports companies whose social and environmental records are consistent with positive corporate citizenship (Social Investment Forum 2003, 4). SRI managers often overlay a qualitative analysis of corporate policies, practices, and impacts onto the traditional quantitative analysis of profit potential. SRI managers also implement weighting schemes, such that specific companies or industry sectors demonstrating superior social or environmental performance enjoy a greater presence in their investment portfolios. These techniques enable social investors to identify appropriate investment opportunities.

2.1.3 Corporate Social Responsibility and Corporate Financial Performance

The growing momentum behind the SRI movement suggests that it will soon become a mainstream practice in the financial world. However, as the popularity of these funds increases, one central question remains unresolved by theoretical and empirical research, as well as by stakeholder consensus: how does the concern for “ethical” issues affect financial returns on investment portfolios?

Nobel laureate economist Milton Friedman long opposed the notion of corporate social responsibility. Maintaining that the only “social responsibility” of businesses is to maximize profits within the bounds of the law, Friedman rebuffed the very motivation behind SRI strategies (1970). Consequently, scholars have scrutinized his arguments to determine whether profit maximization and social performance are in fact mutually exclusive. The relationship between a company’s corporate social performance (CSP) as a measure of corporate social responsibility and its corporate financial performance (CFP) has been extensively researched; with a high degree of certainty, the literature concludes that a positive association exists.

Margolis and Walsh documented thirty years of empirical studies on the relationship between CSP and CFP. Their meta-analysis of 127 studies conducted between 1972 and 2002 reveals a positive correlation (2003). In addition, the meta-analysis of 52 studies from 1972 to 1997 conducted by Orlitzky and Rynes suggests that positive corporate social and environmental performance will likely “pay off” (2003). These

studies strengthen the argument that social responsibility is compatible with increased profits and thus creates value for stockholders.

2.1.4 SRI Funds and Financial Performance

Mounting evidence suggests a positive correlation between an individual firm's CSP and CFP; however, a portfolio of SRI-compatible company shares may not necessarily provide superior financial returns relative to their conventional investment counterparts. Compared to conventional funds, SRI funds have limited investment opportunities. Non-SRI funds may hold shares in any company – including those that are socially responsible. Therefore, conventional investment funds have the same opportunities as SRI funds to benefit from any superior financial performance by socially responsible companies. As a result, conventional funds should expect higher returns than SRI funds. Empirical research, however, shows that SRI funds follow market trends just like their non-SRI counterparts.

Studies of US and European SRI retail funds have found little evidence that they over- or under-perform the market. One study of 60 European funds found no difference between the performance of ethical and non-ethical funds (Kreander et al 2002). Hamilton and Statman examined the relative (risk-adjusted) returns of socially responsible and conventional portfolios and employed Jensen's Alpha³ to test the investment performance of 17 SRI mutual funds from 1981 to 1990. They found that SRI mutual funds did not earn statistically significant excess returns and that SRI mutual fund performance was not statistically significantly different from the performance of conventional mutual funds (1993). A similar study by Statman that compared the returns of SRI funds to conventional funds reported that socially responsible mutual funds performed better than conventional funds of equal asset size, though the difference was not statistically significant (2000). A 2003 study of 103 German, UK and US ethical mutual funds found no evidence of significant differences in risk-adjusted returns between ethical and conventional funds for the period between 1990 and 2001 (Bauer et al 2005). Finally, a recent study by Mill that investigated a specific fund's transition over time from conventional investment objectives to SRI principles found no evidence linking the adoption of SRI principles to a significant change in mean risk-adjusted returns relative to its benchmark index (2006, 132).

Although SRI research may seem comprehensive, empirical research has not yet directly addressed “climate-friendly” funds. Because the development of any such products has been relatively recent, sufficient data are not available for an adequate study. An assessment of the financial returns on a “climate-friendly” fund may actually produce considerably different results than those of previous studies, as global climate change has material impacts on businesses and is associated with specific material risks.

³ Jensen's Alpha is the difference between actual portfolio returns and the expected returns predicted by the CAPM (see 2.2.4 for more information).

2.2 Financial Dimensions of Constructing a Fund

2.2.1 Finance Theory and Equity Markets

Financial assets include stocks and bonds, which differ in their associated levels of risk and return. Unlike real assets, financial assets are not tangible, but are rather claims to shares of cash flows generated from real assets. Shares of stock are claims to uncertain future cash flows generated by a firm; therefore, the level of risk obtained by purchasing shares of stock relative to other assets is higher for a given level of return (Bodie et al 2005). So long as uncertainty exists, so too does the potential to gain or lose money by investing in stocks. Investors want to minimize the likelihood of losing money – regardless the risk and maximize positive returns for their preferred level of risk. In order to achieve these goals, however, investors must overcome problems of incomplete information to reduce uncertainty.

The share price of a stock, when multiplied by the total number of shares available to the stock market, is the best estimate of the present value of the firm (Bodie, Kane and Marcus 2005). The market continually reevaluates the value of the firm as additional information becomes available to investors about it and how it may be affected by future states of the world. Such revaluations manifest themselves in changes in share price. The opportunities to make money in stock markets lie in these price changes and more specifically, in the ability to predict these changes before the market. Once the market has the information, however, the opportunity is lost.

Incomplete information in pricing shares of stock is a form of market failure. Perhaps the most well-known example of market failure is the neighborhood effect generated by environmental pollution, also called an externality. As information about the existence, cost, and distribution of neighborhood effects is attained, the external costs are internalized by the market. In the case of greenhouse gases, those firms unprepared for regulation may face higher future taxes and business costs, while those adopting innovative solutions to address climate change risks may enjoy greater opportunities. The ability to predict which firms face costs and which face potential opportunities and to estimate the effect on share prices is particularly valuable to investors.

2.2.2 Portfolio Theory: Risk, Return, and Diversification

Investors rarely purchase the stock of one company alone, instead opting to purchase bundles – or portfolios of stocks. The rationale for buying stocks from several companies is simple: a diverse portfolio achieves a higher rate of return for a given level of risk (Bodie, Kane and Marcus 2005). Figure 1 demonstrates the principle of diversification by plotting the efficient frontier for a specific risky asset and a capital allocation line for the combination of this risky asset with a risk-free asset. An investor buying a risky asset alone is constrained by the efficient frontier; an investor buying both a risky and risk-free asset is constrained by the capital allocation line (CAL). Investors earn a higher rate of return at all levels of risk by investing on the CAL: the difference between the efficient frontier and CAL at a specific level of risk

is the benefit of diversification.⁴ Fundamentally, this increased efficiency is achieved through the addition of a risk-free asset, because this asset eliminates a degree of uncertainty and risk for a given rate of return.

2.2.3 The Capital Asset Pricing Model

The original two-factor Sharpe model, a method for pricing risky assets first developed in 1964, has since expanded to a four-factor model (Sharpe 1964; Jensen 1969; Fama and French 1993). The Capital Asset Pricing Model (CAPM) represents a significant breakthrough, because it provides a systematic method for modeling a random variable, stock returns. Because the CAPM is extremely important to finance and modern portfolio theory, it has been rigorously tested and critiqued. Analysis of long-term risk-return data has consistently supported the results predicted by Sharpe's two-factor CAPM and indicates that it predicts excess returns with near perfect correlation; we therefore rely upon it in our analysis (Sharpe and Cooper 1972; Black, Jensen and Scholes 1972).⁵

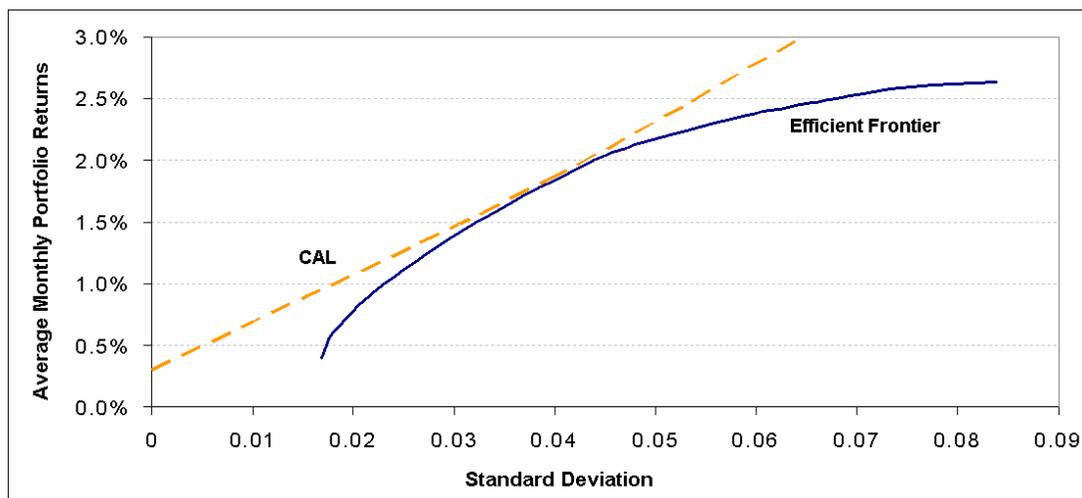


Figure 1 Sample Efficient Frontier and Capital Allocation Line

NOTE: A 91-day T-Bill provides the monthly risk-free rate of return, $R_f=0.3004\%$.

2.2.4 CAPM Explained

The principle component of the Sharpe CAPM is Beta (β) (see Equation 1), which is unique to each asset or portfolio. Beta aids the investor in comparing the risk-return ratio of his or her investment by measuring the relative volatility of the portfolio to the stock market, or the percent change in the portfolio return (R_P) for a one percent change in the market return (R_M). A portfolio may be perfectly correlated with the market ($\beta=1$) or perfectly uncorrelated with the market ($\beta=0$); it may be more volatile than the market ($\beta > 1$) or less volatile than the market ($\beta < 1$) (Sharpe 1964;

⁴ The monthly risk-free rate of return, $R_f = 0.3004\%$, is calculated from the mean monthly yield to 91-day U.S. Treasury Bills from 01/1997 to 01/2007.

⁵ For additional discussion of the CAPM, including some critiques of its approach to residual risk, please refer to Douglas (1968), Fama and McBeth (1973), Black and Scholes (1974), Stambaugh (1982), Elton and Gruber (1987), Fama and French (1993) and Carhart (1997).

Sharpe et al 1972; Bodie et al 2005). Equation 2 shows what Beta quantifies, the covariance of the portfolio returns with the market returns as a fraction of the total variance of the market returns.

We also analyze the portfolio Alpha (α) to measure the excess return on an investment above or below what the asset's Beta predicts. Alpha is specific to a portfolio manager and different investment styles can earn a range of Alphas on the same portfolio. The most precise method of applying the CAPM is a regression of portfolio returns on market returns. In the regression output, the slope of the regression represents portfolio Beta and y-intercept represents the portfolio Alpha. Alpha is zero when the excess returns are exactly predicted by the CAPM and accordingly, a non-zero Alpha is referred to as an abnormal return (Jensen 1969).

Equation 1 Capital Asset Pricing Model

$$R_p = \alpha + \beta \cdot R_M + \varepsilon_p$$

Equation 2 Beta

$$\beta = \frac{\sigma_{PM}}{\sigma_M^2}$$

2.2.5 SRI's added Value to Investment Products

Portfolio managers frequently boast the ability to deliver a positive alpha, because it suggests they and/or their investment strategies have the unique ability to produce market-beating returns. Any insight that may identify opportunities for abnormal returns and hence produce a positive alpha attracts significant attention and numerous research efforts. Despite mixed results, studies that correlate return data with “extra-financial” corporate performance – referred to as “corporate social responsibility” – continue to search for trends that predict superior excess returns. This project tests whether an investment strategy based upon climate change risk can deliver a positive alpha.

The principle theory behind SRI is that extra-financial screens applied in investment decisions can mitigate present market failures. If an investor believes that a high-polluting company will be taxed or penalized in the foreseeable future, its stock is likely presently overvalued. Given the current political climate, the majority of social investors – and perhaps all investors – believes that a carbon tax may be levied in the near future. Should such a tax materialize, the value of high-risk companies and their share prices will decline. Likewise, other high-opportunity companies will expand their market shares and the value of their stocks will increase.

Social investors make their investment choices to capture a social dividend – the knowledge they are investing in a company that shares their values; however, few social investors are willing to sacrifice financial returns and many hope to increase their returns by making such choices. The promise of added value from these social

screens is an integral part of the attraction to SRI products and is an issue not yet resolved. An investment strategy based on climate change hopes to provide investors a positive alpha by identifying the companies that have the highest risks and greatest opportunities in a carbon-constrained world. Whereas our portfolio invests only in those companies that appear to have the greatest opportunities, a savvy investor would invest in both high-risk and high-opportunity stocks to maximize returns. This strategy, however, may contradict the values of most social investors, and is not a practical approach for this project.

3 DEMAND FOR A CLIMATE-FOCUSED INVESTMENT FUND

3.1 Global Appetite for SRI

3.1.1 North America

Socially responsible investing has become a powerful market force in the last decade. Between 1995 and 2005, total SRI assets outgrew the entire universe of managed assets in the United States. According to the Social Investment Forum, SRI assets grew 258 percent – from \$639 billion in 1995 to \$2.29 trillion⁶ in 2005; in contrast, total managed assets increased by only 249 percent in the same period to \$24.4 trillion (2006, iv). These figures form the foundation for the oft-touted assertion that ten percent of actively managed funds in the US are involved in SRI. This claim, however, has been disputed on the basis that the Social Investment Forum’s definition of SRI is too general. According to its definition, any institution, investment manager, or individual that screens for anything in a formal process – including accounting issues, board makeup and pension liabilities – could be considered engaged in SRI (Entine 2003 361).

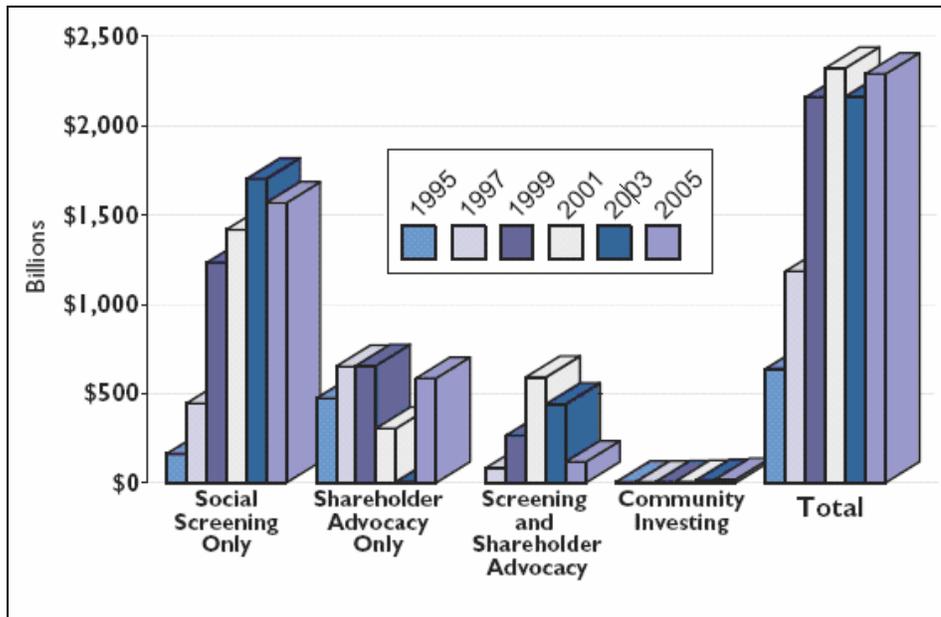


Figure 2 Socially Responsible Investing in the United States, 1995-2005

SOURCE: Social Investment Forum 2006, 2

NOTE: Social screening includes mutual funds and separate accounts

Though the total value of socially responsible investment in the United States may be inflated, the presence of a market demand for these types of products remains strong.

⁶ The Social Investment Forum defines SRI investment as any managed investment using one or more of the following investment strategies, including screening, shareholder advocacy and community investing.

Table 2 shows the amount of capital allocated to socially responsible investment in the United States among the eleven largest SRI funds. The world's largest families of socially screened investment funds, the Ariel, Pax World, Domini and Calvert, control over \$11 billion in assets and account for six percent of the total SRI mutual fund market in the United States. Six percent may appear unimpressive, but this group of families at its current value would have comprised 92 percent of total SRI fund investments a decade earlier (Social Investment Forum 2006). The dramatic growth of SRI funds within the United States between 1995 and 2005 illustrates the strong market for these types of funds.

Table 2 Ten Largest SRI Funds by Total Assets

Fund Name	Inception Date	Total Assets (millions)
Ariel Fund	November-86	\$4,200.00
Ariel Appreciations	December-89	\$2,800.00
Pax World Balanced	August-71	\$2,209.16
Bridgeway Ultra Small Company Market Fund	July-97	\$1,166.44
Domini Social Equity A	June-91	\$1,104.15
Calvert Social Investment Equity A	August-87	\$937.57
Calvert Large Cap Growth A	October-00	\$927.05
Parnassus Equity Income Fund	September-92	\$828.50
CRA Qualified Investment	August-99	\$736.42
Neuberger Berman SRI	March-94	\$579.74

SOURCE: Social Investment Forum 2007

The Canadian Social Investment Organization (SIO) estimated that as of June 30, 2004, \$48.7 billion⁷ were classified as managed under socially responsible guidelines in Canada, up 27 percent from 2002. Retail funds experienced the sharpest increase in assets in the same time period (2002 to 2004), rising 48 percent to \$11.01 billion. Investments controlled by asset managers employed by private investors also increased markedly, up 27 percent to \$15.78 billion. As in the US, institutional investors hold the largest share of SRI assets at \$18.92 billion; however, they showed the smallest percentage increase from 2002, only five percent. The SIO further estimated a marginal increase in SRI's share of total mutual fund and institutional assets, from 3.3 percent in 2002 to 3.6 percent in 2004 (2004, 5).

3.1.2 Europe

European Union countries exhibit a strong demand for SRI products. Total retail SRI investment grew over 40 percent between mid-2005 and the second quarter of 2006, from €24.1 billion to €34.0 billion.⁸ A portion of this increase can be attributed to positive market performance; however, many European asset managers now view SRI as a competitive strategy and are more aggressively marketing these products.

Growth of SRI assets differs to a large extent among EU countries. France, for example, experienced a 272 percent increase in SRI assets from 2004 to 2006, as a result of the launch of three large funds, the AGF Euro Actions, Natexis ISR Obli

⁷ Canadian dollars have been converted to US dollars.

⁸ Numbers do not include private or institutional portfolios.

Euro Moyen Terme, and AGF Valeurs Durables. The AUM of these three funds combined equals €1,923 million. Belgium and Switzerland have also seen large gains in SRI assets, 173 percent and 156 percent, respectively. Other EU countries, in contrast, have experienced only modest gains, such as Austria, where SRI assets grew only 38 percent (Avanzi 2006).

Discrepancies in the asset types found in European portfolios exist as well. In Sweden and the UK for example, equity funds are the predominant investment vehicle, whereas in Austria, fixed income securities are the more popular option. These discrepancies demonstrate that certain markets may be more receptive to an equity based product, such as a carbon conscious mutual fund or an ETF, than others. Understanding these trends may prove useful in determining which SRI vehicles will be successful in different countries.

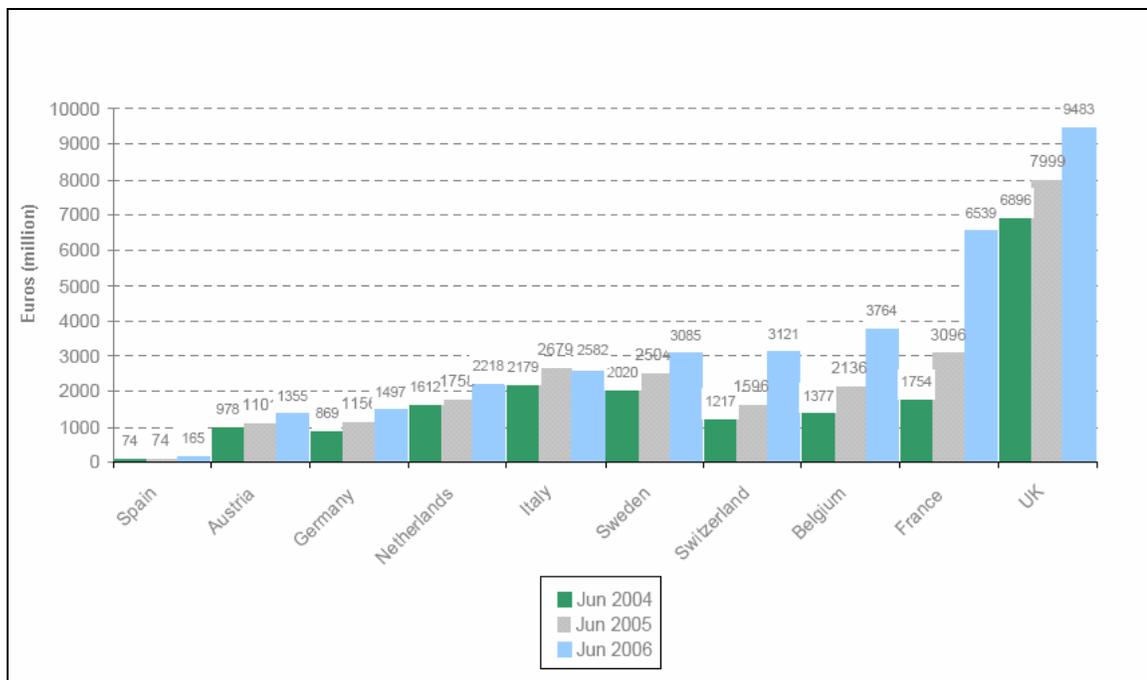


Figure 3 SRI Fund Assets per Country in the European Union as of June 30, 2006

SOURCE: Avanzi SRI Research 2006, 8.

3.1.3 Asia and Australia

Asia and Australia

Japan holds the largest market for SRI in Asia due to its popular Nikko-ECO Fund, which amassed one billion dollars in its first six months of operation. More than ten other funds exist with combined AUM of approximately \$600 million. With six SRI funds, Hong Kong has the second largest market for SRI in Asia. While India, China and Indonesia show promise for SRI, individual wealth in these three countries is small and investment opportunities are limited. Economic expansion and environmental degradation in the region over the next decade, however, may greatly increase SRI demand in response to the environmental issues that countries with large populations will face (Finneren 2005).

Though nowhere near as size of its US and European counterparts, the Australian SRI market is growing rapidly. Between 2000 and 2006, total assets under SRI managed portfolios grew an incredible 3,587 percent, from \$325 million to \$11.98 billion. The Local Government Superannuation Services and Hunter Hall manage the largest of these funds, which have \$2.41 billion and \$1.66 billion in AUM, respectively (EIA 2006).

3.2 Appetite for Climate-Focused SRI

Investors can generally be classified into two groups, retail and institutional. The first group, retail investors, represents small net worth individuals who invest on behalf of themselves or a small group. The second group, institutional investors, consists of large entities that invest relatively large sums of money on behalf of others, such as pension funds, corporations, churches, and charities. The second group also includes high net worth individuals, whose investments are actively managed by a third party, as well as other private equity operations, including venture capital.

The increase in public awareness of global warming and its consequences has piqued the interest of both types of investors in the climate performance of companies and the climate risk associated with potential investments. CalPERS, for example, California's largest pension, invested \$500 million in environmentally friendly companies through the use of screened funds in 2005, in response to a mandate by state treasurer, Phil Angelides (Sterlicchi 2006).

A strong interest in climate-related issues also exists among European institutional investors. The Institutional Investors Group on Climate Change (IIGCC), for example, is a "forum for collaboration between pension funds and other institutional investors on issues related to climate change" whose membership includes 31 pension, insurance, and trust managers. These members manage €2.5 trillion in assets, but this total is not entirely SRI (IIGCC 2006). The group's main purposes are to promote better understanding of climate risk among member investors and to help the markets and companies in which they invest address material risks and opportunities posed by climate change.

Howard Pearce, head of England's Environmental Finance and Pension Fund Management Environment Agency, recognizing the relationship between climate risk and potential pension fund performance, stated:

To fulfill their fiduciary duty to protect the interests of current and future beneficiaries of pension funds – increasingly trustees will need to encourage and select asset managers who take greater account of environmental risks (like climate change) in their investment processes such as sector/stock selection and, weightings than hitherto (Gribben et. al 2006, 5).

The 2006 Thomson Extel and UKSIF SRI-Extra Financial Survey further highlighted the increased focus on climate issues in the investment process. The results of this survey indicate that environmental concerns – and specifically climate change – are the most important SRI screening factors from the perspective of both buy-side and sell-side investment firms. When asked to rate the importance of several types of SRI/financial data on a scale from one to five (with five as most important), firms scored environmental information highest, at an average of 4.41. When asked which environmental factor was most important, the surveyed firms rated greenhouse gas emissions highest, at an average of 4.57. The detailed results of the Thomson Extel/UKSIF survey are presented in Figure 4. The findings from the survey demonstrate that institutional investors are both aware of and concerned with the risks to their investments posed by climate change (Thomson Extel 2006).



Figure 4 Rating the Importance of Environmental Data in the Investment Decision Process
SOURCE: Thomson Extel/UKSIF 2006, 24.

In January 2006, the Civil Society Institute and Ceres released a joint study on mutual fund investors’ attitudes towards climate change (Opinion Research Corporation 2006). The two groups surveyed 2,034⁹ adults via telephone and found that mutual fund investors overwhelmingly consider climate change an important investment concern. Roughly 70 percent of mutual fund investors surveyed stated that they wanted their mutual funds to screen companies “linked to global warming” and to “support shareholder resolutions calling on companies to address climate change issues.” Seventy-four percent of the mutual fund investors surveyed replied that they wanted “mutual funds to ask questions about the potential impact of global warming on the companies in which [the mutual funds] are investing [their] money.” Seventy-one percent of the survey respondents claimed that they would not “invest directly in a company that is a major source of pollution linked to global warming, whether from its operations or the products it produces.” Finally, 79 percent of the investors surveyed asserted that companies should “analyze the long-term financial impacts

⁹ 2034 represents the initial population sample, from which many were excluded after the first survey question, “Do you hold shares in a mutual fund, either directly or indirectly?” Findings and graphs are based on an actual investor responses where N=845.

that global warming will have on their businesses and on the potential value of their stock to people who either own shares directly or indirectly through a mutual fund.” The results of this study illustrate that retail investors are interested in mutual funds that consider climate issues as part of the screening process.

3.3 Evolution of Green Funds to Include Climate Change Analysis

As information on corporate behavior has become more readily available, social investors have found more reasons for divestment. New social investors added their lists of concerns to that of the established SRI community, which led to the development of SRI funds with multiple exclusionary principles. However, because not all social investors share the same set of general concerns, products applying a more narrowly focused set of screens to their investment decisions were launched. “Green funds,” which base their investment strategy solely on environmental issues, are one of these types of narrowly focused funds. Green funds offer the opportunity to invest in environmentally conscientious companies without making concurrent judgments irrelevant to the green investor. For example, an investor who does not wish to invest in high-polluting companies does not necessarily want to divest from tobacco and alcohol companies. Thus, green funds allow investors to buy their “green dividend” without sacrificing investment in companies engaging in traditionally SRI-excluded businesses.

Recent empirical evidence supports the idea that focused SRI products add value to investments, and suggests that they may deliver stronger returns than general SRI mutual funds. Results from a recent study that analyzed average SRI mutual fund returns in correlation with the number of social screens applied by the fund indicated that an optimal range of social screens does exist, five to seven per fund. The financial performance of funds within this range mimicked the Laffer curve, where returns are optimized with an intermediate number of screens. These results suggest the following: too few screens limit investments to one sector of the market and expose them to additional risk, and too many screens constrain the universe severely across all sectors. Ideally, green funds and other narrowly focused funds apply just enough screens to deliver a social dividend, yet not enough to constrain investment opportunities and negatively impact, returns (Barnett and Salomon 2006).

3.4 Existing Green Fund and Climate-Focused Funds

2006 was reportedly the year of green investing; not only did it become more mainstream, it “caught on like wildfire,” with the launch of several new green funds and green indexes. This green investing boom has been attributed to shifts in investor consciousness brought on by the increased media presence of environmental issues, namely climate change (Baue 2007). Green-minded investors have two main choices: environmentally friendly companies and environmental problem-solving companies. Companies that employ people to probe their environmental impact are continuing to be associated with good corporate management, something investors take into account when making their investment decisions. On the other hand, investing in

companies that provide solutions to environmental problems is also increasing. Investment in alternative energy companies is gaining momentum as the number of funds focused on these companies steadily increases (Baue 2006a). Some investors even view the risk of new energy technology companies as decreasing, because many are “underpinned by generous government subsidies” (Moore 2006, 2). New and smaller companies are also viewed upon favorably compared to their larger counterparts, because they are believed not to have “picked up on the[ir] bad habits” (Harper 2006, 99). The following funds represent the most prominent green funds and illustrate both investor options mentioned above.

3.4.1 Green Century Equity Fund

The Green Century Equity Fund is based on the Domini Social 400 Index and invests most heavily in the financial, healthcare, information technology, and consumer discretionary sectors (Green Century 2006). The fund operates under the philosophy that well-managed companies that demonstrate environmental responsibility minimize their environmental risks and thus enjoy a competitive advantage. Environmental costs and liabilities should be lower for these companies, while their products are expected to be of higher quality; as a result, they should experience enhanced profits. Green Century categorizes companies by their levels of environmental performance and invests only in those that are proactive, responsible, benign, or the best-in-class. Only firms that are environmentally neutral or better in the following categories may be members of the fund: waste management and disposal, emissions, non-compliance, and product and service performance.

Green Century Capital Management assumes that these kinds of companies place a high priority on ethics and will be able to retain the trust of their shareholders. In the last ten years, the Equity fund has underperformed its benchmark, the S&P 500 (Green Century 2006).

3.4.2 Winslow Green Growth Fund

Launched in May, 1994, the Winslow Green Growth Fund is a small cap growth mutual fund that invests in clean technology companies, green sectors, renewable energy, and natural foods (Winslow Management 2006b). The sector breakdown of the fund is given in Figure 5.

The objective of this fund is capital appreciation through “environmentally responsible investing,” which Winslow Management defines as investing in companies that “provide environmental solutions or benefits; or in companies that operate responsibly with respect to the environment.” These companies should enjoy competitive advantages from “cost reductions, quality improvements, profitability enhancements, and access to expanding and new growth markets.” The fund is comprised of companies whose shares are deemed “reasonably priced” and “exhibit the potential for superior growth” (Winslow Management 2006c, 2-3).

The Winslow Green Growth Fund is unique, in that its manager was ranked number one in aggressive growth in 2006 by the Annual Baron’s/Value Line mutual fund

manager survey. The scoring for this award was based on how much risk-adjusted value managers added relative to their competitors with the same value line investment objective. Jack Robinson, the lead manager, said his strategy is to find “hidden opportunities among the small companies in these market niches – companies that appear poised for rapid growth, or companies whose stocks are unrecognized by the broader market” (Winslow Management 2006a).

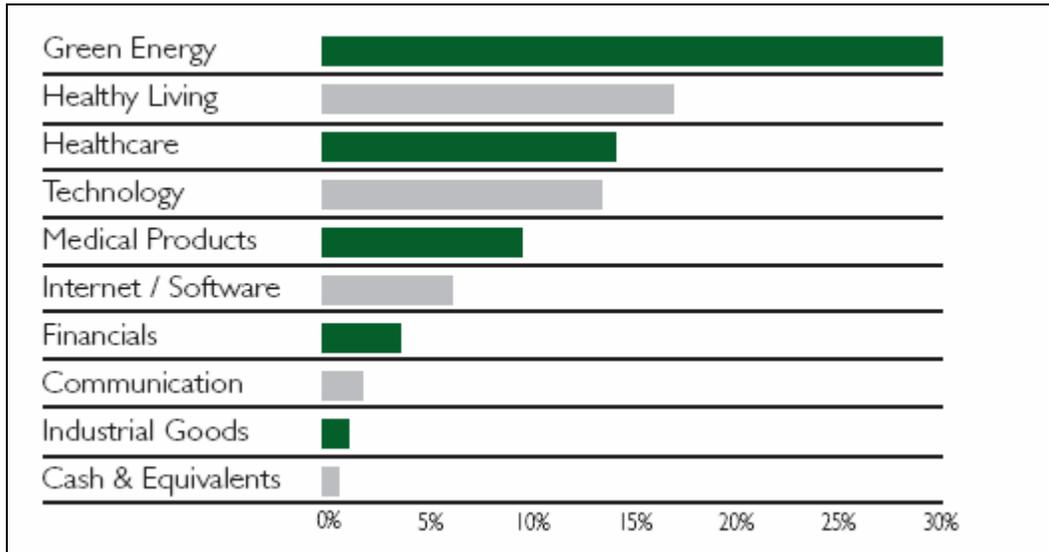


Figure 5 Winslow Green Growth Fund Holdings by Sector, as of 31 December 2006

SOURCE: Winslow Management, *Winslow Green Growth Fund*, Fact sheet, 31 December 2006, 1.

Robinson’s strategy has evidently been successful; the Winslow Fund has consistently outperformed its benchmark, the Russell 200 Growth Index (Winslow Management 2006b). The fund’s financial performance over time, compared to its benchmark is provided in Figure 6. Success of the Winslow Green Growth Fund has been attributed to the thorough research methods that integrate both environmental and financial analysis (Winslow Management 2006a).

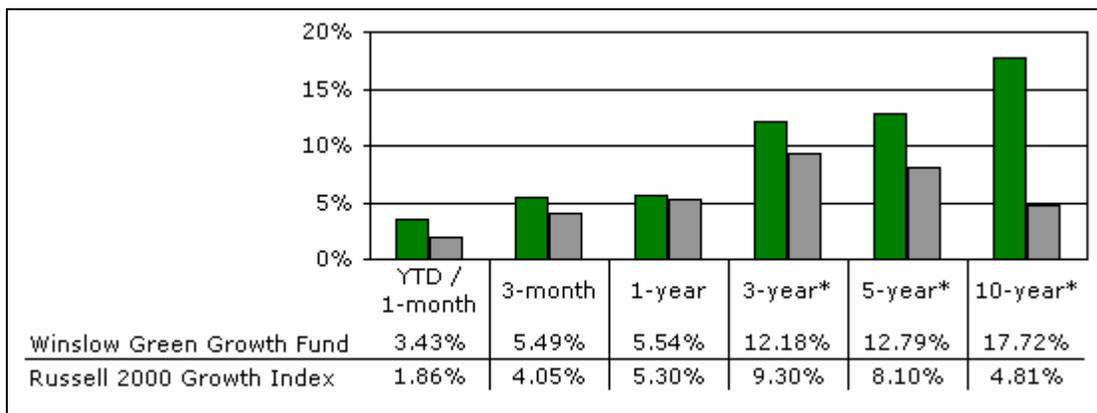


Figure 6 Winslow Green Growth Fund’s Average Annual Total Returns, as of 31 January 2007

SOURCE: Winslow Management Company, LLC, “Winslow Green Growth Fund Performance (Investor Shares),” 31 January 2007.

3.4.3 Jupiter Green Investment Trust

The Jupiter Green Investment Trust was launched in June 2006 and represents a partnership of sorts between Jupiter Investment Management and Winslow Management (Jupiter Asset Management 2007a). In this unique “cross-continent collaboration,” Winslow manages North American assets, which account for 30 percent of the portfolio, while Jupiter manages the rest of the assets (Baue 2006b). This global fund engages in positive screening only, using six “green investment themes,” clean energy, water management, waste management, sustainable living, environmental services, and green transport (Jupiter Asset Management 2006, 5).

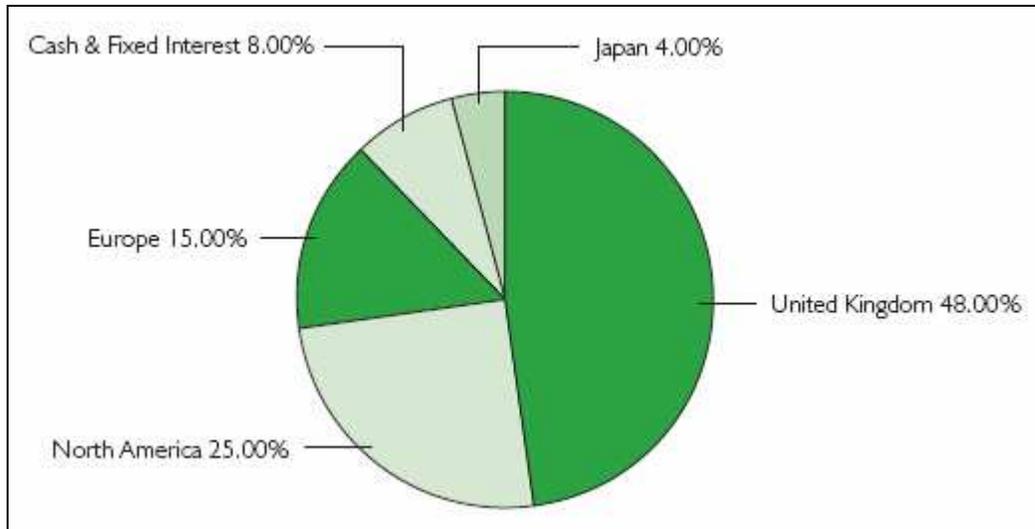


Figure 7 Jupiter Green Investment Trust Portfolio Distribution as at 31 December 2006.

SOURCE: Jupiter Investment Trusts, *Jupiter Green Investment Trust PLC*, Fact sheet, 31 January 2007, 2.

The investment objective of the Jupiter Green Investment Trust is to “generate long-term capital growth through a diverse portfolio of companies providing environmental solutions” (Jupiter 2006, 5). The fund has an expected bias towards small and medium cap companies, as well as a strong bias for UK based companies (Jupiter 2007a, 2). Figure 7 illustrates the portfolio’s geographic distribution. Each of the top ten holdings, which together make up 33.4 percent of the fund, is European, and seven of the ten are based in the UK. Its top ten companies include consultancies, engineering firms, and businesses involved in transportation, alternative energy sources, public transit, and organic food (Jupiter 2007b).

Because the Jupiter Green Investment Trust was launched less than a year ago, it has limited performance history data. Two benchmarks are used, one each by Winslow and Jupiter; they are the FTSE World Smaller Companies and the Russell 2500 Growth Indexes. Since its inception, the fund has achieved 12.7 percent growth, outperforming the Russell 2500, but underperforming the FTSE World, see Figure 8 (Jupiter 2007, 2).

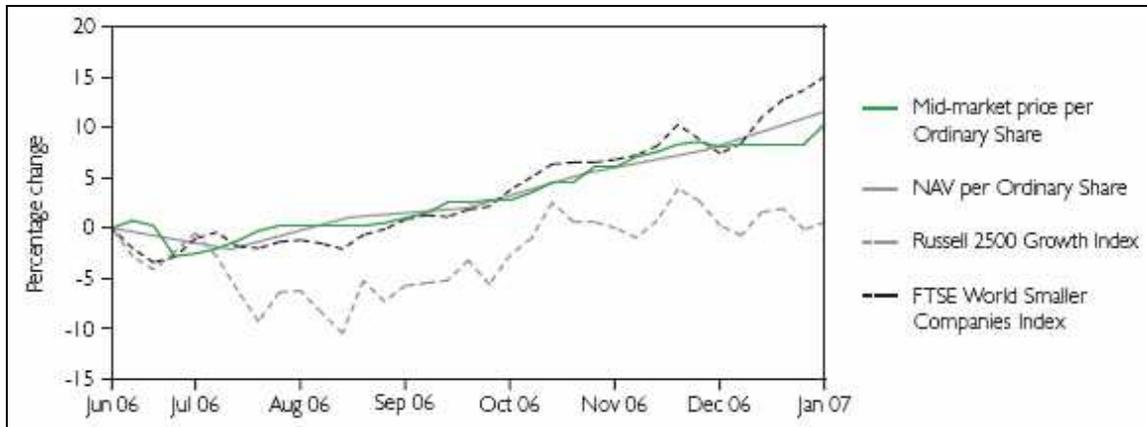


Figure 8 Jupiter Green Investment Trust Performance since Launch to 31 December 2006

SOURCE: Jupiter Investment Trusts, *Jupiter Green Investment Trust PLC*, Fact sheet, 31 January, 1.

3.4.4 Sierra Club Stock Fund

The Sierra Club Stock Fund, managed by Forward Management, was launched in October, 1998 (Sierra Club Mutual Funds 2006, 1). Its objective is to “achieve high total return by investing in stocks that meet environmental and social criteria” (Forward Funds, 34). The screening process used by the Forward has over 20 proprietary environmental and social guidelines that are designed to avoid “meaningful conflicts with the club’s core values,” and every company in the fund must be individually approved by the Sierra Club. The criteria used to screen for this fund are also intended to fulfill Sierra Club environmental and social desires, which include:

- Protection of the earth’s natural resources,
- Reduction of nuclear and chemical waste,
- Responsible and environmentally friendly land use,
- Opposition to risky agricultural practices,
- Humane animal treatment,
- Opposition to tobacco and weapons,
- Protection of individual rights,
- Opposition to profiteering from members of disadvantaged communities, and
- Promotion of disclosure and corporate environmental, social, and financial responsibility (40).

Despite this extensive list and a promise to invest for sustainable growth, this fund has become criticized for its company holdings, because as of 2005, it did not “own shares in a single company that promote alternative energy, organic farming or other solutions to environmental problems. Most of the companies it does own [...] do not even report publicly on their environmental practices” (Gunther 2005). However, the top sectors, which comprise over 50 percent of the fund, are financials and information technology, which are not considered environmentally intensive. Figure 9 shows the sector breakdown of the fund (Sierra Club 2006, 1).

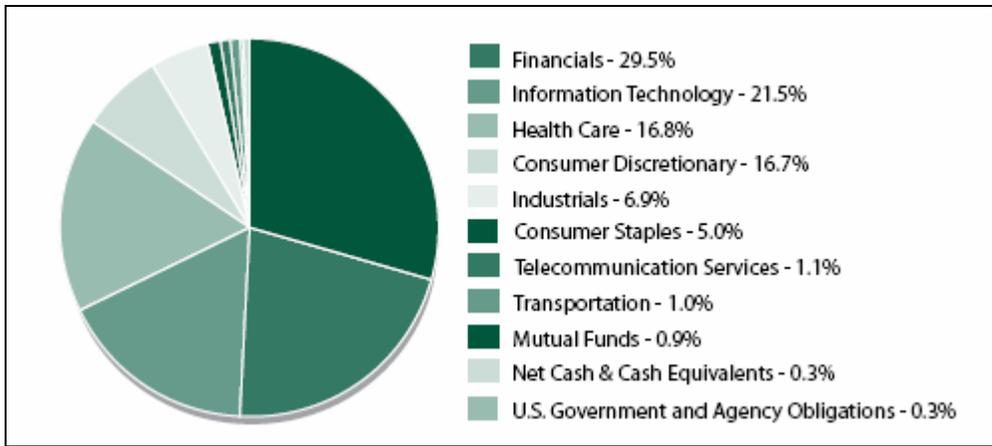


Figure 9 Sierra Club Stock Fund Sector Allocation as of 31 December, 2006

SOURCE: Sierra Club Funds, *Sierra Club Stock Fund*, Fact sheet, 31 December 2006, 1.

Though the Sierra Club Stock Fund has closely tracked its benchmark, the S&P 500, it has significantly underperformed it in the last two years, as Figure 10 and Figure 11 show.

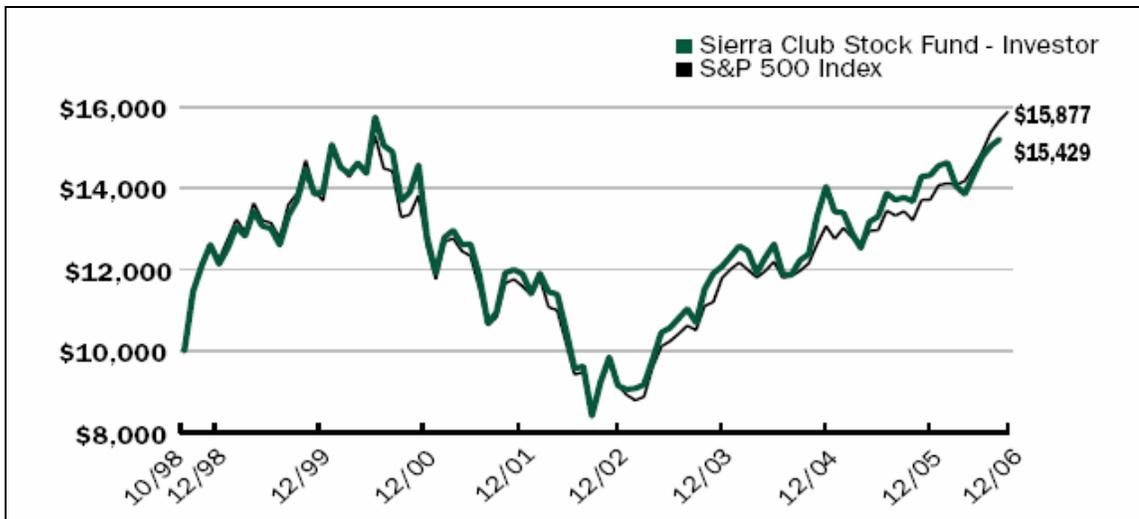


Figure 10 Growth of \$10,000 in the Sierra Club Stock Fund from its Inception Date

SOURCE: Sierra Club Funds, *Sierra Club Stock Fund*, Fact sheet, 31 December 2006, 1.

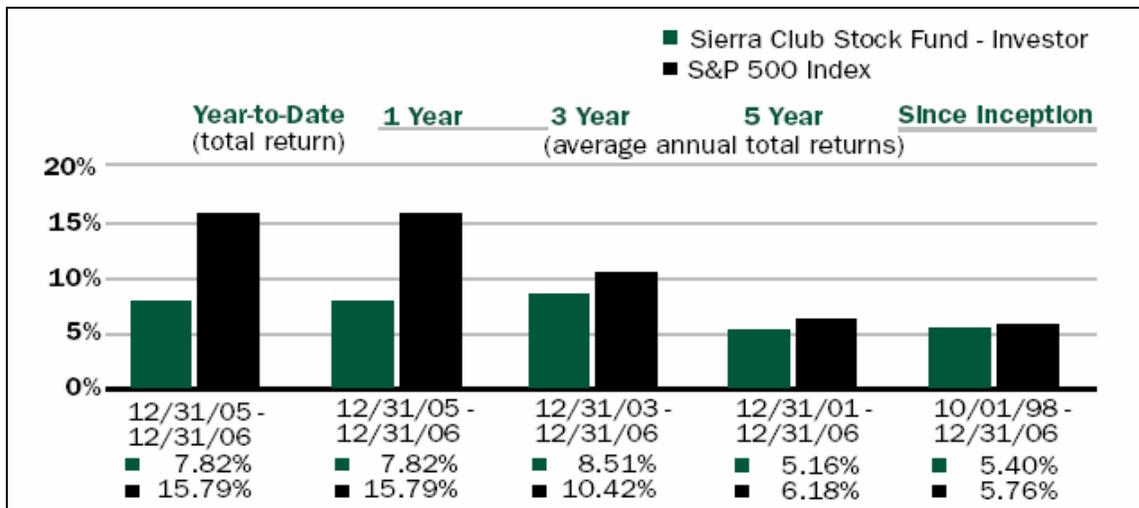


Figure 11 Sierra Club Stock Fund Performance

SOURCE: Sierra Club Funds, *Sierra Club Stock Fund*, Fact sheet, 31 December 2006, 1.

3.4.5 Chikyuryoku Fund

“Chikyuryoku” is the nickname for the Japan-based Chikyu Ondanka Boushi Kanrenkabu Fund, or the Global Warming Prevention Equity Fund. The Chikyuryoku is the first investment product indexed to the KLD Global Climate 100 and was launched on January 30, 2006 (KLD 2006). The KLD Global Climate 100 is a global index of 100 companies that was created in response to “growing demand from institutions and individuals for investment strategies that address global warming,” and aims to “promote investment in public companies whose activities demonstrate the greatest potential” for mitigating climate change.” KLD chooses companies from a global universe of companies engaged in renewable energy, alternative fuels, and clean technology and efficiency. Companies selected for the index are leaders in climate-related efforts, market influence, geographic distribution, and offsetting negative climate impact (KLD 2007, 1).

Each company in the index is equally weighted, and the index is continuously monitored for changes in climate performance and financial viability, and companies may be removed if their performance deteriorates (KLD 2007). Since its inception, the KLD 100 has experienced 16 percent turnover in its company holdings due to corporate actions (KLD 2006).

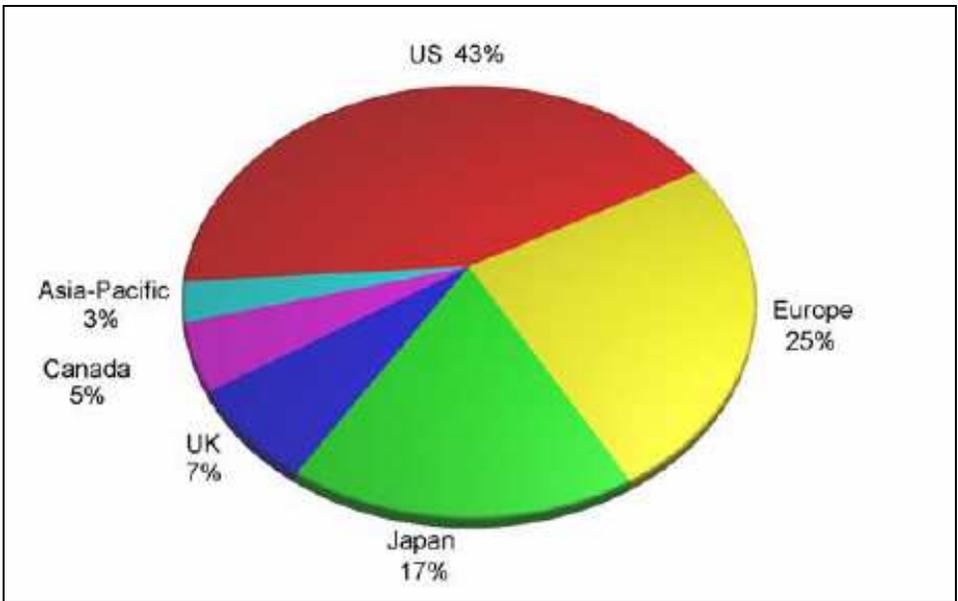


Figure 12 Geographic Representation of KLD Global 100
 SOURCE: KLD, *KLD Global Climate 100 Index*, Fact Sheet, 31 January 2007, 2.

The index is broadly diversified, in terms of geographic distribution (Figure 12), sector representation (Figure 13), and component company size (KLD 2006).

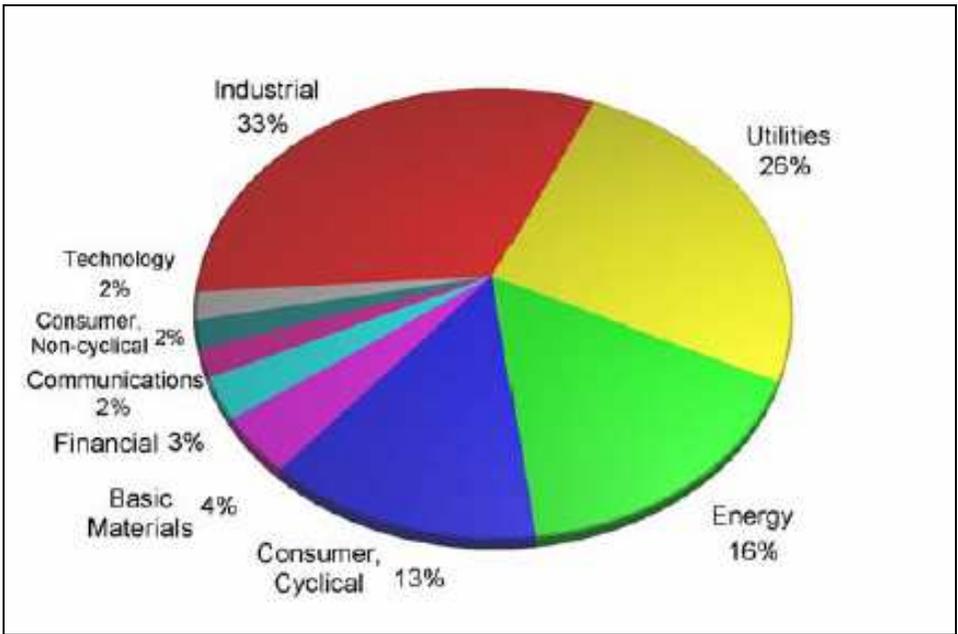


Figure 13 Sector Breakdown of KLD Global Climate 100
 SOURCE: KLD, *KLD Global Climate 100 Index*, Fact Sheet, 31 January 2007, 2.

The KLD 100 is benchmarked against the MSCI World. Since its launch in July, 2005, it has outperformed the MSCI, albeit not significantly (KLD 2007, 2). Figure 14 presents its financial performance.

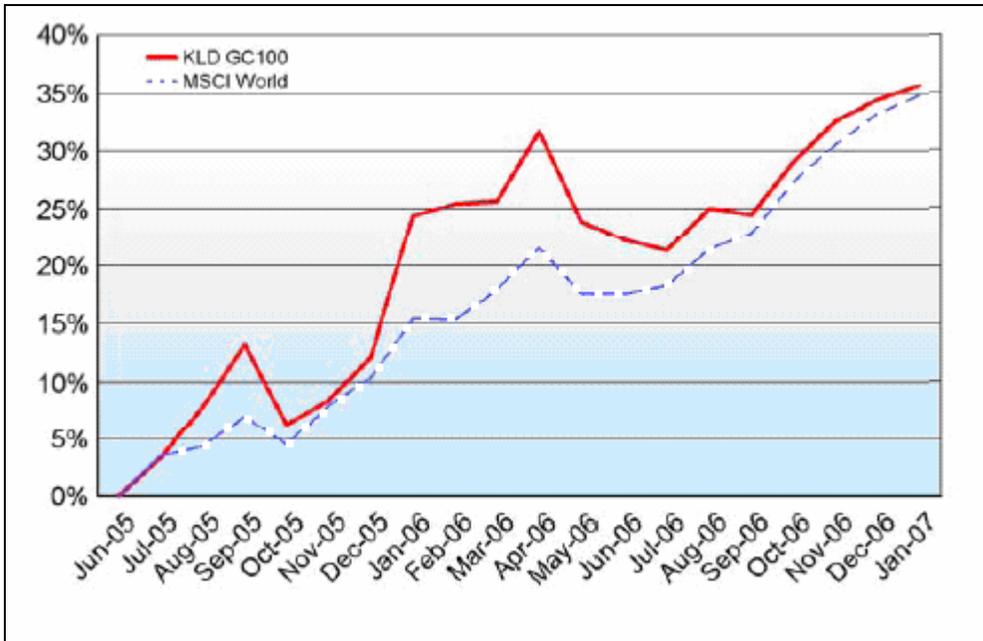


Figure 14 Cumulative Return on the KLD 100, from Inception to 31 January 2007
 SOURCE: KLD, *KLD Global Climate 100 Index*, Fact Sheet, 31 January 2007, 2.

4 METHODS FOR DEVELOPING A CLIMATE FUND

4.1 Establishing the Investment Universe

Our investment universe was constructed using climate performance as the sole determining factor. As a result, the construction of our universe was constrained by the availability of publicly available information on individual companies' climate change policies and greenhouse gas emissions data. We chose the 2006 Carbon Disclosure Project Report (CDP) as the central data source for our study, because it is the most comprehensive publicly available data source. The 2006 CDP provides survey response summaries for the world's 500 largest companies based on market capitalization and quantitative ratings for 326 of these firms. We used these 326 respondents as our investment universe.

4.2 Evaluating the Carbon Disclosure Project Ratings

Microsoft Excel was used to produce descriptive statistics for the CDP data. CDP ratings are discrete scores in ten categories – 0, 5, or 10 – and total Climate Leaders Index (CLI) scores range from 0 to 100 in 5-point increments. We generated a histogram of the CDP scores and descriptive statistics for the distribution to determine the mean and standard deviation of CDP scores and to test for normalness. Descriptive statistics were produced using the Excel Data Analysis Toolkit to test for normalness of the data and to compute the mean and standard deviation of the distribution. Our results indicated that despite the truncation of the 326 scores at zero and 100, they were approximately normally distributed. We then identified the 55 companies that scored greater than one standard deviation above the mean and grouped them into our “Climate Leaders” Portfolio. This restriction to 55 companies creates a 90% confidence interval, and we may conclude that our “Climate Leaders” are significantly different from the average CDP respondent with 90% certainty. We were unable to apply the 95% significance threshold ($\mu = .05$) applied throughout the project, because the 95% confidence interval extends beyond 100.

4.3 Selecting the Benchmark

The Carbon Disclosure Project collects information from the 500 largest global companies, so any derivative investment product is essentially a global large-cap fund. Presently, no global large-cap index exists to use as an appropriate benchmark. Ideally, a custom benchmark would be constructed combining North American, UK, European, and Australasian large-cap indexes in proportions similar to the CDP. We do not, however, have the resources to create a custom index or purchase returns data from a number of vendors. We therefore selected the MSCI World Index as our benchmark as the next best available option. The MSCI World Index is one of the most commonly referenced benchmarks among global equity products, so investors are familiar with it. The MSCI World Index's two main drawbacks are that it includes stocks from sectors and countries not represented in the Carbon Disclosure Project, as

well as many stocks with smaller market capitalization. However, we believe it more important for our benchmark to reflect global macroeconomic factors into its returns rather than to have it precisely replicate the cap-weighting of the Carbon Disclosure Project. Furthermore, the MSCI World Index will become an increasingly appropriate and useful benchmark as the Carbon Disclosure Project expands its database to include more mid-/small-cap stocks and additional sectors.

4.4 Analyzing the “Climate Leaders” Portfolio

We acquired monthly stock return data for each of the 326 “respondents” for the period from January 1997 to January 2007. We also acquired monthly return data for our benchmark, the MSCI World Index, over the same period. These data were used to calculate the mean and the variance of monthly returns for each stock over ten-, five-, and one-year periods (Equation 3 and Equation 4). R_k is the return in month k for n months, and \bar{R}_x is the mean monthly return over the sample period. The risk of a stock’s returns over a period is measured by the standard deviation of returns, which is the square root of the variance (Equation 5).

Equation 3 Mean

$$\bar{R}_x = \frac{1}{n} \sum_{k=1}^n R_k$$

Equation 4 Variance

$$\sigma_x^2 = \sum_{k=1}^n (R_k - \bar{R})^2$$

Equation 5 Standard Deviation

$$\sigma_x = \sqrt{\sigma_x^2}$$

We also used the mean, variance, and standard deviation equations to calculate the mean monthly returns to the MSCI World Index, the “Climate Leaders” Portfolio, and the “Bren Fund,” which will be discussed later. A weighting coefficient, equal to the percentage of the market or portfolio attributed to one stock, is added to the calculation. We use an equal-weighted approach such that the total number of stocks in the portfolio is the denominator in the weighting coefficient; thus, each stock is weighted as one percent of a portfolio with one hundred stocks. This process is referred to as naïve diversification. Equation 6 shows that the mean return to a portfolio is the sum of the mean returns of n stocks multiplied by their portfolio weight.

The total risk of the portfolio returns is a more complex computation, since it is the sum of weighted variances of each stock and the covariance of each stock with every other stock in the portfolio. Covariance is calculated for two stocks using Equation 7, where R_{xk} is the return to stock x in month k , R_{yk} is the return to stock y in month k ,

and \bar{R}_x and \bar{R}_y are the mean monthly returns in the period with n months. A portfolio with n stocks has n variance terms and $n^2 - n$ covariance terms, where the weight of each covariance term is the product of the weights of the two underlying stocks. Equation 8 presents the calculation of portfolio variance for an n -stock portfolio over a specified period: the first summation is the weighted variance of each stock in the portfolio; the double summation is the weighted covariance of all stocks in the portfolio.

Equation 6 Portfolio Return

$$\bar{R}_p = \sum_{x=1}^n w_x \bar{R}_x$$

Equation 7 Covariance of Returns for Two Stocks

$$\sigma_{xy} = \sum_{k=1}^n (R_{xk} - \bar{R}_x)(R_{yk} - \bar{R}_y)$$

Equation 8 Portfolio Variance

$$\sigma_p^2 = \sum_{k=1}^n w_k^2 \sigma_k^2 + \sum_{x=1}^n \sum_{y=1}^n w_x w_y \sigma_{xy}$$

4.4.1 Plotting the “Climate Leaders” Portfolio and Efficient Frontier

The expected mean monthly return and standard deviation of returns to the “Climate Leaders” Portfolio were plotted on a mean-variance or risk-return graph over ten, five, and one year return periods. The mean monthly return to the benchmark, the MSCI World Index, and standard deviation were also plotted. We then used Excel Solver™ to determine the efficient frontier for the “Climate Leaders” Portfolio, maximizing portfolio return for different levels of risk. We first programmed Solver™ to create a minimum variance portfolio and a maximum return portfolio. These two portfolios are the endpoints of the efficient frontier. Next, we programmed Solver™ to maximize expected portfolio return subject to a fixed level of variance over the interval bounded by the variance of the endpoints. We plotted the expected portfolio returns against the corresponding portfolio standard deviations of returns – the square roots of the variance values – to produce the efficient frontier.

4.4.2 Optimizing Return and Drawing the Capital Allocation Line

We expect the “Climate Leaders” Portfolio to represent the risk-return characteristics of a passively managed fund, but we also wanted to examine the characteristics of an actively managed fund. Our new theoretical portfolio represents a combination of stocks optimized to maximize return, which we call the “Bren Fund.” From the efficient frontier, we determined the optimal risk-return allocation within the portfolio that occurs at a tangency point on the efficient frontier. This point lies on the line of

tangency with return-intercept equal to the risk-free rate of return. The Capital Allocation Line represents the new efficient frontier obtained by combining the “Bren Fund” with the risk-free security. We restrict our model to exclude borrowing, such that the CAL has endpoints at the risk-free security and the “Bren Fund.”

4.4.3 Analyzing the Portfolios

We analyze the performance of the “Climate Leaders” Portfolio and the optimized “Bren Fund” over ten, five, and one year periods using portfolio Beta, Alpha, Sharpe’s ratio (Equation 9), and the information ratio (Equation 10). Portfolio Beta and Alpha calculation and interpretation were previously discussed in Section 2.4. From our CAPM regression, we determine the excess return to the portfolio, the difference between the portfolio and benchmark return at a fixed level of risk. The standard deviation of this excess return is the portfolio tracking error; dividing the excess return by the tracking error yields the information ratio for the portfolio. A lower tracking error indicates that a portfolio closely tracks its benchmark. A higher information ratio indicates a larger excess return given the portfolio volatility; as a result, a higher information ratio is preferred. The Sharpe Ratio is a similar measure of the risk-return characteristics of the portfolio and measures the excess return earned for the additional risk accepted by investing in a particular portfolio. The Sharpe Ratio is essentially an indicator of the efficiency with which the investment strategy earns excess returns by taking on additional volatility. A higher Sharpe Ratio is preferred, because it indicates greater efficiency (Elton and Gruber 1987; Bodie, Kane, and Marcus 2005).

Equation 9 Sharpe Ratio

$$S = \frac{E(R_p - R_f)}{\sqrt{\text{var}(R_p - R_f)}}$$

Equation 10 Information Ratio

$$IR = \frac{\alpha}{\sigma(e_p)}$$

4.5 Statistical Analysis

Our project was designed to test whether the portfolio Beta for a climate-focused investment strategy is significantly different from one (the market Beta), and to what degree – if any – the strategy produces abnormal returns (Alpha). We used the least-squares regression function in Excel™, because it calculates standard error, t-statistics, and significance tests for each coefficient. We used the adjusted squared residual (R^2 -adjusted) to measure the efficacy with which the regression reflects the

data, as well as the F-statistic to test the overall significance of the model.¹⁰ We tested each variable at a 95% ($\mu = .05$) significance level. Results are reported in Section 5.1, in Table 3 and

	10 Years (1997 – 2007)			5 Years (2002-2007)			1 Year (2006-2007)		
	“Bren Fund”	“Climate Leaders”	MSCI	“Bren Fund”	“Climate Leaders”	MSCI	“Bren Fund”	“Climate Leaders”	MSCI
Monthly Volatility ($\bar{\sigma}_r$)	3.95%	3.94%	4.18%	4.19%	3.71%	3.58%	3.58%	2.73%	2.07%
Monthly Return (\bar{r})	1.62%	0.84%	0.54%	1.94%	0.88%	0.72%	3.44%	2.14%	1.46%
Alpha (95% confidence)	1.10 ± 0.798%	0.242± 0.468%	-	1.20± 0.97%	-0.069± 0.05%	-	0.43± 1.75%	0.243± 0.711%	-
SE	3.56×10^{-3}	2.39×10^{-3}	-	4.95×10^{-3}	2.63×10^{-3}	-	8.92×10^{-3}	3.63×10^{-3}	-
t-stat	3.15	1.07	-	2.41	-0.26	-	0.483	0.66	-
p value	0.002	0.37	-	0.018	0.79	-	0.63	0.51	-
Beta	0.67±0.161	1.04±0.111	-	1.03±0.026	1.32±0.142	-	1.91±0.729	1.35±0.288	-
SE	8.19×10^{-2}	5.68×10^{-2}	-	1.33×10^{-2}	7.27×10^{-2}	-	3.72×10^{-1}	1.47×10^{-1}	-
t-stat	8.18	18.3	-	7.78	18.14	-	5.13	8.81	-
p value	3.71×10^{-13}	3.94×10^{-36}	-	1.28×10^{-10}	8.21×10^{-26}	-	3.25×10^{-4}	2.57×10^{-6}	-
R ²	0.36	0.73	-	0.51	0.84	-	0.71	0.86	-
Information Ratio	0.139	0.198	-	0.148	0.007	-	0.228	0.125	-

Table 4.

We examined possible bias in our portfolio by conducting a χ^2 -test¹¹ on the geographic distribution of the companies held in the “Climate Leaders” Portfolio. The expected geographic distribution was derived from the geographic distribution of the MSCI World Index. We tested for significance at the five percent level. We used the same χ^2 -test of significant bias in sector representation by comparing the expected (benchmark) distribution to the actual distribution in the “Climate Leaders” Portfolio.

¹⁰ The F-statistic tests whether all coefficients in the model equal zero; a significant F-statistic ($p < 0.05$) allows us to reject the null hypothesis that all coefficients equal zero, and further suggests that the overall model is significant.

¹¹ The Chi-squared test was used, because sector and geographic data are discontinuous, and both geographic and sector data sets were independent and normally distributed.

5 “CLIMATE LEADERS” PORTFOLIO AND “BREN FUND”

5.1 Portfolio Composition

The “Climate Leaders” Portfolio consists of the 55 companies that scored between 85 and 100 on the 2006 CDP questionnaire. As Figure 15 illustrates, it is geographically diverse, with a stronger bias toward UK and European companies than the benchmark, and a bias away from Japanese and North American companies ($\chi^2 = 70.166$, $df = 15$, $p < 0.001$). Our “Climate Leaders” Portfolio also has a significant bias toward UK and European companies and away from North American companies relative to the total CDP respondents ($\chi^2 = 85.324$, $df = 15$, $p < 0.001$). We thus conclude that the frequency and quality of responses are higher for European companies and lower for North American and Japanese companies.

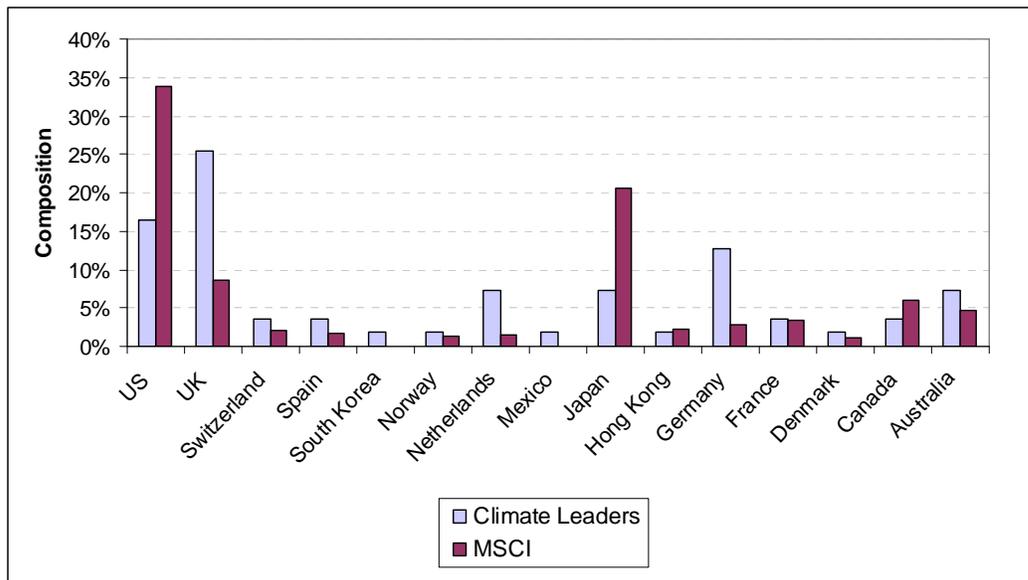


Figure 15 Geographic Composition of “Climate Leaders” Portfolio and MSCI World Index

Each of the ten market sectors defined by the Global Industry Classification Standards (GICS) and used by the MSCI World Index is represented in our portfolio (see Figure 16 for sectors).¹² Figure 16 shows that the “Climate Leaders” Portfolio is well diversified, without any overwhelming sector biases.

¹² The GICS system is used by several major indexes, including our benchmark, to group companies into sectors.

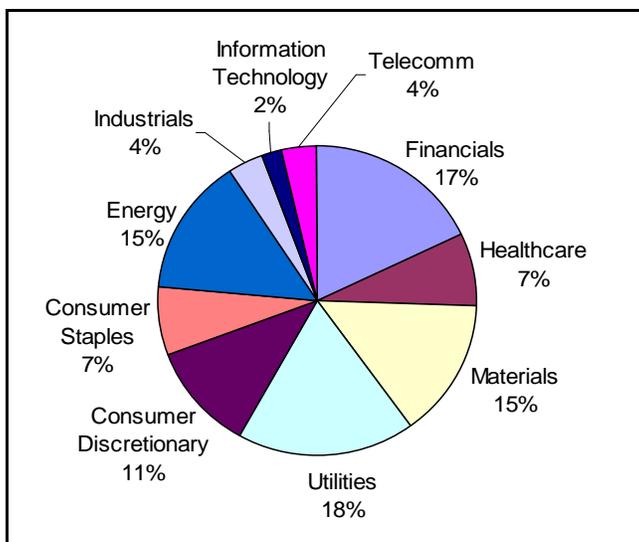


Figure 16 Sector Composition of “Climate Leaders” Portfolio

Relative to the FT500 investment universe, however, our Portfolio shows moderate sector biases: it has a larger position in Energy, Utilities, and Materials; a weaker position in Industrials, Information Technology, Telecommunications, and Financials; but an equal position in Consumer Staples, Consumer Discretionary, and Health Care ($\chi^2 = 20.066$, $df = 9$, $p < 0.05$).

5.2 Portfolio Performance

5.2.1 Performance Measurements

The results of our regression analysis on the monthly returns of the “Climate Leaders” Portfolio and the MSCI World are presented in Figure 17, Figure 18, and Figure 19. The regression statistics we used to evaluate our null hypotheses (Equation 11 and Equation 12) are summarized in Table 3.

Equation 11 Alpha Null Hypothesis

$$H_{0, \alpha} = 0$$

Equation 12 Beta null Hypothesis

$$H_{0, \beta} = 1$$

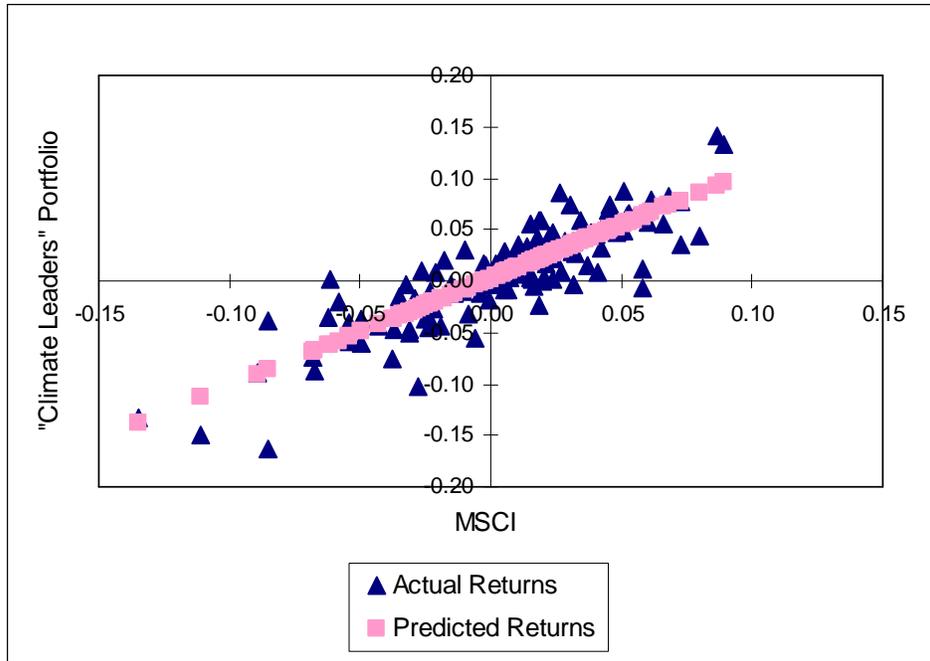


Figure 17 Ten-Year Least Squares Regression of “Climate Leaders” Portfolio and MSCI World

The regression for the ten year monthly returns was highly significant at the five percent level, with an F-statistic of 334.97.¹³

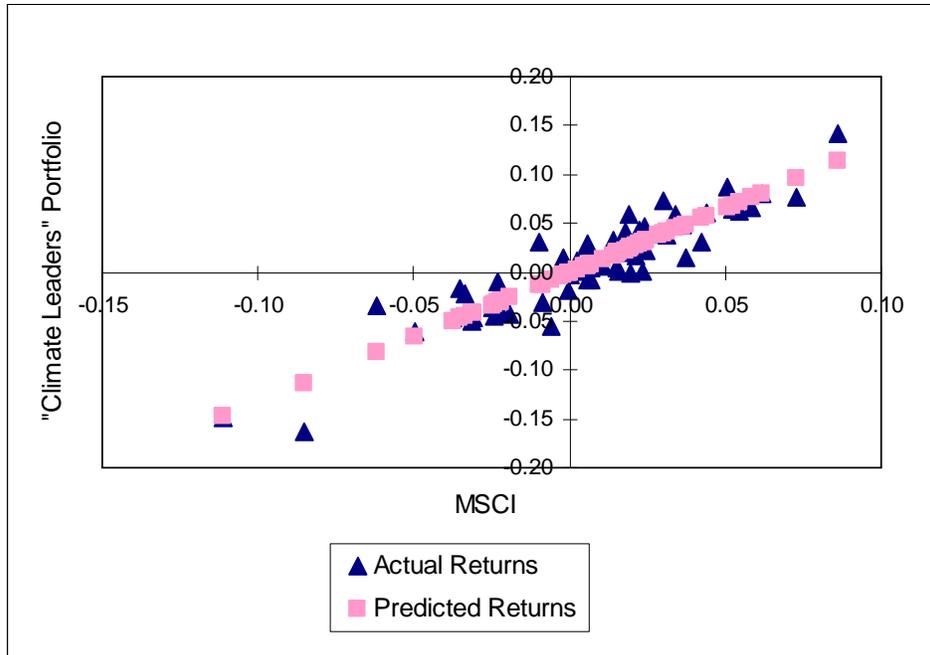


Figure 18 Five-Year Least squares regression for “Climate Leaders” Portfolio and MSCI World
 The regression for the five year monthly returns was also highly significant at the five percent level, with an F-statistic of 329.14.¹⁴

¹³ $P = 3.94 \times 10^{-36}$, $DF = 118$, R^2 (adjusted) = 0.739

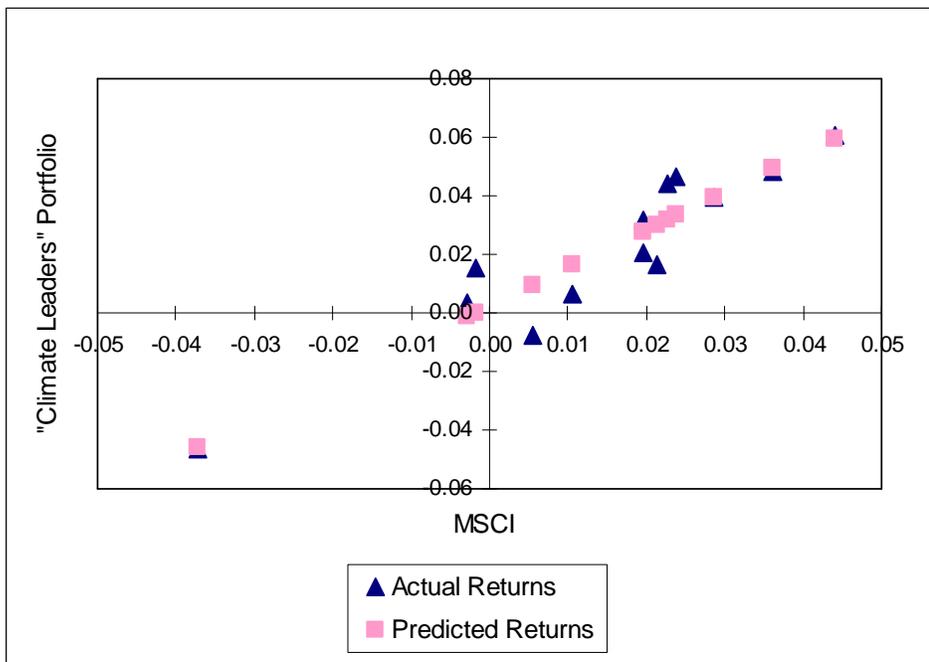


Figure 19 One-Year Least Squares Regression for “Climate Leaders” Portfolio and MSCI World

The regression for the one year monthly returns was highly significant at the five percent level as well, with an F-statistic of 77.68.¹⁵

Table 3 Performance Measures, “Climate Leaders” Portfolio vs. Market¹⁶

	10 Years (1997-2007)		5 Years (2002-2007)		1 Year (2006-2007)	
	Leaders	Market	Leaders	Market	Leaders	Market
Monthly Volatility ($\bar{\sigma}$)	3.94%	4.18%	3.71%	3.58%	2.73%	2.07%
Monthly Return (\bar{r})	0.84%	0.54%	0.88%	0.72%	2.14%	1.46%
Expected Return	0.59%	-	0.43%	-	1.21%	-
Alpha (95% confidence)	0.242 ± 0.468%	-	-0.069 ± 0.05%	-	0.243 ± 0.711%	-
SE	2.39x10 ⁻³	-	2.63x10 ⁻³	-	3.63x10 ⁻³	-
t-stat	1.01	-	-0.26	-	0.66	-
p value	0.31	-	0.79	-	0.51	-
Beta	1.04 ± 0.111	-	1.32 ± 0.142	-	1.3 ± 0.288	-
SE	5.68x10 ⁻²	-	7.27x10 ⁻²	-	1.47x10 ⁻¹	-
t-stat	18.3	-	18.14	-	8.81	-
p value	3.94x10 ⁻³⁶	-	8.21x10 ⁻²⁶	-	2.57x10 ⁻⁶	-
Sharpe Ratio	0.107	-	0.112	-	0.642	-
Information Ratio	0.055	-	-0.018	-	0.112	-

¹⁴ P = 8.21x10⁻²⁶, DF = 60, R² (adjusted) = 0.845

¹⁵ P = 2.57x10⁻⁰⁶, DF = 12, R² (adjusted) = 0.86

¹⁶ Risk free rate = 0.3%

The “Climate Leaders” Portfolio is more volatile than the market for both one and five year investment horizons, as Beta was significantly greater than one. The Portfolio Alpha is not significantly different from zero for the one year horizon, but it is significant and negative for the five year investment period. In the long run (defined as a ten-year investment horizon), however, the “Climate Leaders” Portfolio presents the same level of volatility as the market and has an Alpha not significantly different from zero. This close tracking of the Portfolio with the market can be visualized in Figure 20, a time-series graph of monthly returns for the “Climate Leaders” Portfolio and MSCI World Index between January 1997 and January 2007.

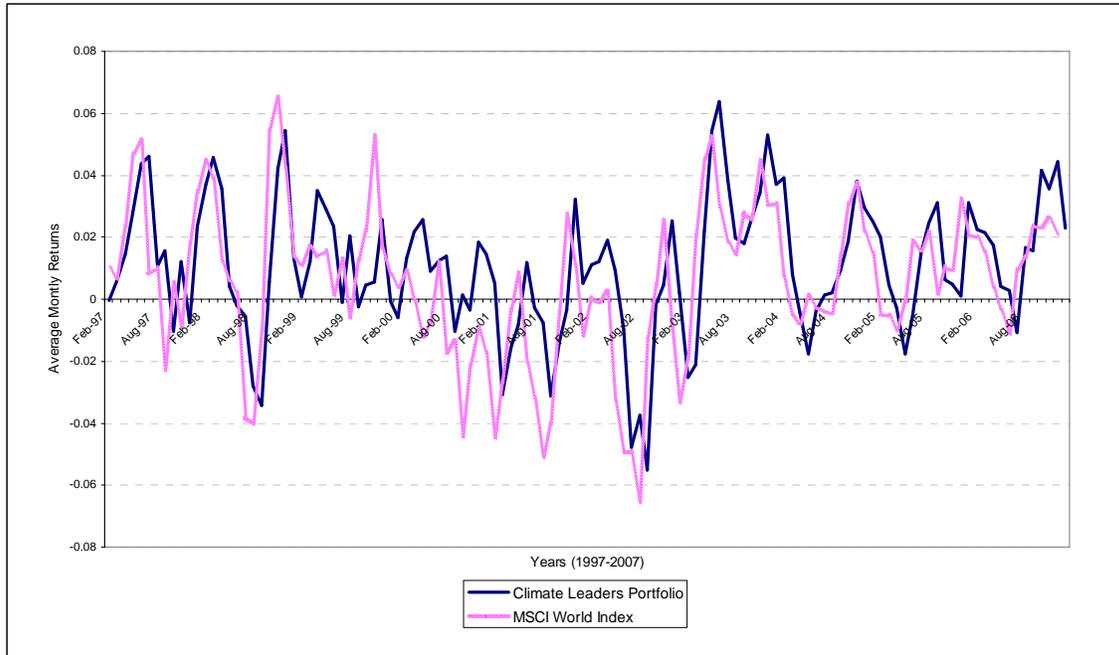


Figure 20 Financial Performance of “Climate Leaders” Portfolio and MSCI World

5.3 Capital Asset Pricing Model (CAPM)

When applying the Capital Asset Pricing Model (CAPM), we used a risk-free interest rate to construct a new efficient frontier that yields greater returns than the “Climate Leaders” Portfolio. This new efficient frontier is achieved by combining the Portfolio with a risk-free security. The various combinations of the two assets are plotted along the Capital Allocation Line (CAL), which runs tangent to the efficient frontier in Figure 21, and in our model assumes no borrowing. Equation 13 models the CAL and shows the relationship between risk and return for the investment (R_C) given the risk-free rate (R_F), the risky asset Beta (β), and the expected excess return to the risky asset above the risk-free rate ($R_P - R_F$).

Equation 13 Capital Allocation Line

$$R_C = R_F + \beta(R_P - R_F)$$

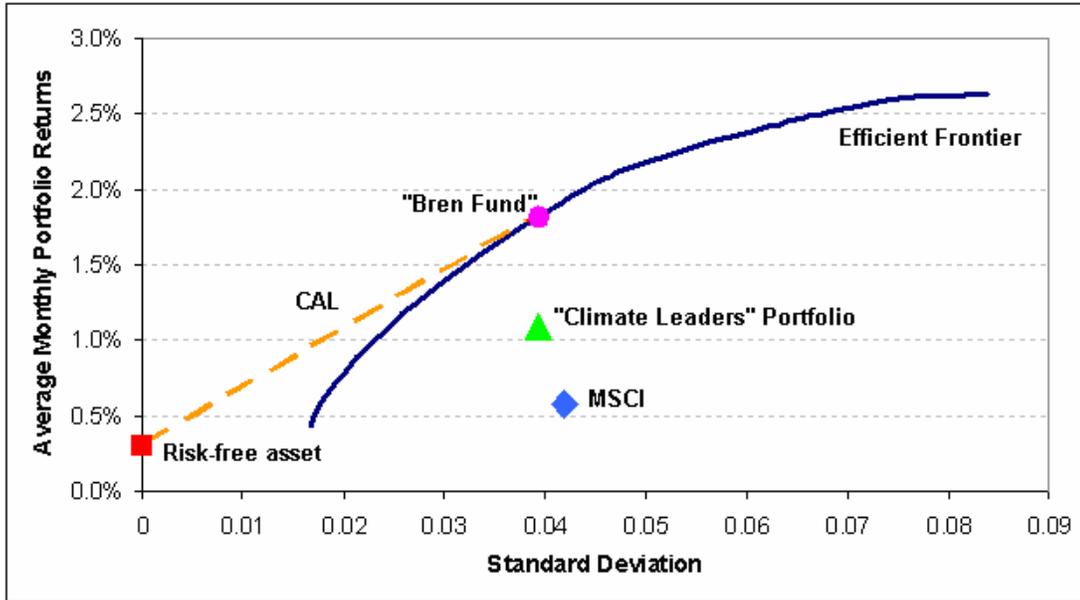


Figure 21 Allocative Efficiency of the Portfolio

5.4 The “Bren Fund”

5.4.1 “Bren Fund” Composition

The tangency point to the efficient frontier is the returns-optimized investment, which we call the “Bren Fund” (see Figure 21). Figure 22 and Figure 23 present the sector and geographic composition of the “Bren Fund.” The sector composition of the “Bren Fund” is not significantly different from that of the “Climate Leaders” Portfolio ($\chi^2 = 13.057$, $df = 9$, $CV_{\mu=.05} = 16.92$), which suggests that the climate screen based on the CDP scores does not interfere with successful stock-picking. The “Bren Fund” still presents a sector bias similar to that of the “Climate Leaders” Portfolio relative to the universe, the FT500 ($\chi^2 = 25.809$, $df = 9$, $p < 0.01$). No significant difference in geographic bias exists between the “Bren Fund” and “Climate Leaders” Portfolio ($\chi^2 = 2.334$, $df = 3$, $CV_{\mu=.05} = 7.82$), but the “Bren Fund” does have a significant regional bias toward European companies relative to the FT500 universe ($\chi^2 = 8.452$, $df = 3$, $p < 0.05$) and the MSCI World Index ($\chi^2 = 9.994$, $df = 3$, $p < 0.05$).

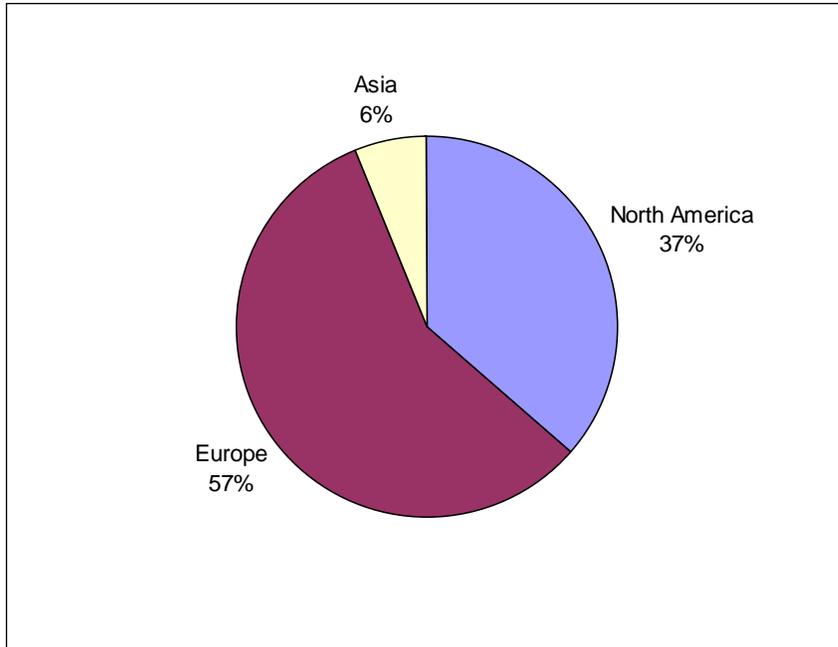


Figure 22 Geographic Representation of "Bren Fund"

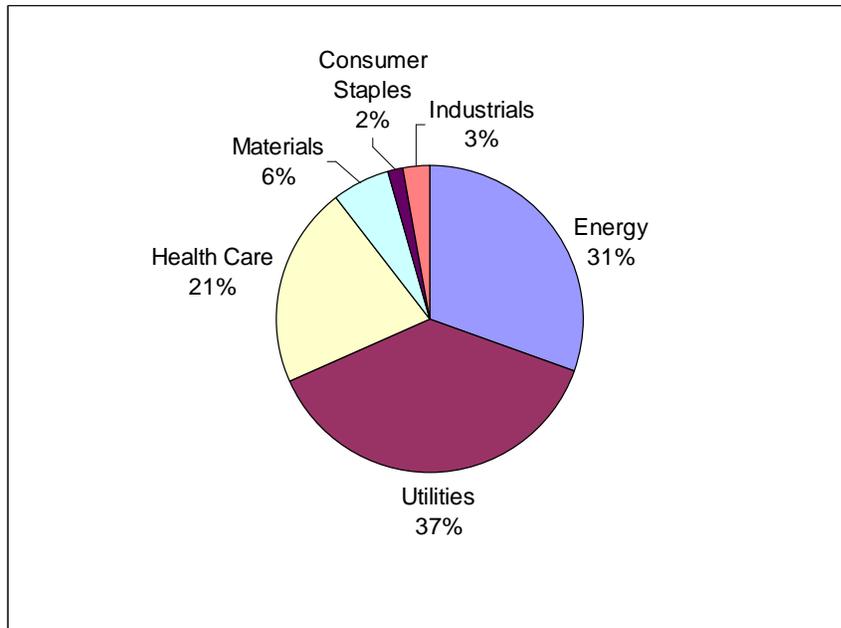


Figure 23 Sector Composition of "Bren Fund"

5.4.2 “Bren Fund” Performance

	10 Years (1997 – 2007)			5 Years (2002-2007)			1 Year (2006-2007)		
	“Bren Fund”	“Climate Leaders”	MSCI	“Bren Fund”	“Climate Leaders”	MSCI	“Bren Fund”	“Climate Leaders”	MSCI
Monthly Volatility ($\bar{\sigma}_r$)	3.95%	3.94%	4.18%	4.19%	3.71%	3.58%	3.58%	2.73%	2.07%
Monthly Return (\bar{r})	1.62%	0.84%	0.54%	1.94%	0.88%	0.72%	3.44%	2.14%	1.46%
Alpha (95% confidence)	1.10 ± 0.798%	0.242 ± 0.468%	-	1.20 ± 0.97%	-0.069 ± 0.05%	-	0.43 ± 1.75%	0.243 ± 0.711%	-
SE	3.56×10^{-3}	2.39×10^{-3}	-	4.95×10^{-3}	2.63×10^{-3}	-	8.92×10^{-3}	3.63×10^{-3}	-
t-stat	3.15	1.01	-	2.41	-0.26	-	0.483	0.66	-
p value	0.002	0.31	-	0.018	0.79	-	0.63	0.51	-
Beta	0.67 ± 0.161	1.04 ± 0.111	-	1.03 ± 0.026	1.32 ± 0.142	-	1.91 ± 0.729	1.35 ± 0.288	-
SE	8.19×10^{-2}	5.68×10^{-2}	-	1.33×10^{-2}	7.27×10^{-2}	-	3.72×10^{-1}	1.47×10^{-1}	-
t-stat	8.18	18.3	-	7.78	18.14	-	5.13	8.81	-
p value	3.71×10^{-13}	3.94×10^{-36}	-	1.28×10^{-10}	8.21×10^{-26}	-	3.25×10^{-4}	2.57×10^{-6}	-
R ²	0.36	0.73	-	0.51	0.84	-	0.71	0.86	-
Information Ratio	0.139	0.198	-	0.148	0.007	-	0.228	0.125	-

Table 4 summarizes the performance of the “Bren Fund,” the “Climate Leaders” Portfolio, and our benchmark, the MSCI World Index. Over the one year investment horizon, the “Bren Fund” is significantly more volatile than the market but not significantly more volatile than the “Climate Leaders” Portfolio. The Fund Alpha for one year is not significantly different from zero. Over five years, the “Bren Fund” is not significantly more volatile than the market, yet it is significantly less volatile than the “Climate Leaders” Portfolio over the same period. For the five-year investment horizon, however, the “Bren Fund” Alpha is significantly different from zero and positive. The “Bren Fund” Beta is significantly less volatile than both the MSCI World Index and the “Climate Leaders” Portfolio over ten years, and the “Bren Fund” has an Alpha significantly larger than one, but not significantly different from the “Climate Leaders” Portfolio Alpha for the same period.

	10 Years (1997 – 2007)			5 Years (2002-2007)			1 Year (2006-2007)		
	“Bren Fund”	“Climate Leaders”	MSCI	“Bren Fund”	“Climate Leaders”	MSCI	“Bren Fund”	“Climate Leaders”	MSCI
Monthly Volatility ($\bar{\sigma}_r$)	3.95%	3.94%	4.18%	4.19%	3.71%	3.58%	3.58%	2.73%	2.07%
Monthly Return (\bar{r})	1.62%	0.84%	0.54%	1.94%	0.88%	0.72%	3.44%	2.14%	1.46%
Alpha (95% confidence)	1.10 ± 0.798%	0.242 ± 0.468%	-	1.20 ± 0.97%	-0.069 ± 0.05%	-	0.43 ± 1.75%	0.243 ± 0.711%	-
SE	3.56×10^{-3}	2.39×10^{-3}	-	4.95×10^{-3}	2.63×10^{-3}	-	8.92×10^{-3}	3.63×10^{-3}	-
t-stat	3.15	1.01	-	2.41	-0.26	-	0.483	0.66	-
p value	0.002	0.31	-	0.018	0.79	-	0.63	0.51	-
Beta	0.67 ± 0.161	1.04 ± 0.111	-	1.03 ± 0.026	1.32 ± 0.142	-	1.91 ± 0.729	1.35 ± 0.288	-
SE	8.19×10^{-2}	5.68×10^{-2}	-	1.33×10^{-2}	7.27×10^{-2}	-	3.72×10^{-1}	1.47×10^{-1}	-
t-stat	8.18	18.3	-	7.78	18.14	-	5.13	8.81	-
p value	3.71×10^{-13}	3.94×10^{-36}	-	1.28×10^{-10}	8.21×10^{-26}	-	3.25×10^{-4}	2.57×10^{-6}	-
R ²	0.36	0.73	-	0.51	0.84	-	0.71	0.86	-
Information Ratio	0.139	0.198	-	0.148	0.007	-	0.228	0.125	-

Table 4 Results of Least Squares Regressions on Monthly Returns

5.5 Discussion

5.5.1 Comparison of Returns

We focus primarily on ten-year returns, because ten years is a more typical holding period for mutual fund investors. The “Climate Leaders” Portfolio does not differ significantly from the market in its volatility or its returns over this investment horizon ($0.929 < \beta < 1.151$, $t\text{-stat} = 18.3$, $p < 0.001$; $-22.6 < \alpha < 71.0$ bps, $t\text{-stat} = 1.01$, $p = 0.31$), which implies that it is an attractive alternative to a market portfolio for the green investor. If an investor were capable *ex ante* of constructing the “Bren Fund,” he or she would discover a significant bargain. Over ten years, the “Bren Fund” is one-third less volatile than the market ($0.509 < \beta < 0.831$, $t\text{-stat}=8.18$, $p<0.001$) and substantially outperforms it ($30.2 < \alpha < 189.8$ bps, $t\text{-stat}=3.15$, $p=0.002$). Figure 24 illustrates the excess returns an investor would have earned in the last ten years, had he or she invested \$10,000 in the “Climate Leaders” Portfolio in January 1997.

Our climate-focused investment strategy would be less attractive to investors with one or five year investment horizons. In the short run – over one year – both the “Climate Leaders” Portfolio ($1.062 < \beta < 1.638$, $t\text{-stat}=8.81$, $p<0.001$) and “Bren Fund” ($1.181 < \beta < 2.639$, $t\text{-stat}=5.13$, $p<0.001$) are considerably more volatile than the market, yet do not provide abnormal returns. They also carry a reasonable risk of underperforming the market, commensurate to their relative risk ($-46.8 < \alpha < 95.4$ bps, $t\text{-stat}=0.66$, $p=0.51$; $-132 < \alpha < 218$ bps, $t\text{-stat}=0.483$, $p=0.63$). Over five years, both the Portfolio and Fund are significantly more volatile than the market, although the latter is only marginally so. The five-year “Bren Fund” Alpha is significantly greater than zero, and thus presents an attractive alternative to a market portfolio. The five-year “Climate Leaders” Portfolio Alpha, however, is significantly negative, indicating that the climate-focused strategy bears considerable costs over this period.

Unfortunately, we find that our investment strategy is not particularly efficient for any investment horizon. The Sharpe Ratios for both the “Climate Leaders” Portfolio and the “Bren Fund” are relatively small and decline as the test period lengthens. In the long-run, we expect returns on risky assets to decline asymptotically to the cost of equity capital or the risk-free rate of return; consequently, we expect a corresponding decline in the Sharpe Ratio measure of efficiency. We did not expect the overall efficiency of our investment strategy to be so low. The efficiencies of both the “Climate Leaders” Portfolio and “Bren Fund” relative to the market benchmark are also low, as the Information Ratios imply, which suggests that the passive investment strategy does not produce returns in excess of the market proportional to the additional volatility accepted to earn such returns. This latter observation confirms our assertion that our strategy does not significantly differ from the market and implies that the investment may not be worth the additional risk for strongly risk-averse investors.

Our results are inconsistent over the three investment horizons we examined, indicating that the risk and return to a climate-focused investment strategy are dominated by other factors. Our results for sector and geographic distribution,

presented in sections 5.1 and 5.4.1, may offer answers for the chronological variability of our investment strategy. Underexposure to North American markets is the likely cause for low and insignificant abnormal returns, as these markets have provided exceptional returns over the past decade, despite the 2002-2003 recession. In general, the regional biases of both the “Climate Leaders” Portfolio and “Bren Fund” are likely responsible for the greater short- and medium-term volatility of our investment strategy. This volatility is offset somewhat by our strong position in value companies in the Utilities, Energy, and Materials sectors. These positions may similarly have provided high abnormal returns in the short-run, coincident to record highs in oil, natural gas, and various metals prices.

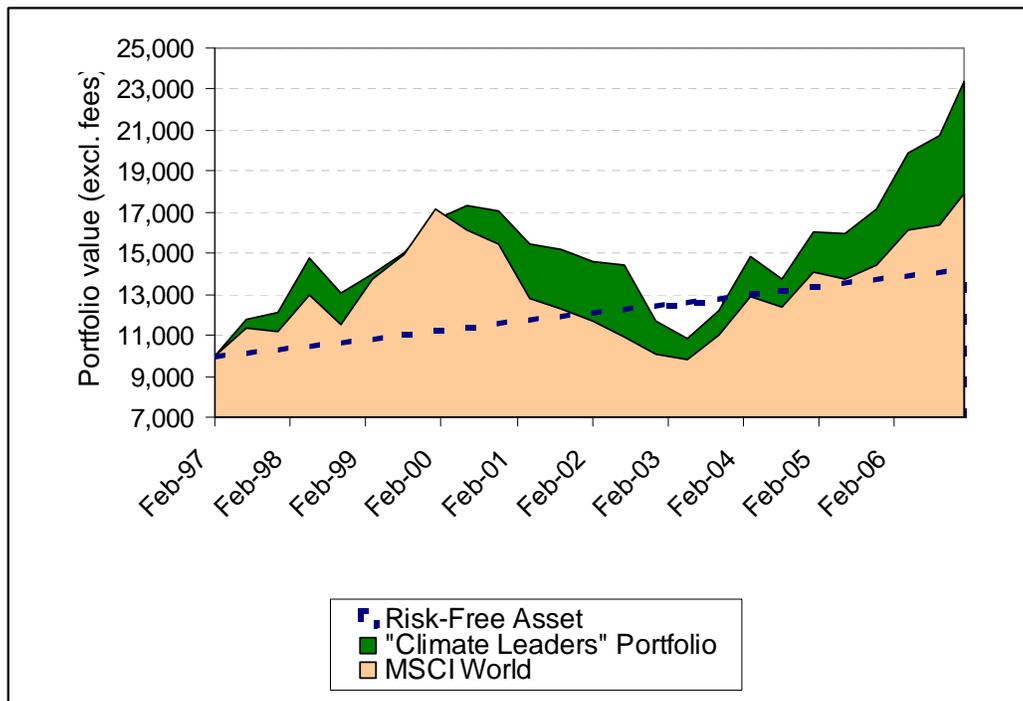


Figure 24 Value of Portfolio on January 31, 2007 with Initial Investment in January 1997

Ultimately, a climate-focused investment strategy appears to be a competitive substitute for a market portfolio in the long-run and offers an attractive investment opportunity to green investors. Our ten-year results for the “Bren Fund” imply that our strategy is in fact quite a bargain, with significant positive abnormal returns and one-third less risk than the market; however, this specific allocation is based on *ex post* optimizations to maximize returns. Because this would be an exceedingly rare and random event *ex ante*, we do not consider the “Bren Fund” an appropriate framework from which to draw our conclusions. Furthermore, as our hypothesis tests the value of a climate performance screen – not a returns-maximizing strategy, we base our conclusions on the “Climate Leaders” Portfolio.

Consequently, we lack the sufficient evidence to reject our null hypothesis. The ten-year “Climate Leaders” Portfolio risk and returns are not significantly different from the market, thus directly confirming the null. Inconsistent risk and return measures for

intermediate periods imply a higher level of short-run volatility, but they are not sufficient to contradict the robust ten-year results. In non-market valuation methods, our findings should convince investors that investing in climate-friendly companies yields both environmental and financial dividends, with a net “return” greater than the market. This claim, however, is subjective and not a testable valuation method at this time.

Our findings are consistent with those of similar studies conducted on how socially responsible portfolios and indexes perform relative to the market. An analysis of six socially responsible indexes by Filip Corten of Dexia Asset Management (2003) found that the indexes did not significantly outperform their benchmarks over one to two years, and carried a slightly higher degree of risk. Additionally, an examination of 17 socially responsible mutual funds by Hamilton et al. (2002) found that returns to 15 of the funds were not significantly different from the market. The average return of these 15 funds was -0.06% per month. Our “Climate Leaders” Portfolio, by contrast, outperformed the market by 0.24% per month over an equivalent period, although this result was also statistically insignificant.

5.5.2 Geographic Composition

Both the “Climate Leaders” Portfolio and the “Bren Fund” exhibited a strong bias toward UK and European companies (Figure 22), with over a quarter of either fund’s assets invested in UK companies alone.¹⁷ The two funds are proportionately underweighted in U.S. and Japanese firms. We believe these biases are directly attributable to the differences in regulatory climates in these countries. Because European companies are already subject to CO₂ reduction requirements and are more likely to be involved in carbon trading mechanisms, they are more likely to respond to the CDP questionnaire and should – on average – score higher than their U.S. competitors.

5.5.3 Sector Analysis

The two sectors most heavily represented in the “Climate Leaders” Portfolio in absolute terms are Financials and Utilities. Relative to the market and investment universe, however, the Portfolio’s allocation to Financials is less than expected, whereas the allocation in Utilities companies is nearly twice that of the market. Our geographic allocation within the Utilities sector is heavily invested in Europe companies. In addition to the regulatory pressures enforced in Europe, the very nature of Utilities companies necessitates extensive disclosure and the development of proactive policies. Combined regulatory and consumer pressures place a considerably greater level of risk on the Utilities sector than other sectors. Development of comprehensive strategies to address climate risk is necessary for these companies to minimize costs, uphold their public images, and remain profitable. It may ultimately be the case that the market in which European utility companies operate, has better conditioned them to address climate risk.

¹⁷ Composition as of 11 February 2007.

In contrast to Utilities companies, Financials institutions have achieved a strong presence in the “Climate Leaders” Portfolio, because their operations are largely unaffected by climate legislation. Losses from insurance claims present the greatest risk to Financials companies, yet these risks have not yet materialized. Furthermore, the improvement of climate forecasting and due diligence procedures may sufficiently mitigate physical risks to customers, thereby reducing the risk directly faced by the insurers. Additionally, survey responses from this sector reflected the perception that climate change has created greater opportunities for innovation and profit. Almost every financial company in our “Climate Leaders” Portfolio has developed or is in the process of developing climate-focused investment products or services.

5.5.4 “Bren Fund”

Our optimized “Bren Fund” has substantial sector biases, with a 68% stake in Utilities and energy companies and zero investment in diversified financial firms (Figure 23Figure 22). We propose that the predominance of Energy and Utilities companies is due to higher levels of stability within these industries relative to more risky growth industries. For the ten-year period beginning January 1997, Utilities and Energy had the lowest volatility of returns compared to all other sectors (0.069% and 0.075%, respectively). Though it may seem counterintuitive for a climate-focused fund to invest so heavily in Utilities and Energy, it makes sense in the context of our methodology, which screens for climate disclosure, not emissions intensity. Further, the portfolio screening and optimization process was conducted using mean-variance data only.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

A massive green investment boom occurred in 2006, during which several green indexes and funds were launched. With the increased media attention paid to global climate change and the increased awareness of this environmental issue, a boom in climate-related investment products may be around the corner. The portfolio analysis conducted in this project offers climate-minded investors meaningful findings. Because we were not able to reject our null hypotheses, we can conclude that those seeking to invest in companies with strong climate performance will not sacrifice returns. Climate investors may expect their returns and volatility to match the market over the long-run.

On a broader scale, investors may be able to exert some influence on companies to improve their financial performance. Fund managers are lobbying companies to improve their environmental policies with increasing frequency. These fund managers aim to increase the universe of environmentally friendly companies, so they will not have to screen out top financial performers that may have poor environmental records (Harper 2006). The greater the universe of environmentally or climate-friendly companies, the more diverse and robust a portfolio derived from this universe will be. In addition, as climate and environmental regulations come into force around the world, becoming environmentally friendly will not only benefit investors and fund managers, but also the companies themselves.

6.2 Recommendations for Future Research

Today's marketplace increasingly accepts the notion that to varying degrees, companies will be exposed to competitive and reputational pressures resulting from climate change. These market pressures will likely lead to corresponding financial impacts. Voluntary reporting initiatives relating to climate change, like the Carbon Disclosure Project, address investors' concerns, such as the effect of climate change on the valuation of companies. From an investment standpoint, risks that are better understood can be more easily addressed. Similarly, companies best positioned to create new products and tap emerging markets in reaction to climate change may be more valuable than traditional valuation techniques suggest (Gardner 2007). However, the lack of consistent, effective, and reliable data with regard to the business impacts of climate change hinders investors' and stakeholders' abilities to efficiently assess these opportunities and risks. The evaluation of a company's climate change risks and opportunities can require a full-scale public disclosure effort. The time necessary to find and analyze such materials as sustainability reports, company press releases, SEC filings, and company websites makes it difficult to engage in a thorough and accurate analysis of consistent public disclosure.

The CDP offers the most comprehensive first step for investors to analyze companies' climate change risks and opportunities, because it provides investors with a consistent viewpoint that can be referenced through time. In the absence of mandatory climate-related disclosures, voluntary external reporting (such as the CDP) and public relations campaigns on the part of corporations themselves may provide the best climate performance data currently available. Our guiding principle in this project has been to identify how companies are preparing for the physical, regulatory, legal, and reputational risks in the context of global warming. Investors' use of historical data to predict how current actions, events, and plans will affect tomorrow's risks also influenced our approach to this project. Our analysis and subsequent results were essentially an exercise in investigating how effective the Carbon Disclosure Project's findings are at predicting financial performance in the face of climate risks and opportunities. As demand for publicly available corporate climate information increases, we recommend the following further research and uses of the CDP:

- 1. Examination of long term climate performance trends.** As future CDP reports are published, investors should find value in examining the correlation between company stock price and CDP score over a longer timeframe. Only four CDP reports have been published thus far, so any statistical analysis comparing four scores to financial trends data would not result in any significant findings. Were responding to the CDP questionnaire to become a standard business practice, publicly available disclosure data would be abundant in the future. These data, which include overall scores, could serve as the basis for additional research into the link between climate disclosure performance and financial returns. For example, according to the fourth CDP report, total GHG emissions reported in the CDP surveys have increased over 70 percent from 2001 to 2005, primarily as a result of improved disclosure. As future CDP surveys are conducted, the associated climate risks and opportunities will highlight and emphasize the correlation between a company's climate performance and its financial performance.
- 2. Incorporation of actual emissions intensity into the evaluation process.** The CDP score is an evaluative measure of disclosure, not actual emissions intensity. Within the CDP survey, companies are asked to quantify their emissions intensity as a function of emissions per unit of sales; however, a deeper analysis of the physical impacts of climate change on business activities is necessary. It may be useful to incorporate emissions intensity data into a future analysis, in order to evaluate companies' overall environmental risk in a more comprehensive manner. The incorporation of more specific emissions intensity measurements would more clearly confirm that climate change is a financially material issue, and will present significant material exposure and creative opportunity.

- 3. Evaluation of CDP scores as an accurate and predictive measure of climate management strategies.** The CDP serves as a tool for climate change reporting, but as the effects of climate change begin to materialize, future analysis should compare companies' historical CDP scores to the financial impacts associated with global warming. As these events unfold, the effectiveness of the CDP score in light of the material risks and opportunities can be gauged. Companies' valuable and harmful environmental strategies will manifest themselves in the face of realized risk, such as new legislation, physical asset damage due to climate change, or other risk factors related to climate.
- 4. Increase in number of companies surveyed by the CDP.** The CDP is currently sent to 2,000 global companies, but were it sent to an even larger, more stratified universe of companies, the scope and breadth of carbon disclosure could be greatly increased. Future analysis of smaller market capitalization companies that may have higher stock price volatility but a strong climate commitment would illustrate how climate change impacts business at all levels and sizes. Smaller companies have just as much to gain or lose as their large-cap counterparts, so the analysis of their business strategies is equally as important as that of large multinational firms.
- 5. Research into whether climate improvements are driven by investors or managerial discretion.** The CDP identifies companies' present and future challenges and opportunities associated with climate change; however, it does not reveal whether the benefits and risks are accounted for as a result of investor concerns or managerial pressure to forecast future business operations. Many companies have adopted adjustments within their business operations to respond to climate change, but the distinction between investor-driven change and managerial forecasting has not yet been distinguished. Companies not pressured by investors to manage their business with climate change in mind could illustrate that effective management and governance strategies could lead to potential future benefits. Companies that incorporate their indirect greenhouse emissions (i.e. investment in high-emitting companies) into management strategies, internalize the business risks and opportunities associated with climate change. Should these companies take their indirect contribution into account, they can strategically position themselves to reduce the impacts of climate change on their own business operations. Therefore, even if a company's own operations pose no direct risks or opportunities, it stands poised to potentially benefit or suffer from the impacts of climate change, because these impacts are tied to their supply chain, investment universe, and product mix.
- 6. Incorporation of climate modeling and scenario schematics to analyze the potential physical impacts to businesses.** If investors are concerned

with the material impacts of climate change on a particular businesses operation, there would be great value in incorporating climate change models into investment decisions. To supplement a company's CDP response, an investor could research the company's specific operations to project the impact of changing weather patterns, increased storm intensity, sea-level rise, forest fires, flooding, decreased availability of water, and temperature changes, as well as the health impacts on the company's workforce.

- 7. Engagement.** Companies competitively positioned within their respective industries to absorb the impacts of climate have scored relatively well on the CDP. These firms have made tangible commitments to managing their business with climate change in mind and work to remain on the Climate Leaders Index. Therefore, those companies that score poorly on the CDP have the additional incentive to change their strategies in an effort to stave off investor concerns. This idea of engagement is a public pressure mechanism provided by the CDP. Because the CDP is a publicly available resource, it can continually pressure firms to account for the business impacts of climate change through investor awareness. Future research should highlight those companies that have scored poorly in past CDP reports, but whose scores are continually improving. Additionally, any future analysis using CDP data should emphasize those companies that have not responded to the CDP in the past, but decide to do so at some point in the future. New participant engagement highlights the growing pressure for companies to disclose the business risks and opportunities of climate change.

Our investigation used public information to screen an investment portfolio using climate performance criteria, a distinct approach compared to the proprietary screens currently used to produce environmentally-friendly investment funds. We have pointed out several short-comings in the data we used for our analysis, none more significant than the lack of greenhouse gas emissions data. As this data gap is closed, the value of public information to investors seeking a climate-friendly portfolio will be enhanced, thereby creating opportunities for future research into the climate performance/stock performance question. We believe that future research will present a more lucid connection between corporate climate change performance and investor returns, which will increase demand for better information and for investment products that incorporate this information into the stock-picking process.

APPENDIX 1: CDP Questionnaire

Top score is 100 pts; each question is allocated 10 pts.

1. General: How does climate change represent commercial risks and/or opportunities for your company?

- 0 – response shows that company has not thought about implications of climate change
- 5 – response provides basic overview of key risks and opportunities
- 10 – response is detailed and provides comprehensive overview of key risks and opportunities

2. Regulation: What are the financial and strategic impacts on your company of existing regulation of GHG emissions, and what do you estimate to be the impact of proposed future regulation?

- 0 – response shows that company has not thought through financial/strategic impacts of regulation
- 5 – response shows that the company has limited awareness of relevant financial/strategic impacts
- 10 – response shows that company is highly strategically aware and has either clearly mapped out relevant impacts or explained how these risks are not relevant

3. Physical risks: How are your operations affected by extreme weather events, changes in weather patterns, rising temperatures, sea level rise and other related phenomena both now and in the future? What actions are you taking to adapt to these risks, and what are the associated financial implications?

- 0 – response shows company is poorly aware of physical risks posed by climate change
- 5 – response shows that company is thinking about how their operations could be affected by physical effects of extreme weather
- 10 – company highly aware and discloses strategy to mitigate risks or explains how it does not face exposure in this area

4. Innovation: What technologies, products, processes or service has your company developed, or is developing, in response to climate change?

- 0 – response shows that company has not considered these opportunities
- 5 – response shows that company is making use of eco-efficiency solutions
- 10 – where the nature of its business and corporate focus permits, company reports that it is exploring ways to benefit from developing products and services in response to climate change

5. Responsibility: Who at board level has specific responsibility for climate change related issues and who manages your company's climate change strategies? How do you communicate the risks and opportunities from GHG emissions and climate change in your annual report and other communications channels?

- 0 – no response
- 5 – company discloses that it has set up responsibility under EHS or has a senior person/small team in charge of energy/emissions management

- 10 – response shows that company has climate change management group that reports to board or executive team, and publicly reports emissions

6. Emissions: What is the quantity in tonnes CO₂e of annual emissions of the six main GHGs produced by your owned and controlled facilities in the following areas, listing data by country?

- Globally.
- Annex B countries of the Kyoto Protocol.
- EU Emissions Trading Scheme.

Please list GHG Protocol scope 1, 2 and 3 emissions equivalent showing full details of the sources. How has this data been audited and/or externally verified?

- 0 – company has not measured emissions or does not disclose
- 5 – company has measured emissions but re-directs to SD or EHS report
- 10 – fully discloses direct and indirect emissions data (where relevant) as well as geographic distribution

7. Products and services: What are your estimated emissions in tonnes CO₂e associated with the following areas and please explain the calculation methodology employed.

- Use and disposal of your products and services?
- Your supply chain?
 - 0 – company has not measured these emissions or does not disclose
 - 5 – discloses limited information
 - 10 – fully discloses data in response

8. Emissions reduction: What is your firm's current emissions reduction strategy? How much investment have you committed to its implementation, what are the costs/profits, what are your emissions reduction targets and timeframes to achieve them?

- 0 – no response
- 5 – discloses programs and targets for energy reduction and/or operations retrofits that will lead to reductions in GHG; no GHG reduction target
- 10 – response shows that company has advanced strategy in place and discloses targets and timeframes

9. Emissions trading: What is your firm's strategy for, and expected cost/profit from trading in the EU Emissions Trading Scheme, CDM/JI projects and other trading systems, where relevant?

- 0 – company has not considered emissions trading
- 5 – response shows that company has considered emissions trading, but has not followed up on any relevant opportunities; discloses some information and is participating in ETS
- 10 – discloses details and is investing/looking into CDM/JI and has disclosed cost/profit

10. Energy costs: What are the total costs of your energy consumption, e.g. fossil fuels and electric power? Please quantify the potential impact on profitability from changes in energy prices and consumption.

- 0 – does not disclose
- 5 – discloses limited info
- 10 – discloses all data clearly in response

APPENDIX 2: “Climate Leaders” Portfolio Composition

<i>"Climate Leaders" Portfolio</i>		
Company	Industry	Location
ABN Amro Holding	Banks - Europe	Netherlands
Allianz	Insurance - Europe	Germany
Anglo American	Metals & Mining	UK
ANZ Banking	Banks - Asia	Australia
AstraZeneca	Pharmaceuticals	UK
Barclays	Banks - UK & Ireland	UK
Baxter International	Health Care Equipment & Supplies	US
Bayer	Diversified Chemicals	Germany
BHP Billiton	Metals & Mining	Australia / UK
BMW	Automobiles	Germany
BP	Integrated Oil & Gas	UK
British Sky Broadcasting	Broadcasting & Cable TV	UK
BT Group	Integrated Telecommunication Services	UK
Cadbury Schweppes	Food Products	UK
Cemex	Construction Materials	Mexico
Centrica	Multi-Utilities & Unregulated Power	UK
Chevron	Integrated Oil & Gas	US
CLP Holdings	Electric Utilities - Intl	Hong Kong
Deutsche Telekom	Integrated Telecommunication Services	Germany
Diageo	Beverages & Tobacco	UK
Dow Chemical	Diversified Chemicals	US
EnCana	Oil & Gas Exploration & Production	Canada
FPL Group	Electric Power Companies - N. America	US
Fuji Photo Film	Leisure Equipment & Products	Japan
GUS	Multiline Retail	UK
HSBC	Banks - UK & Ireland	UK
Iberdrola	Electric Utilities - Intl	Spain
Intel	Semiconductor Equipment & Products	US
Kansai Electric Power	Electric Utilities - Intl	Japan
Marsh & McLennan	Insurance - N. America	US
Matsushita Electric Industrial	Household Durables	Japan
Munich Re	Insurance - Europe	Germany
National Grid plc	Multi-Utilities & Unregulated Power	UK
Nippon Steel	Steel	Japan
Norsk Hydro	Oil & Gas Exploration & Production	Norway
Novo Nordisk	Pharmaceuticals	Denmark
Pfizer	Pharmaceuticals	US
PG & E	Multi-Utilities & Unregulated Power	US
POSCO	Steel	South Korea
Praxair	Specialty Chemicals	US
Reed Elsevier	Publishing	Netherlands / UK
Repsol YPF	Integrated Oil & Gas	Spain
Rio Tinto	Metals & Mining	Australia / UK
Royal Dutch / Shell	Integrated Oil & Gas	Netherlands /

		UK
RWE	Electric Utilities - Intl	Germany
Scottish Power	Electric Utilities - Intl	UK
Siemens	Industrial Conglomerates	Germany
Suez	Multi-Utilities & Unregulated Power	France
Suncor Energy Inc	Integrated Oil & Gas	Canada
Swiss Re	Insurance - Europe	Switzerland
Tesco	Food & Drug Retailing	UK
Total	Integrated Oil & Gas	France
UBS	Diversified Financials - Europe	Switzerland
Unilever	Food Products	Netherlands / UK
Westpac Banking	Banks - Asia	Australia

APPENDIX 3: “Bren Fund” Composition

<i>"Bren Fund" Composition</i>					
Company	Industry	Location	Region	Weight	CDP Score
<i>Suncor Energy Inc</i>	Energy	Canada	North America	0.301	85
<i>National Grid plc</i>	Utilities	UK	Europe	0.223	85
<i>Novo Nordisk</i>	Health Care	Denmark	Europe	0.15	85
<i>Iberdrola</i>	Utilities	Spain	Europe	0.063	85
<i>Baxter International</i>	Healthcare	US	North America	0.059	90
<i>Scottish Power</i>	Utilities	UK	Europe	0.058	85
<i>POSCO</i>	Materials	South Korea	Asia	0.04	85
<i>Centrica</i>	Utilities	UK	Europe	0.032	85
<i>Siemens</i>	Industrials	Germany	Europe	0.027	90
<i>BHP Billiton</i>	Materials	Australia / UK	Asia	0.019	90
<i>Tesco</i>	Consumer Staples	UK	Europe	0.018	85
<i>EnCana</i>	Energy	Canada	North America	0.003	85

GLOSSARY OF TERMS

Alpha: Measure of a stock's performance beyond what its Beta predicts.

AUM: (Assets Under Management) The market value of assets an investment company manages on behalf of investors.

Beta: A measure of an investment's volatility, relative to an appropriate asset class, such as an index. A Beta of 1 implies perfect correlation between volatilities.

Capital Allocation Line (CAL): The line of expected return plotted against risk (standard deviation) that connects all portfolios that can be formed by combining a risky asset and a riskless asset.

Efficient Frontier: The line or curve on a risk-reward graph comprised of all efficient portfolios. Portfolios on this line maximize returns for a given level of risk.

Engagement: The process of stakeholders communicating their environmental concerns to companies to enhance environmental performance.

ETF: (Exchange Traded Fund) A security that tracks an index, a commodity or a basket of assets like an index fund, but trades like a stock on an exchange, thus experiencing price changes throughout the day as it is bought and sold.

Information Ratio: the ratio of expected return to risk, as measured by standard deviation

Investment Risk: The potential for fluctuation in the value of an investment, which could result in loss of principal.

Laffer Curve: A inverted parabola used to illustrate the existence of a median level of taxation that maximizes total government receipts.

Market Capitalization: Market capitalization represents the aggregate value of a company or stock. It is obtained by multiplying the number of shares outstanding by their current price per share.

Riskless Asset: An asset with a guaranteed rate of return, such as cash in a savings account or a treasury bill.

Sharpe Ratio: A measurement of the reward-to-risk efficiency of an investment, used to create risk-efficient portfolios.

Universe: A group of companies that shares a common characteristic or represents the market as a whole.

Volatility: A measure of the uncertainty of an investment as measured by the difference between observed and expected price movements.

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