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Carbon Efficiency: A Strategic Look

INTRODUCTION

As concerns over climate change continue to grow, carbon asset risk is becoming increasingly important, especially for long-term investors. World leaders are weighing in on fossil fuel divestments, and the UN warned last year that ignoring these risks could be seen as a breach of the investors' fiduciary duty to their beneficial owners. With institutional investors like pension funds, insurance companies, and sovereign wealth funds proactively looking to hedge climate risk, the demand for low-carbon investment options is surging, and the market has seen a slew of new index-linked products catering to this need. Investors can choose strategies based on a number of parameters, such as the level of carbon reduction they desire, the degree of benchmark tracking, portfolio returns and risks, and other specific indicators.

Many investors are interested in divesting from fossil fuels and high-carbon-emitting companies, due to an ethical commitment to halt global warming or because of government pressure.

In this paper we look at the case for carbon efficient investment and analyze a few passive solutions that aim to provide either divestment from carbon or beta exposure with a lower carbon footprint.

THE CASE FOR CARBON EFFICIENT INVESTING

Many investors are interested in divesting from fossil fuels and high-carbon-emitting companies, due to an ethical commitment to halt global warming or because of government pressure. In addition, there may be a desire to hedge a portfolio against the risks associated with companies with high carbon footprints.

A major potential risk of investing in these companies is unexpected costs arising from potential regulatory changes in the form of caps or taxes on emissions. Companies with high carbon footprints will likely face increasingly higher costs and will need to either reduce or limit their emissions due to new regulations, such as performance standards, emissions trading, and carbon taxes. Another highlighted issue is the concept of "stranded assets."[1] The main thesis is that if existing fossil fuel reserves of coal, oil, and natural gas are extracted and burnt, climate catastrophe is inevitable. In order to remain within the widely accepted climate threshold of an increase of no more than 2°C in average global

[1] Source: "Unburnable Carbon–Are the world's financial markets carrying a carbon bubble?" Carbon Tracker, 2014.

temperature, the vast majority of already discovered fossil fuel reserves will ultimately need to remain in the ground, thus becoming "stranded" and worthless. This impact is especially acute in sectors like oil and gas exploration and production companies that typically show their reserves as assets on their balance sheets. These assets could be marked down and, as a result, company valuations could be negatively affected by divestment campaigns and changing norms and regulations.

In spite of the growing awareness of these issues, it is widely considered that financial markets are still underpricing carbon risk.

Additional potential reasons for investing in carbon efficient solutions include the possibility of falling demand for fossil fuels from the substitution of competing "clean" energy, such as wind and solar. Improvements in energy efficiency and other technologies in the industrial, commercial, and transportation sectors could result in significantly lower demand for traditional high-carbon energy sources.

Many investors are interested in divesting from fossil fuels and high-carbon-emitting companies, due to an ethical commitment to halt global warming or because of government pressure. Also, low-carbon energy infrastructure has significantly lower operating expenses and a longer expected lifespan than fossil fuel assets, with significant potential to achieve operating savings and lower costs of capital.[2] As governments commit funding to promote research advancements and innovations, there could be potentially significant upside for low-carbon investors as there are major technological breakthroughs.

In spite of the growing awareness of these issues, it is widely considered that financial markets are still underpricing carbon risk. Carbon efficient indices reflect the belief of some investors that these factors are not adequately captured by research analysts who, being uncertain about the timing of new regulations and their impact, end up treating carbon risk as a zero-probability event.

HISTORICAL ANALYSIS

As can be seen, the premise for carbon efficient investing is highly dependent on forward-looking analysis. However, a historical comparison[3] between the highest- and lowest-carbon-emitting companies may be useful as an extreme example to understand which factors other than future carbon risk might affect the performance of a carbon efficient portfolio. High carbon footprint companies are predominantly concentrated in energy, utilities, and materials, whereas a hypothetical portfolio avoiding carbon would likely have a higher exposure to the financials and information

[2] Source: "Moving to a Low-Carbon Economy: The Financial Impact of the Low Carbon Transition" Climate Policy Initiative, 2014.

[3] The 100 highest carbon emitting companies in the S&P Global 1200 are compared against the lowest 100. Carbon emission data from Trucost. Measured by annual greenhouse gas (GHG) emissions/revenue. Data taken from December 2008 is assumed to be static for previous periods due to non-availability of data for prior periods.

technology sectors (see Exhibits 1 and 2). The heavy sector differences ensure that the two portfolios have varying periods of outperformance and price declines. Though changes in oil prices affect the utilities and materials sectors differently from the energy sector, the correlation of monthly returns of the aggregate high-carbon portfolio to the Brent crude index is around 80%. The returns of high-carbon stocks on an aggregate basis can be attributed to some extent to oil and more broadly to the commodities super cycle of the first decade of the 21st century. From 2000 to 2011, the lowest carbon emitters had an annualized return of 8.03%, significantly less than the 13.57% return of the highest emitters. The returns from 2012 onward look different, however, with a poorer performance from high-carbon names (2.46% annualized versus 16.84% for the lowest-carbon-emitting stocks), driven chiefly by the slump in commodities (see Exhibit 3). Although high-carbon companies had higher cumulative returns over the entire 15-year period, investors should be aware of the inherent dangers of looking backward to base future performance, given the natural boom and bust cycles of the energy sector and the huge recent focus on renewables.

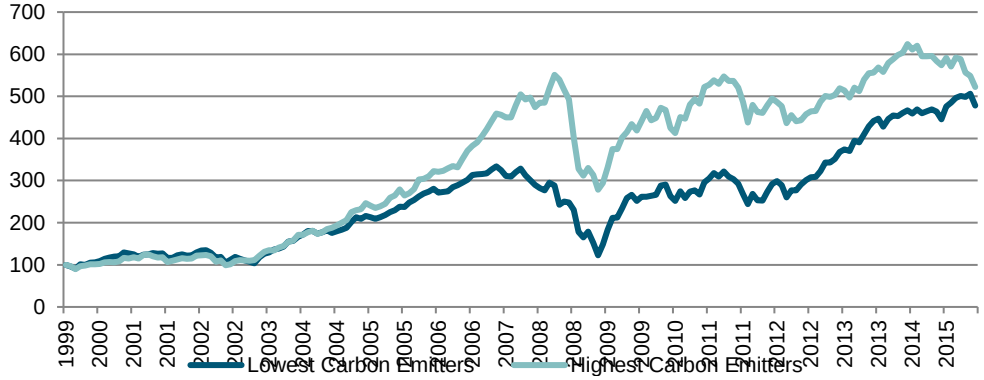
The heavy sector differences ensure that the two portfolios have varying periods of outperformance and price declines.

Exhibit 1: Sector Breakdown of Highest and Lowest Carbon Emitters in the S&P Global 1200

SECTOR	LOWEST 100 BY CARBON EMISSIONS	HIGHEST 100 BY CARBON EMISSIONS
Consumer Discretionary	5	1
Consumer Staples	-	10
Energy	-	28
Financials	66	-
Industrials	3	9
Information Technology	21	-
Materials	-	22
Telecommunication Services	-	-
Utilities	-	30
Health Care	5	-

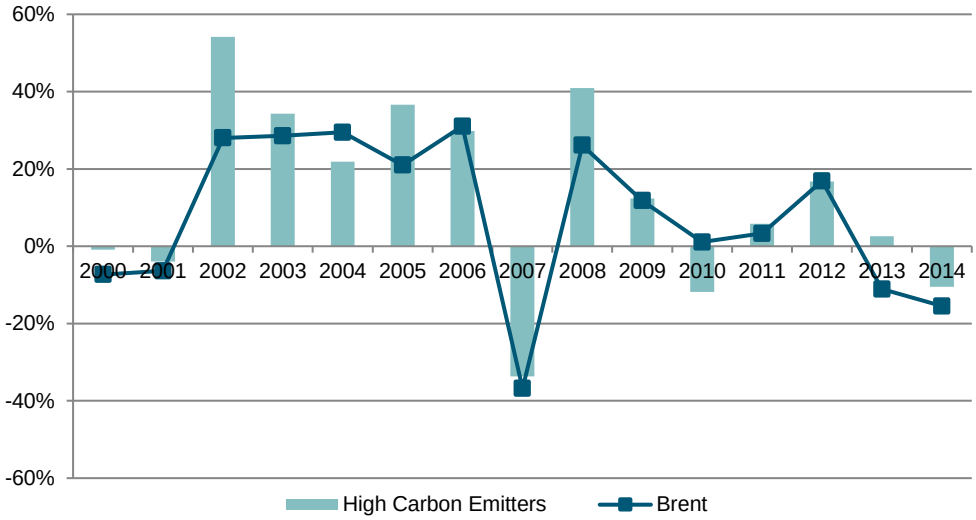
Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1999, to Aug. 31, 2015. Table is provided for illustrative purposes.

Exhibit 2: Performance Comparison of Highest and Lowest Carbon Emitters in the S&P Global 1200



Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1999, to Aug. 31, 2015. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

Exhibit 3: Annual Returns from High Carbon Emitters in the S&P Global 1200 Versus Brent Crude[4]



Source: S&P Dow Jones Indices LLC. Data from January 2000 to January 2015. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

We find that within sectors, certain sub-industries have structurally high/low carbon emissions.

Given the large sector concentrations in the previous analysis, it may be worthwhile to look at a sector-neutral comparison of the historical performance of high and low carbon emission portfolios. In order to make the comparison net of sector effects, the highest- and lowest-carbon-emitting companies are chosen within the sector[5]. We find that within sectors, certain sub-industries have structurally high/low carbon emissions. Water utilities, for instance, have a much lower carbon footprint than electric utilities, while the packaged foods and meats sub-industry, which is around one-fifth of the consumer staples sector, disproportionally contributes more than 45% of emissions consistently. As seen in Exhibit 4, high carbon emitters within sectors can have significantly different performances from their low carbon counterparts. The degree to which the performance differential can be attributed to the effect of sub-industry allocations (as opposed to stock specific factors) varies considerably between sectors. In the sectors of consumer discretionary, consumer staples, and financials, sub-industry allocations contribute around 98% of the difference in returns. The allocation effect is weaker in utilities, energy, materials, and health care averaging around 35%.

[4] Brent crude as measured by the S&P GSCI Brent Crude 1 Month Forward.

[5] The 30 highest carbon emitting companies in the S&P Global 1200 with the sector are compared against the lowest 30. Carbon emission data from Trucost. Measured by annual greenhouse gas (GHG) emissions/revenue. Data taken from December 2008 is assumed to be static for previous periods due to non-availability of data for prior periods. Only those sectors whose stocks exhibit significant variation in carbon emissions are considered. Information technology, telecommunication services, and industrials are thus excluded for this analysis.

Exhibit 4: Performance of High Versus Low Carbon Emitters (CE) Within Sectors

PORTFOLIO	ANNUALIZED RETURN (15 YEARS) (%)	ANNUALIZED RETURN (5 YEARS) (%)
Highest CE Utilities	7.74	5.15
Lowest CE Utilities	10.06	4.47
Highest CE Energy	13.67	-0.25
Lowest CE Energy	11.44	2.15
Highest CE Materials	12.92	-3.91
Lowest CE Materials	16.18	9.85
Highest CE Financials	13.81	13.29
Lowest CE Financials	10.02	13.39
Highest CE Consumer Staples	14.08	16.89
Lowest CE Consumer Staples	9.85	10.80
Highest CE Consumer Discretionary	13.44	19.11
Lowest CE Consumer Discretionary	7.75	19.00
Lowest CE Industrials	12.82	15.18
Highest CE Industrials	12.40	7.69
Highest CE Healthcare	10.61	16.31
Lowest CE Healthcare	15.84	22.45

Source: S&P Dow Jones Indices LLC. Fifteen-year data from Aug. 31, 2000, to Aug. 31, 2015. Five-year data from Aug. 31, 2010, to Aug. 31, 2015. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

Measuring a company's carbon footprint involves two key aspects: recent carbon emissions and the potential future emissions embedded in fossil fuel reserves of coal, oil, and natural gas.

In our view, it is difficult to conclude any causality between carbon emissions and financial performance (on a historical basis), but the results can identify key sectors and subsectors that contribute heavily to return differences. Portfolios that attempt to lower carbon footprint on a sector blind basis will have constrained allocations to utilities, materials, and energy, while sector neutral portfolios will avoid sub-industries that structurally emit higher greenhouse gases.

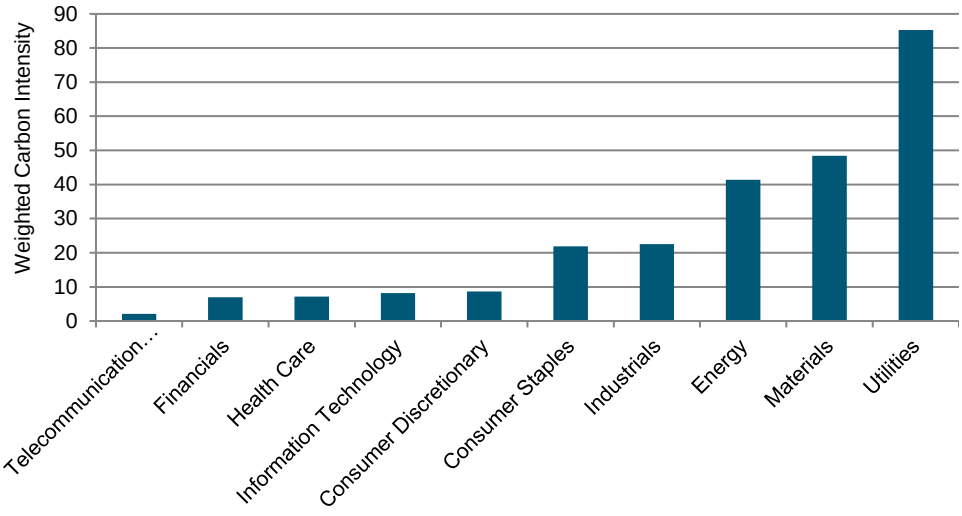
MEASURING CARBON FOOTPRINTS

Measuring a company's carbon footprint involves two key aspects: recent carbon emissions and the potential future emissions embedded in fossil fuel reserves of coal, oil, and natural gas. Limiting future emissions would target companies at the supply side, meaning those that own or produce fossil fuels while reducing current emissions would penalize the largest consumers and emitters of pollutants.

As a rough guideline, future emissions are almost completely concentrated in the energy sector, where fossil fuel reserves are extracted or mined. Current carbon emissions, on the other hand, are mainly attributable to the utilities sector and then energy and materials (as indicated in the breakdown of the highest-carbon-emitting names in the previous section). As shown in Exhibit 5, the weighted carbon emissions of GICS® sectors in

the S&P Global 1200 varies significantly, with utilities, materials, energy, and industrials accounting for 80% of emissions, combined.

Exhibit 5: Current Carbon Emission Intensity of Sectors in the S&P Global 1200[6]



Source: S&P Dow Jones Indices LLC. Data as of Aug. 31, 2015. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

The S&P Carbon Efficient Family uses carbon intensity data provided by Trucost, incorporating both direct and first level indirect carbon emissions.

HARMONIZING CARBON EMISSION DATA–MARKET CAPITALIZATION OR REVENUE?

The S&P Carbon Efficient Family uses carbon intensity data provided by Trucost, incorporating both direct and first level indirect carbon emissions.[7] The carbon emissions of a company are determined by data[8] of annual greenhouse gas (GHG) emissions expressed as tons of carbon dioxide equivalent (CO_2e). To compare the carbon performance of companies of all sizes and sectors equitably and avoid a large-cap bias, GHG emissions need to be normalized (typically by revenue or market cap) to give a carbon intensity score. Since the objective is to model operational efficiency with respect to carbon, it is preferable to use CO_2e/revenues, as this parameter denotes how much GHGs a company emits relative to its peers, for every unit of output. Ideally a sector-relevant measure such as CO_2e/tons of crude steel, or CO_2e/barrels of oil equivalent should be used, as this would be the best representation of operational efficiency. However, since this measure cannot be aggregated across sectors, a revenue denominator is preferred. Using market capitalization in the denominator is less suitable in this context of measuring output. Additionally, it is price dependent, which can create a volatile carbon intensity measure.

PASSIVE STRATEGIES FOR CARBON REDUCTION

[6] Carbon emission intensity data provided by Trucost. Measured by annual GHG emissions/revenue.
[7] Trucost Carbon Emission methodology is available at www.trucost.com.
[8] Either disclosed by the company or estimated in other cases. Data provided by Trucost.

A simple passive strategy for carbon reduction is to exclude companies with fossil fuel reserves or high carbon emissions from the index universe. Another approach would be to "tilt" toward companies with lower carbon footprints, either within each individual sector or on a sector-agnostic basis. To minimize tracking error relative to the benchmark, the tilts are either further optimized or they are applied in conjunction with tight constraints in order to avoid a sector or geographic bias. Thematic indices can offer exposure to environmentally themed sectors that may benefit from regulatory or structural changes.

The most obvious parameter in measuring the efficacy of these passive strategies is the extent of carbon reduction; however, this should be balanced against considerations of tracking error, turnover, portfolio bias, and diversification. Different carbon reduction approaches could create different risk profiles and tradeoffs, as discussed next.

Divestment

The divestment or exclusionary approach has the advantage of simplicity, and it effectively communicates a proactive investment approach to climate change. While completely opting out of carbon may seem like the optimal environmental solution, this is accompanied with higher tracking error, which could be inappropriate for passive managers with a fiduciary duty to track a benchmark. The higher the share of an index universe that is excluded, the greater its potential impact on a portfolio. Since carbon exposure is concentrated in a few sectors, full divestment may also lead to structural biases.

Depending on individual tolerance limits, the criteria for exclusions could vary considerably from investor to investor.

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Companies that directly own, develop, and extract coal, oil, and natural gas reserves are usually the first to be screened out. Using the GICS classifications, this could translate to the divestment of integrated oil & gas, oil & gas exploration & production, and coal & consumable fuels companies. An even more demanding exclusionary screen would be to eliminate sub-industries involved in downstream activities such as refining, marketing, or financing fossil fuels, as well as primary users such as power plants, automakers, and airlines. However usage of such broad screens at the sub-industry level may run the risk of excluding a few companies that have no direct involvement in fossil fuels.

The subjectivity of the exclusionary approach boils down to determining which stocks and sub-industries to exclude—one could focus only on upstream businesses or they might consider the full value chain, including mid-stream companies involved in fossil fuel supply chains, or even down-stream companies consuming these fuels. By employing a negative screen, one could end up excluding anywhere from 6% to 30% of the global universe. The proportion excluded is more in regional indices covering

Australia, Canada, or Latin America, which have a higher concentration in mining and commodity companies.

The S&P Dow Jones Indices approach, as seen in the S&P Global 1200 Fossil Fuel Free Index, is to employ a selective divestment from fossil fuels using GICS sub-industries as criteria as well as company-specific fossil fuel reserve information from RobecoSAM. Ultimately, sectors with the closest links to both upstream fossil fuel activities and the rest of the value chain are divested, while still providing broad exposure to the universe.

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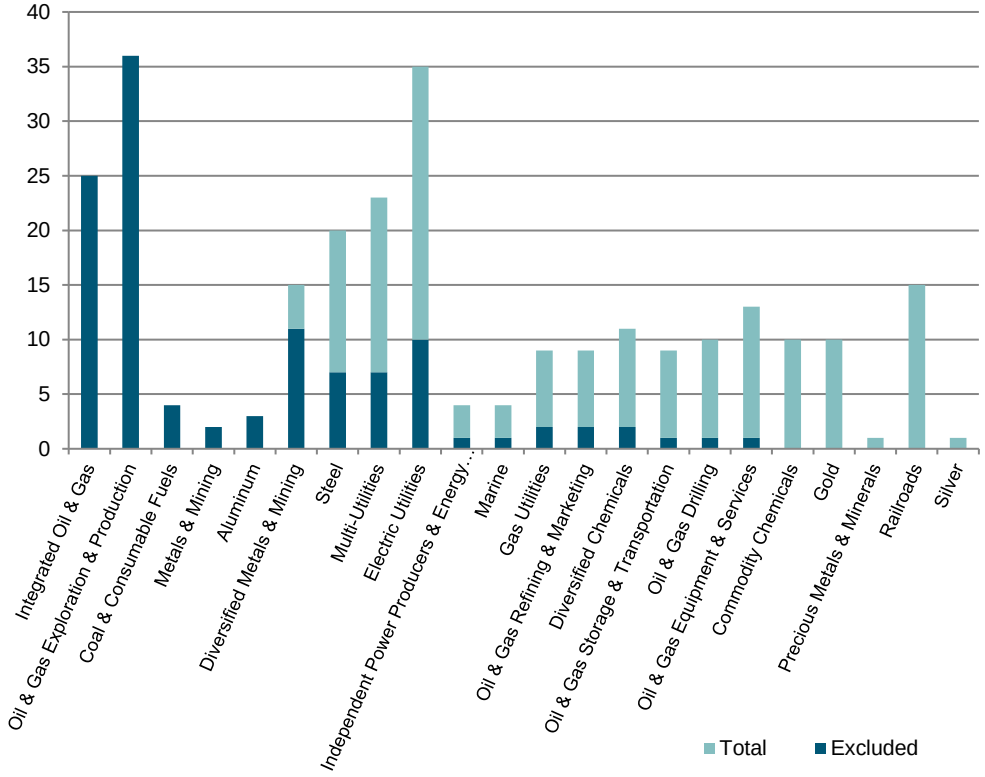
Exhibit 6: Regional Breakdown of the Investable Universe of the S&P Global 1200 Fossil Fuel Free Index

REGION	S&P GLOBAL 1200 FOSSIL FUEL FREE INDEX NUMBER OF CONSTITUENTS	BENCHMARK NUMBER OF CONSTITUENTS	PROPORTION OF INVESTABLE UNIVERSE AVAILABLE (%)
U.S.	387	502	77
Asia	39	50	78
Australia	35	50	70
Europe	271	350	77
Latin America	28	40	70
Japan	128	150	85
Canada	40	60	67
Global	928	1,202	77

Source: S&P Dow Jones Indices LLC. Table is provided for illustrative purposes.

Exhibit 7: Proportion of the Investable Universe of the S&P Global 1200 Fossil Fuel Free Index



Source: S&P Dow Jones Indices LLC. Chart is provided for illustrative purposes.

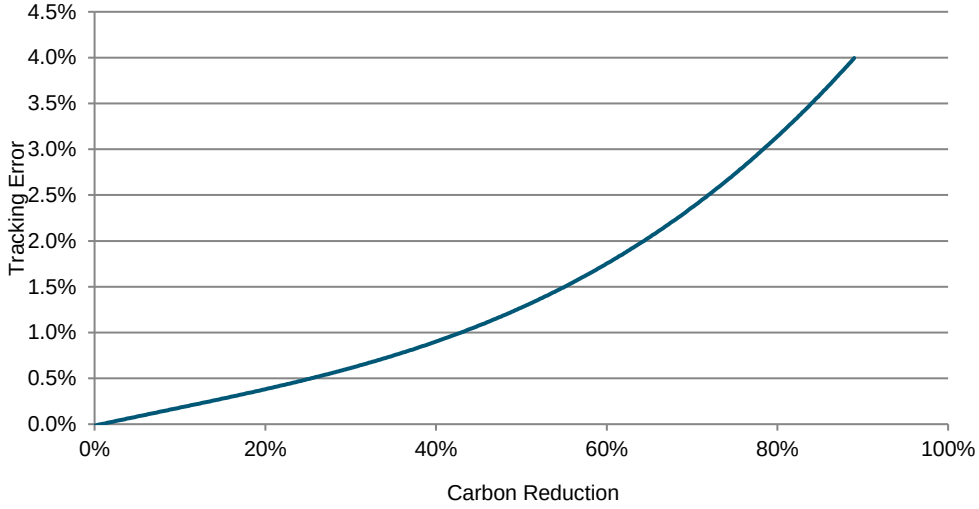
Beta Exposure With Low Carbon Footprint

Many investors wish to avoid the more drastic option of divestment in favor of tilting their portfolios toward carbon efficiency. The idea behind this approach is that investors can achieve carbon reduction without significant tracking error and an active sector or industry bias. This approach is similar to a benchmark tracker embedded with a low-cost option on carbon emissions being limited or expensive in the future. While divestment stresses on excluding companies that contribute to climate change, the focus of these tilted indices is to reward companies that have greater efficiency in reducing their carbon output.

Many investors wish to avoid the more drastic option of divestment in favor of tilting their portfolios toward carbon efficiency.

The magnitude of the tilt can be tailored to an individual investor's risk appetite for carbon reduction, with a heavier tilt leading to a higher tracking error, though this effect is nonlinear. Exhibit 8, which plots the tracking error against the degree of the "tilt," shows that a significant carbon reduction of 30%-50% can be achieved while keeping the tracking error between 60 to 125 bps and, at the same time, avoiding exclusions or active sector bets. While this tracking error is not insignificant for institutional investors, it may still be presumed as worthwhile when considered as a hedge against carbon risk.

Exhibit 8: Carbon Emission Reduction Versus Tracking Error



Source: S&P Dow Jones Indices LLC. Chart is provided for illustrative purposes. Tracking error is the difference between a portfolio's returns and the benchmark, measured by the standard deviation of the difference in the portfolio and benchmark returns over time.

Two indices from S&P Dow Jones Indices that offer beta exposure with significant carbon reduction are the S&P Global 1200 Carbon Efficient Index and the S&P Global 1200 Carbon Efficient Select Index.

S&P GLOBAL 1200 CARBON EFFICIENT INDEX

The S&P Global 1200 Carbon Efficient Index takes a sector-by-sector approach for each region and tilts the weights toward low-carbon stocks,

while reducing exposure to high-carbon stocks within each sector. The regional indices have the same constituents as the parent benchmarks, but companies are reweighted according to their carbon efficiency (within their respective sector). The aggregate carbon emissions of the resulting indices ranges from 30%-50% lower than those of the parent indices (depending on the region), but because the sector weights are neutral and the constituents are identical, tracking error is kept low. Maintaining sector neutrality can help increase portfolio resilience against sector-specific shocks while still lowering carbon emissions.

The carbon intensity of companies within each sector varies significantly, as shown in Exhibit 9, and these companies have differing exposures to carbon costs. Companies that have relatively higher carbon intensities are less likely to be able to transfer higher costs to shareholders and face increased potential for financial risk.

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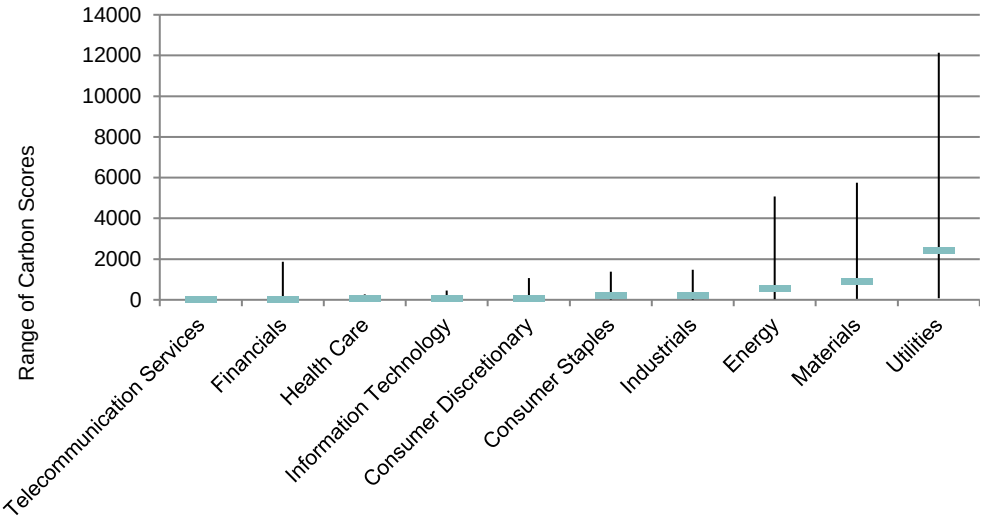
Exhibit 9: Ranges in Carbon Intensity of Sectors in the S&P Global 1200 Carbon Efficient Index



Source: S&P Dow Jones Indices LLC. Data as of December 2014. Chart is provided for illustrative purposes.

The methodology of the S&P Global 1200 Carbon Efficient Index accounts for this variation in carbon intensity within sectors of each region. In order to minimize turnover and tracking error, reweighting is restricted only to "high-potential" sectors that have a wider range of carbon emissions, wherein the tilting is more substantial and has the highest impact. Across regions, it is typically the telecommunication services and health care sectors that are not selected for intra-sector reweighting.

REDUCING BOTH FOSSIL FUEL RESERVES AND CURRENT EMISSIONS

For investors wishing to target both reserves and emissions, the S&P Global 1200 Fossil Fuel Free Carbon Efficient Index first divests out of fossil fuels and then tilts toward low-carbon-emission stocks within sectors.

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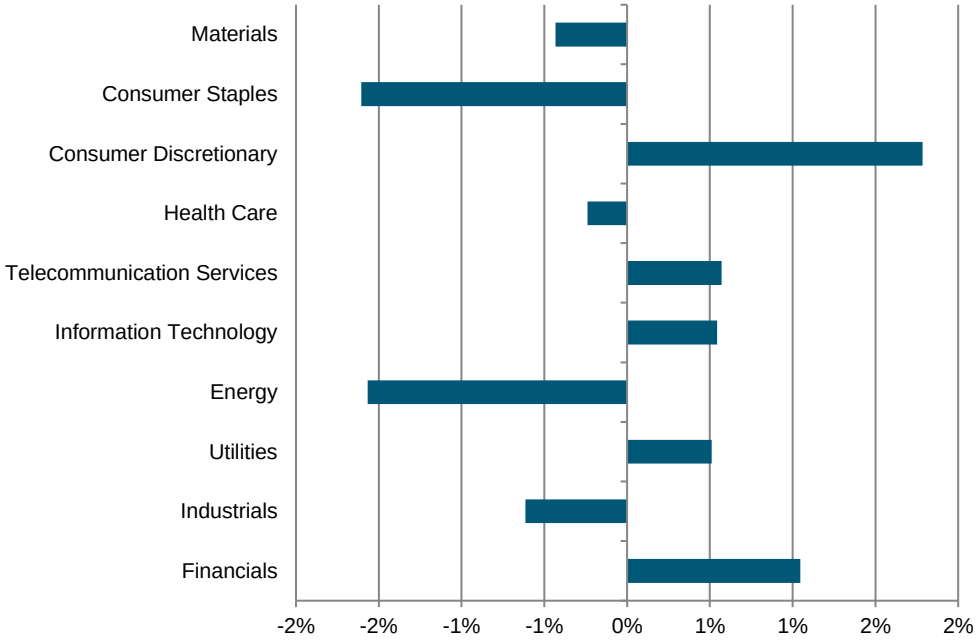
S&P GLOBAL 1200 CARBON EFFICIENT SELECT INDEX

This index employs a hybrid approach to emission reduction using a combination of exclusions and optimization. The highest carbon footprint stocks in each region are removed with the objective of meeting a target carbon reduction, and then the remaining index is reweighted through an optimization procedure so as to minimize tracking error with the benchmark index. Since the exclusions are done on a sector-blind basis, this approach will exhibit sector bias. In order to avoid severe sector deviations from the benchmark, the aggregated exclusion is performed with the constraint that it does not reduce any sector weight to less than 50% of its original weight.

Although 25% of the highest-carbon names are excluded, the absolute change in sector weights versus the benchmark is maintained below 2% (as shown in Exhibit 10) due to the optimization. In fact, we can see that the utilities sector has increased allocation in the optimized index, the S&P Global 1200 Carbon Efficient Select Index, as lower carbon footprint utilities are allocated additional exposure.

Exhibit 10: Active Sector Bets in the S&P Global 1200 Carbon Efficient Select Index



Source: S&P Dow Jones Indices LLC. Data as of December 2014. Chart is provided for illustrative purposes.

Exhibit 11: Carbon Emission Reduction in the S&P Global 1200 Carbon Efficient Select Index

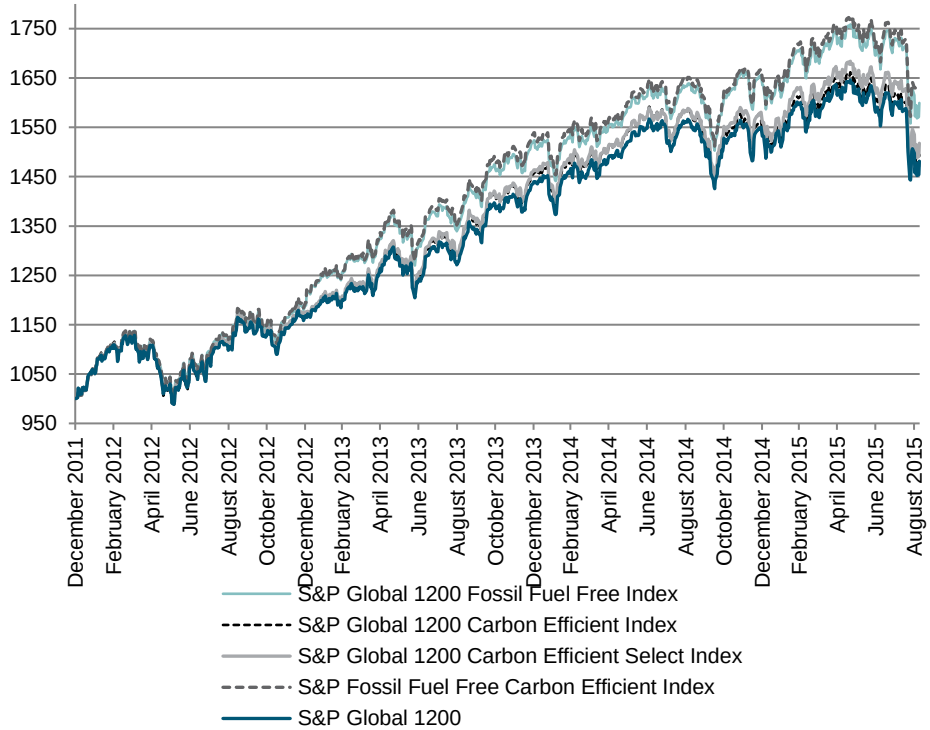
SECTOR	WEIGHTED CARBON INTENSITY	
	BENCHMARK	OPTIMIZED
Financials	7.00	4.47
Industrials	22.40	10.38
Utilities	85.91	51.87
Energy	41.63	22.99
Information Technology	8.14	6.39
Telecommunication Services	2.07	2.32
Health Care	7.22	5.94
Consumer Discretionary	8.62	7.71
Consumer Staples	21.91	9.27
Materials	48.53	19.60

Source: S&P Dow Jones Indices LLC. Data as of December 2014. Table is provided for illustrative purposes.

It should be noted that in order to maintain the low tracking error, the optimizations are run quarterly and the additional rebalancing adds higher turnover when compared to the benchmark index. Higher turnover is typically the tradeoff in approaches that employ optimizations to minimize tracking error.

PERFORMANCE ANALYSIS

Exhibit 12: Performance of Carbon Efficient Methods



Source: S&P Dow Jones Indices LLC. Data from December 2011 to September 2015. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosures at the end of this

document for more information regarding the inherent limitations associated with back-tested performance.

Exhibit 13: Summary and Performance Statistics of Carbon Efficient Methods

CATEGORY	METHOD 1	METHOD 2	METHOD 3	METHOD 4	BENCHMARK
Index Name	S&P Global 1200 Fossil Fuel Free Index	S&P Global 1200 Carbon Efficient Index	S&P Global 1200 Carbon Efficient Select Index	S&P Global 1200 Fossil Fuel Free Carbon Efficient Index	S&P Global 1200
Target	Fossil Fuel Reserves	Carbon Emissions	Carbon Emissions	Fossil Fuel Reserves Carbon Emissions	-
Approach	Divestment of Companies With Fossil Fuel Reserves	Tilting Toward Low-Carbon-Emission Stocks	Optimized Low Carbon Footprint With Exclusions of Highest-Carbon Emission Stocks	Divestment of Companies With Fossil Fuel Reserves Tilting Toward Low-Carbon-Emission Stocks	-
Investment Set	Exclusions	Same as Benchmark	Exclusions	Exclusions	-
Carbon Emission Reduction (%)	20[9]	34	44	37	-
Tracking Error (January 2012-September 2015) (%)	1.1	0.68	0.48	1	-
Beta	0.97	1.00	0.98	0.99	1.00
Approximate Turnover (One-Way) (%)	5	11	31	6	4
ANNUALIZED RETURN (%)					
1-Year	-3.76	-7.18	-5.64	-1.00	-6.70
3-Year	11.88	9.85	10.25	13.20	9.62
5-Year	-	10.44	10.75	-	10.02
ANNUALIZED VOLATILITY (%)					
1-Year	11.85	12.11	11.99	11.10	12.18
3-Year	10.31	10.39	10.31	9.70	10.34
5-Year	-	13.94	13.82	-	13.91

Source: S&P Dow Jones Indices LLC. Data as of Sept. 1, 2015. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosures at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

The fossil fuel free strategies have the highest tracking errors, an unsurprising fact given they are divestment strategies.

From the results, we can see that the fossil fuel free strategies have the highest tracking errors, an unsurprising fact given they are divestment strategies. Though the S&P Global 1200 Carbon Efficient Select Index also has large exclusions and reduces carbon intensity by almost half, the tracking error is only 50 bps due to the optimization process (although it has a higher turnover). The beta of the three exclusion strategies is slightly lower than the benchmark, but the difference is not large enough to worry about these strategies underperforming in times of strong growth. The tilting approach retains the same constituents as the benchmark, yet it

[9] An unfair metric for this strategy, as the goal is to divest out of fossil fuel reserves rather than reduce current emissions.

shows a significant reduction in carbon intensity, at 66% of the S&P Global 1200's carbon intensity.

The excess return of the fossil fuel free strategies is easy to break down, as the primary difference arises from its limited exposure to energy companies. The two fossil fuel free strategies performed the best in recent years, given the fall in the energy sector and a steep decline in oil prices since May 2014. Despite avoiding the highly volatile energy sector, volatility is not significantly reduced due to the counter effect from the increased allocation to other sectors like financials and technology, which are reasonably volatile as well.

A key to understanding the performance of the two emission-reduction strategies—the S&P Global 1200 Carbon Efficient Index and the S&P Global 1200 Carbon Efficient Select Index—is being aware of implicit sub-industry bets. Carbon emissions have less variation within sub-industries and the reweighting favors certain low-carbon sub-industries over others. For example, a positive tilt is seen toward specialty chemicals under materials, hypermarkets & super centers under consumer staples, and life & health insurance under the financials sector. Negative tilts can be observed toward integrated oil & gas under energy, packaged foods & meats under consumer staples, and multi-sector holdings under the financials sector.

Alternative energy has garnered much attention in the wake of widespread concerns over carbon emission, climate change, and other pressing environmental issues.

It is not surprising that the effect of these active sub-industry positions is high in the case of the sector-neutral tilting, as it allocates toward lower-carbon-emitting stocks within every sector. For our back-test period, nearly 40% of the return attribution came from sub-industry factors (the remaining excess return was due to stock-specific factors, arising due to the reweighting). The return attribution to sub-industry bets is even higher in the case of the optimization approach (43%). A look at the cyclicality and individual drivers of sub-sectors, especially in the energy, utilities, and materials space could offer insight to potential drivers of possible future excess returns. We find that for both the pure emission reduction strategies, the attribution to the sub-sector bets significantly overwhelm other sources of return, such as beta, value, dividend yield, or quality.

THEMATIC INVESTING IN CLEAN ENERGY

So far, we have looked at carbon reduction techniques that essentially track the broad market. A thematic approach toward climate change can allow direct exposure to clean and alternative energy, ignoring the traditional constraints of country, region, and sector. Alternative energy has garnered much attention in the wake of widespread concerns over carbon emission, climate change, and other pressing environmental issues. Clean energy companies focus on innovative technology and services for the coming generation; the use of energy from solar, wind, and other renewable sources; and conservation and efficiency.

The S&P Global Clean Energy Index covers both developed and emerging markets. Unlike the other three carbon reduction approaches that aim to track broad markets, this approach focuses specifically on 30 of the largest publicly traded companies in clean energy production and clean energy equipment and technology.

Exhibit 14: Risk/Return of the S&P Global Clean Energy Index

PERIOD	ANNUALIZED RETURN (%)	ANNUALIZED VOLATILITY (%)
1-Year	-19.94	19.40
3-Year	12.24	18.20
5-Year	-8.98	10.44

Source: S&P Dow Jones Indices LLC. Data as of Aug. 31, 2015. Past performance is no guarantee of future results. Table is provided for illustrative purposes.

As Exhibit 14 shows, the alternative energy sector can have high risk with variable returns. A combination of a weak economic environment and austerity policies enacted by governments across the developed world has hurt private and government support for investment in these industries. Furthermore, given the nascent stage these companies typically are in, many are not yet cost competitive or are not fully commercialized.

However, it is worth noting that thematic funds are more forward looking and aim to take advantage of structural changes affecting certain sectors. These structural changes could be in the form of regulatory pressure to produce more and efficient clean power or growing support for alternative technologies in emerging powerhouses, like India and China.

While some strategies take a strong approach to eliminating carbon footprints, others have shown they can provide high carbon reduction without significant tracking error.

CONCLUSION

High carbon footprint firms pose environmental and economic worries to many investors, especially considering the potential increase in “stranded assets” and the preponderance of fossil fuels in stock market indices. While the moral argument is compelling, there is strong evidence that the financial risks cannot be discounted either.

With the debate on carbon risk increasing, so is the number of products in the market. Some of the strategies incorporated include divesting holdings in high-carbon-emitting corporations, tilting a strategy in favor of companies with low carbon footprints, or using thematic indices that provide exposure to environmentally themed sectors. While some strategies take a strong approach to eliminating carbon footprints, others have shown they can provide high carbon reduction without significant tracking error. Hence, even if fears of carbon regulations do not materialize during the given investment timeframe, these strategies would have returns comparable with the benchmark.

All investors should evaluate their carbon risk and accordingly decide the position they wish to take, which could be anywhere between considering carbon risk as immaterial to full divestment. Any position has an element of

risk and involves tradeoffs, but there are strategies available that have the potential to deliver the desirable mix of carbon reduction, tracking error, turnover, and portfolio risk/return vis-à-vis the benchmark.

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PERFORMANCE DISCLOSURE

The S&P Global 1200 Fossil Fuel Free Index and the S&P Global 1200 Carbon Efficient Select Index were launched on Aug. 28, 2015. The S&P Global 1200 Carbon Efficient Index was launched on Aug. 20, 2015. The S&P Fossil Fuel Free Carbon Efficient Index will launch on Oct. 26, 2015. The back-test calculations are based on the same methodology that was in effect on the index Launch Date. Complete index methodology details are available at www.spdji.com.

S&P Dow Jones Indices defines various dates to assist our clients in providing transparency. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the Index is set at a fixed value for calculation purposes. The Launch Date designates the date upon which the values of an index are first considered live: index values provided for any date or time period prior to the index's Launch Date are considered back-tested. S&P Dow Jones Indices defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company's public website or its datafeed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed "Date of introduction") is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index's public release date.

Past performance of the Index is not an indication of future results. Prospective application of the methodology used to construct the Index may not result in performance commensurate with the back-test returns shown. The back-test period does not necessarily correspond to the entire available history of the Index. Please refer to the methodology paper for the Index, available at www.spdji.com for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations.

Another limitation of using back-tested information is that the back-tested calculation is generally prepared with the benefit of hindsight. Back-tested information reflects the application of the index methodology and selection of index constituents in hindsight. No hypothetical record can completely account for the impact of financial risk in actual trading. For example, there are numerous factors related to the equities, fixed income, or commodities markets in general which cannot be, and have not been accounted for in the preparation of the index information set forth, all of which can affect actual performance.

The Index returns shown do not represent the results of actual trading of investable assets/securities. S&P Dow Jones Indices LLC maintains the Index and calculates the Index levels and performance shown or discussed, but does not manage actual assets. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the Index or investment funds that are intended to track the performance of the Index. The imposition of these fees and charges would cause actual and back-tested performance of the securities/fund to be lower than the Index performance shown. As a simple example, if an index returned 10% on a US $100,000 investment for a 12-month period (or US $10,000) and an actual asset-based fee of 1.5% was imposed at the end of the period on the investment plus accrued interest (or US $1,650), the net return would be 8.35% (or US $8,350) for the year. Over a three year period, an annual 1.5% fee taken at year end with an assumed 10% return per year would result in a cumulative gross return of 33.10%, a total fee of US $5,375, and a cumulative net return of 27.2% (or US $27,200).

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