Credit Suisse

Investing in carbon efficient equities: how the race to slow climate change may affect stock performance

The world may be reaching a tipping point where policy action on climate change by the European Union, United States, China and other major economies will accelerate the shift from fossil fuel energy supplies to low-carbon technologies and fuels.

Using a scenario-based modeling analysis, we show that climate change policies and related technology developments are shown to affect investment returns, giving rise to investment “winners” and “losers”. We believe investors should view climate change as a new return variable.

Sector impacts can be significant. For example, depending on the scenario that ultimately unfolds, our analysis shows the average annual returns from the coal sector could fall between 26% and 138% over the coming decade. Conversely, the renewable energy sector could see average annual returns increase between 4% and 97% over the same period.

Effects on regional equity returns may be material but will vary depending on the scenario. A so-called 2°C scenario could see return benefits for emerging market equities, whereas a 4°C scenario could negatively impact emerging market equities.

Investors can take steps now by using emerging tools and carbon analytics to review the carbon intensity of their equity portfolios, identify carbon hot spots, and consider low-carbon optimization strategies.

According to the World Economic Forum's 2015 Global Risks report,[i] in the coming decade four of the top ten global risks are directly or indirectly linked to changes in the earth's climate system. As concern over climate change persists, government action to mitigate the risk—meaning laws and regulations to reduce carbon emissions from fossil fuels and shift toward low-carbon energy supplies—is likely to accelerate.

Indeed, 2015 may prove to be a critical year in turning the tide against global carbon emissions as the international community will attempt to negotiate a new global climate agreement at the United Nations Climate Change Conference, known as COP21. Though past efforts to negotiate such agreements fell far short of establishing aggressive cuts in emissions, momentum may now be building for significant action, for example:

- More than 40 national and 20 subnational jurisdictions in both developed and developing countries have put a price on carbon emissions or are in the process of doing so.[ii]
- New commitments are being announced in major economies, including:
  - a US commitment to reduce emissions by roughly 20% below current levels by 2025, backed up by regulatory efforts to require emissions reductions from power plants,
  - an EU pledge to continue reducing carbon emissions with an economy-wide target of at least 40% below 1990 levels by 2030, and
  - an announcement by China that it will generate 20 percent of its electricity with non-fossil fuel sources by 2030, and a pledge to peak its carbon emissions by 2030.
- Many business leaders are publicly calling for a strong international climate agreement, including:
  - large, influential fossil fuel companies,[iii]
  - over 350 institutional investors representing over $24 trillion in assets under management,[iv] and
  - CEOs of 43 global companies operating across sectors and geographies, representing collectively over $1.2 trillion in revenue.[v]

Climate science and the significance of 2° celsius (2°C)

The world's most authoritative voice on climate change is the Intergovernmental Panel on Climate Change (IPCC). The IPCC is a scientific body that reviews and assesses the most recent scientific, technical and socio-economic information relevant to our understanding of climate change. Thousands of scientists from all over the world contribute to the work of the IPCC on a voluntary basis as authors, contributors and reviewers.

The IPCC's Fifth Assessment Report released in 2013/14 concluded unequivocally that the climate is warming, and it is extremely likely that human activities have caused more than half of the observed increase in global average surface temperature since 1950.

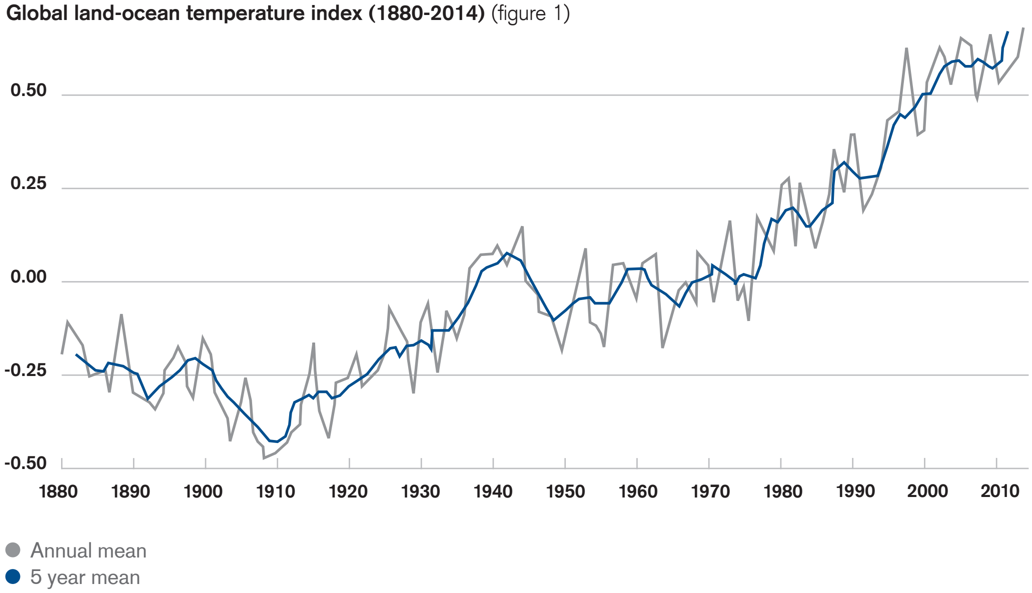
Humans have contributed to a rise in atmospheric greenhouse gases (GHGs) as a result of increased fossil fuel burning and deforestation. Since the 1700s and the dawn of the Industrial Revolution, the largest contributor to global warming has been carbon dioxide (CO_2). CO_2 concentrations have increased from 278 parts per million (ppm) in 1750 to 401 ppm in 2015 – a 44% rise. This significant increase in GHGs has coincided with a variety of shifts in short and long-term weather patterns.

Global average temperature is one of the most-cited indicators of climate change. Historical records show a steady increase in global mean temperatures over the past century and a half (figure 1).

Many climate policy advocates believe it is prudent and necessary to try to limit global warming to 2°C relative to pre-industrial times.

While those in the field of climate science and policy are familiar with the notion of a "2°C world", the concept of temperature pathways—driven by carbon emission trajectories and climate sensitivity—is unfamiliar to most investors. Why is 2°C considered the benchmark for climate policy makers? A 2°C rise in average global temperatures has been identified by climate scientists as a limit that provides a reasonable chance of avoiding dangerous interference with the climate system. It is estimated that there has already been a 0.8°C increase and that a 1.5°C rise is "baked in" to the system and cannot be avoided, regardless of changes we make now. Consequently, action to reduce emissions is becoming increasingly urgent if the 2° C limit is to be met.

Global land-ocean temperature index (1880-2014) (figure 1)



Scale: Temperature Anomaly C°
Source: US National Aeronautics and Space Administration (NASA)

Analyzing climate change as investment risk and opportunity

Carbon-intensive companies make up a significant segment of major stock markets around the world. Considering the S&P 500, for example, energy, utilities and industrials sectors have historically made up as much as 25 percent of the total weighting of the index. Consequently, many investors have a significant exposure to carbon-intensive stocks, including companies that produce oil and gas, coal, electric power, minerals, metals and more. The race to slow climate change, therefore, presents investors with risks—and opportunities—that may materialize in the short, medium and long term.

To better develop an understanding of these risks and opportunities, Credit Suisse participated in a collaborative research project with Mercer and 15 other investor partners, collectively responsible for more than US$1.5 trillion in assets under management, to develop an approach to asset modeling that incorporates various climate change scenarios and risk factors within a standard investment modelling framework.[vi] The scenarios used in the analysis (figure 2) were chosen to reflect a broad range of potential outcomes, and they each have distinctive regulatory, technological and physical impact characteristics that could be translated by investors into strategic planning processes alongside more traditional scenarios dealing with inflation, credit availability and so on.

Overview of climate scenarios (figure 2)

Scenario	Description
Transformation More ambitious climate change mitigation action that puts us on a path to limiting global warming to 2°C above pre-Industrial era temperatures this century	Strong climate change mitigation action: • Emissions peak by 2020 then reduce by 56% relative to 2010 levels by 2050 • Fossil fuels represent less than half of the energy mix at 2050 • Estimated annual emissions at 2050 of 22 gigatonnes of equivalent carbon dioxide (Gt CO_2e)
Coordination Policies and actions are aligned and cohesive, keeping warming to 3°C above pre-Industrial era temperatures this century	Substantial climate change mitigation action: • Emissions peak after 2030 then reduce by 27% relative to 2010 levels by 2050 • Fossil fuels represent around 75% of the energy mix at 2050 • Estimated annual emissions at 2050 of 37 Gt CO_2e
Fragmentation – Lower damages Limited climate action and lack of coordination result in warming rising to 4°C or above from pre-Industrial era temperatures this century	Limited climate action: • Emissions peak after 2040, increasing by 33% over 2010 levels by 2050 • Fossil fuels represent 85% of the energy mix at 2050 • Estimated annual emissions at 2050 of 67 Gt CO_2e
Fragmentation – Higher damages As above, coupled with assumed higher damages	Limited climate action: • As per Fragmentation (Lower Damages), but assumes that relatively higher physical damages result

Source: Mercer

Climate change related public policy and technology deployment will impact returns

The modeling analysis considered multiple climate change risk factors, but for the purposes of this research brief we focus specifically on public policy and technology deployment.[vii] Climate-related policy may involve a variety of measures that can have significant market impacts, such as:

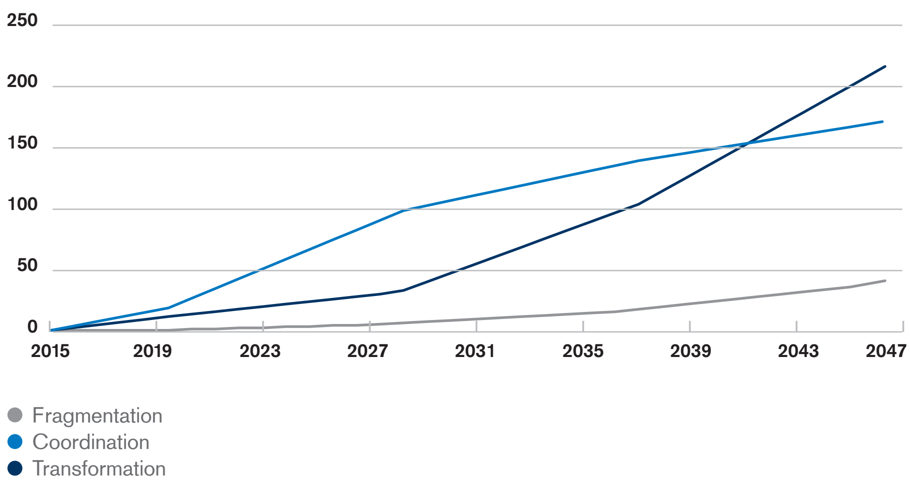
- Explicit carbon-pricing mechanisms, e.g., carbon taxes, emissions trading systems,
- Energy taxes and subsidies, including removal of subsidies,
- Regulatory standards on energy supply measures, e.g., renewable energy mandates,
- Energy efficiency measures, e.g., building codes, appliance standards, fuel-efficiency standards, etc.,
- Land use measures such as programs to reduce emissions from deforestation, and
- Targeted support for research and development, e.g., subsidies relating to clean technology.

Timing and magnitude of policies may differ across regions, but aggregate scenarios emerge

The stringency and timing of climate-related policies are the critical factors to consider when evaluating investment impacts. Indeed, a key feature of climate policy is the extent to which it assigns a cost—either explicitly or implicitly—to carbon emissions and increases the cost sufficiently over time to shift behaviors toward a low-carbon economy.

Estimates of the "cost of carbon" (figure 3) offer a relative indicator of the strength of climate polices aimed at reducing emissions. In practice, a comprehensive climate policy strategy may include many regulations, fiscal measures and so on. These measures will also vary by region and jurisdiction depending on their ambition, carbon intensity and other local circumstances. Thus, actual measures used may not represent the least costly approach as assumed with the carbon prices used in this modeling analysis. The analysis does not assess the cost-effectiveness of different measures but seeks to reflect the strength of the market drivers that mobilize economic shifts within each scenario.

Carbon pricing pathways by scenario (figure 3)



Scale: Carbon Price Curves ($2013/Tonne CO_2e)
Source: Mercer

Technology with favorable mitigation effects likely to attract capital investment flows

The technology factor in this analysis relates primarily to mitigation efforts to transform energy production, transmission and use in order to reduce the world's carbon intensity while also increasing energy efficiency. It also encompasses other technological developments for emissions mitigation in agriculture and land use as well as adaptation to climate change (disaster risk management, resilient infrastructure and so on). The technology factor can be interpreted as a measure of the future private- and public-sector low-carbon investment flows under different climate scenarios, for which a higher technology value indicates a higher level of investment.

Technology is clearly connected to policy. Technology investment flows are expected to correlate to a large degree with the extent of policy interventions, though a decoupling could occur in the future when successful new technologies are less reliant on policy settings. The technology factor is material under all four climate change scenarios. The development pathway for technology remains highly uncertain, however, and this factor remains one of the most difficult to quantify given its complex interaction with mitigation and adaptation measures and uncertainty surrounding technology research and development. Additionally, structural barriers such as network effects, fragmentation costs and agency problems can impede the deployment of promising technologies.[viii]

Gauging policy and technology impacts by sector

In order to help investors consider the potential impacts on an investment portfolio, the sensitivity of different industry sectors to climate change risk factors was assessed and captured in sensitivity "heat maps" using a combination of current-day evidence and forward-looking qualitative judgment. Figure 4 focuses on those industries that are expected to be the most sensitive (either positively or negatively) to climate change. Sensitivities were assigned on a relative basis using a scale of -1 (where we expect the most negative impact on investment returns), to +1 (where we expect the most positive impact on investment returns).

Sensitivity to the climate change risk factors: industry sector level[ix] (figure 4)

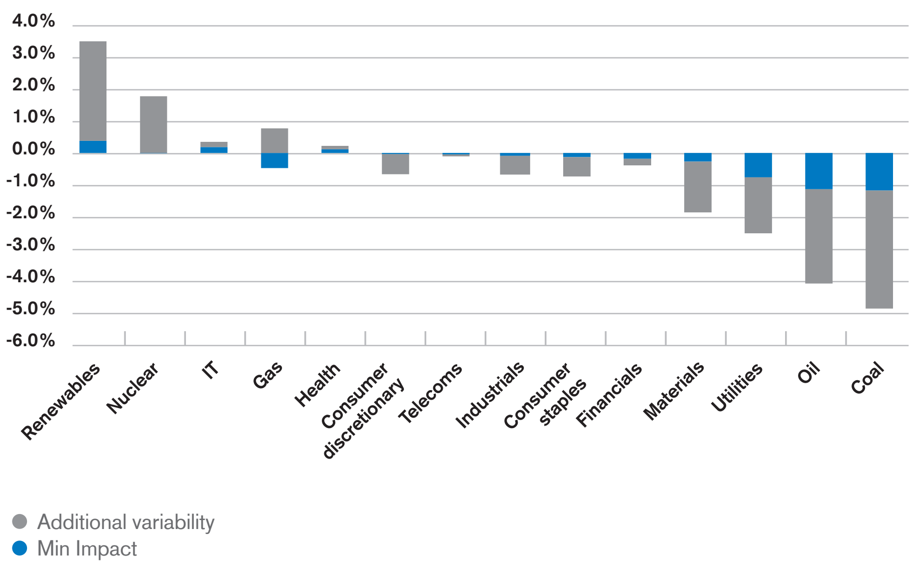
Equity Sector	Technology	Policy
Energy	-0.25	-0.75
Oil	-0.50	-0.75
Gas	<0.25	<0.25
Coal	-0.50	-1.00
Renewable	0.50	1.00
Nuclear	0.50	0.50
Utilities	-0.25	-0.50
Electric	-0.50	-1.00
Gas	-0.25	-0.50
Multi	-0.25	-0.75
Water	-0.25	-0.75
Materials	<0.25	-0.50
Metals and mining	<0.25	-0.75
Industrials	<0.25	-0.25
Transport and infrastructure	<0.25	<0.25

Key: **Positive** – **Neutral** – **Negative**

Source: Mercer

Based on the assumptions about policy, technology and industry sensitivities, the potential climate impact on median annual equity returns for industry sectors were calculated over a long-term horizon (figure 5). The range shows the minimum impact and the additional variability based on the scenario and assumptions. These impacts should be considered as a percentage of underlying expected returns, which range from 6-7% per annum.

Climate impact on median annual returns by Industry sector (35-year horizon) (figure 5)



Source: Mercer

The energy sector is broken into its sub-sectors, as this is one of the most impacted industries. Coal's average expected annual returns could be reduced from 6.6% p.a. to between 1.7% p.a. and 5.4% p.a. over the next 35 years, depending on the scenario. Oil and utilities could also be significantly negatively impacted over the next 35 years, with expected average returns potentially falling from 6.6% p.a. to 2.5% p.a. and 6.2% p.a. to 3.7% p.a., respectively. Renewables have the greatest potential for additional returns: depending on the scenario, average expected returns may increase from 6.6% to 10.1% p.a.

Impact on returns varies by equity asset class

Within the equity asset class, impacts may vary significantly based on the equity asset type. Only developed market global equity is shown in the modeling to experience a reduction in returns across all scenarios (figure 6). For the other equity asset types, climate change is expected to either have a positive or negative effect on returns dependent on the future scenario. The primary way investors will likely reduce this risk exposure is through considering the underlying sector-level exposures of the asset class.

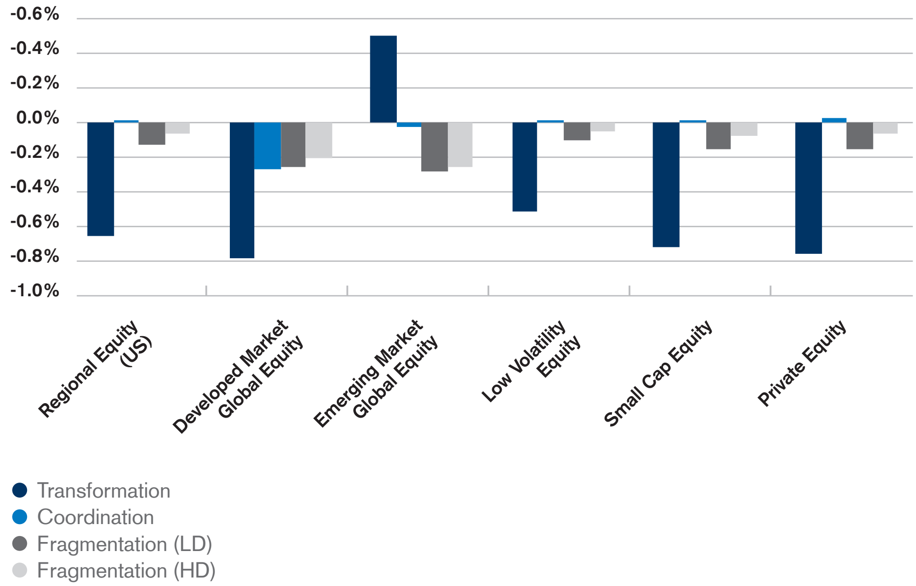
Taking country-level circumstances into account, considerations arise such as:

- UK, Australian, and Canadian equities may be more sensitive given the higher exposure of these regional equity markets to carbon-intensive sectors.
- UK and European equities may be less vulnerable to climate change policy shocks given existing national and regional policies and commitments in place and relative transparency regarding the direction of future policies.
- Australian equities may be more sensitive to a climate change policy shock given the greater level of policy uncertainty in this market.
- The US may continue to drive global equity markets in the near term. Therefore, any significant policy developments in the US may impact global equities to a greater extent than developments in other regions.
- Although there will be country-level differences across emerging markets, overall emerging market equities may benefit from additional climate change mitigation policy and technology developments (subject to the support

and other terms of an international climate agreement). Emerging market equities are more sensitive to the climate change risk factors associated with physical damages of climate change than developed markets, and also are more likely to face higher costs around adaptation to climate change. Thus, emerging markets may receive greater relative gains from more ambitious mitigation policies than developed markets.

For small-cap equity and low volatility equity, risk factor exposures are derived in the modeling from the sector-level analysis. The small-cap space may hold considerable opportunity to invest in companies directly related to the shift towards a low-carbon economy. Low volatility equities have slightly lower negative sensitivity to the climate change risk factors than standard global equities.

Climate impact on returns by equity asset class (10 years) (figure 6)



Scale: Median additional annual returns
Source: Mercer

Stranded assets

The concept of stranded assets relates to investments that lose significant economic value well ahead of their anticipated useful life as a result of changes in legislation, regulation, market forces, disruptive innovation, societal norms and/or environmental shocks. In the context of this modeling analysis, the potential for stranded assets may affect returns over a ten-year horizon.

Modeling results largely support recent discussions on stranded assets, which have focused on the constraints that would be placed on fossil fuel companies from climate action similar to that expected under the "transformation" scenario. Under that scenario, coal and oil sector returns could be eroded over the next 10 years with potential average returns of -2.0% p.a. and -0.7% p.a. respectively. Furthermore, utilities' returns could fall from 5.1% p.a. to 1.2% p.a. over the same period. In contrast, the renewables sub-sector can be expected to see potential returns increase from 5.3% p.a. to 10.4% p.a. and the nuclear energy sub-sector from 5.3% p.a. to 7.7% p.a.

Results also show that regardless of future policy action, climate change could significantly impact sector returns over the next 10 years. For example, across all scenarios the minimum impact for the coal sub-sector could result in expected annual returns falling from 5.2% p.a. to 3.9% p.a., and for the oil sub-sector from 5.3% p.a. to 4.0% p.a.

The transformation scenario may be viewed by investors as contentious because it anticipates swift policy action in the near term, but it presents a potential risk that is worthy of consideration given the potential investment impacts. Investors that remain unprepared and are exposed to these higher risk sectors (and companies) are most at risk of remaining invested in stranded assets. In considering this or other scenarios which may unfold, investors need to ask:

- **What if climate change-related policies are introduced at a level or within a timeframe unanticipated by the market, either globally or in regional blocks? Might this lead to a broad market correction, or could certain assets be left "stranded"?**
- **Could fossil-fuel subsidies be removed? Would this put major investments at risk?**
- **How quickly could the portfolio be repositioned if required, and what options exist today to hedge against future uncertainty?**

Developing carbon efficient equity portfolios

The future of climate change policy and its effects on technology deployment are uncertain, but our scenario analysis shows that whatever the path, stock prices are likely to be affected. Consequently, uncertainty about the future need not be a barrier to action. Rather, investors—both private and institutional—can take advantage of emerging tools to manage carbon risk and protect their portfolios, starting with an assessment of the "carbon footprint" of an equity portfolio as well as the relative carbon intensity of the equity positions and the portfolio as a whole. In fact, many large investors have already pledged to analyze their carbon footprint, and some jurisdictions are actually moving to make this a requirement.[x]

Measuring the carbon footprint of an equity portfolio starts with data on the amount of carbon emitted by portfolio companies on an annual basis, usually expressed in metric tonnes (MT) or kilograms (kg) of carbon dioxide equivalents (CO_2e). The carbon footprint is the portion of those emissions attributable to the investor's (i.e., owner's) equity position. This can be calculated using outstanding shares or market capitalization. For a hypothetical equity portfolio shown in table 2, we use the number of outstanding shares divided by the issuer's emissions, resulting in an estimate of the "embedded carbon" in each share that an investor owns. Based on the number of shares held, the carbon footprint of each equity position and the portfolio as a whole is calculated.

No global requirement exists for companies to report their carbon emissions, but most large companies voluntarily self-report in line with a global standard known as the GHG Protocol.[xi] The quality of disclosure varies, but most large companies provide adequate information and, in some instances, the reported information is backed up by third party assurance or verification.

In performing carbon footprint analyses, Credit Suisse uses data that focuses on a company's direct carbon emissions as well as the emissions from the electricity, heat or steam energy that the company purchases to run its operations, known as "scope 1" and "scope 2" emissions, respectively, in the parlance of carbon emissions accounting. Focusing on these emissions allows for meaningful company-to-company comparisons, including cross-sector comparisons, and closely tracks with a company's exposure to climate policy risk. It omits carbon emissions that may reside upstream or downstream in a company's value chain, but reliable data and estimates of those emissions are difficult to obtain.

Carbon footprint analysis allows the investor to see carbon hot spots in the portfolio, including company, sector and regional breakdowns, among other data views. This includes, for example, carbon intensity expressed as emissions per unit of revenue and/or earnings. Empowered with that information, private and institutional investors can consider adjustments to their equity holdings, for example, by adjusting sector weights, tilting toward less carbon-intensive companies within sectors, exiting very carbon-intensive sectors and/or hedging. This reduces the climate policy risk of the portfolio, and, more broadly, helps to address market mispricing of carbon. The lower the carbon- intensity of the holdings, the less susceptible they should be to increasing carbon pricing and/or related regulation.

Low-carbon portfolio optimization may also lead to increased investment exposure to companies or assets benefiting from climate action strategies, which are more likely to be supported by new technology solutions. In principle, low- carbon portfolios support the flow of capital to a resilient low-carbon economy, which should help to reduce the long-term physical impacts of climate change. For investors who are concerned about climate change and want to invest in a manner that is aligned with their values, low-carbon portfolio optimization may be an effective approach.

The carbon footprint of a hypothetical portfolio

To illustrate, a hypothetical portfolio of leading large cap equities is constructed using sector weightings similar to those in the S&P 500 and generally aligned with recommended sector weightings by some large mutual fund companies. For simplicity, the hypothetical portfolio contains three leading large cap stocks randomly selected from each sector, resulting in a large cap equity portfolio comprised of 30 stocks (table 1). Within each sector, the three stocks are equally weighted.

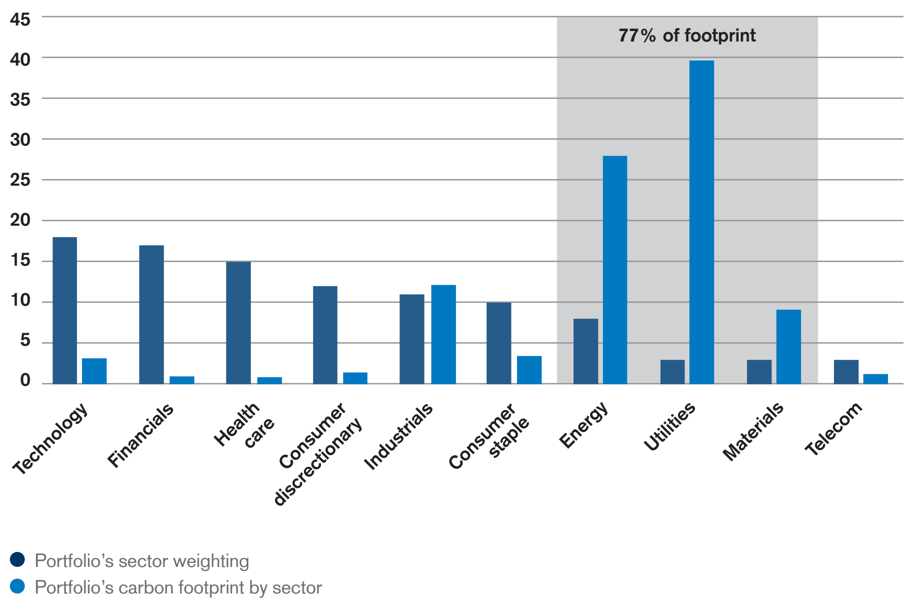
Carbon footprint of a hypothetical portfolio of large cap equities (table 1)

Company name	Ticker	Sector	Domicile	Portfolio weight	# shares held[1]	Quality of emissions disclosure	Embedded carbon per share (kg CO_2e/ share)	Carbon footprint of position (kg CO_2e)
Facebook Inc	FB	Technology	US	6.00%	6,878	Low	0.17	1,150
Tencent Holdings Ltd	TCEHY	Technology	China	6.00%	37,313	Low	0.01	527
Taiwan Semiconductor	TSM	Technology	Taiwan	6.00%	30,912	High	0.98	30,149
Wells Fargo & Co	WFC	Financials	US	5.67%	11,113	High	0.27	2,982
JPMorgan Chase	JPM	Financials	US	5.67%	9,222	High	0.32	2,937
Bank of China Ltd	BACHY	Financials	China	5.67%	52,276	Low	0.08	3,997
Novartis AG	NVS	Health Care	Switzerland	5.00%	5,281	Medium	0.72	3,802
Novo Nordisk A/S	NVO	Health Care	Denmark	5.00%	9,225	High	0.07	665
Pfizer Inc.	PFE	Health Care	US	5.00%	15,944	High	0.27	4,304
The Walt Disney Co	DIS	Consumer Disc	US	4.00%	2,877	Medium	1.05	4,229
Amazon.com	AMZN	Consumer Disc	US	4.00%	4,398	Low	2.24	1,808
McDonald's Corp	MCD	Consumer Disc	US	4.00%	3,852	Medium	2.01	8,592
The Boeing Company	BA	Industrials	US	3.67%	4,745	High	2.41	6,927
Union Pacific Corp	UNP	Industrials	US	3.67%	2,915	High	13.78	60,588
United Parcel Service	UPS	Industrials	US	3.67%	3,143	High	14.06	54,142
Nestle SA	NESN.VX	Consumer Staples	Switzerland	3.33%	4,020	High	2.45	11,607
Toyota Motor	TM	Consumer Staples	Japan	3.33%	806	High	4.45	12,983
Anheuser Busch InBev	BUD	Consumer Staples	Belgium	3.33%	4,279	High	3.30	10,381
Total SA	TOT	Energy	France	2.67%	5,876	High	20.83	122,425
BP PLC	BP	Energy	UK	2.67%	8,297	High	18.28	151,654
Schlumberger LTD	SLB	Energy	US	2.67%	3,536	High	1.75	6,203
NextEra Energy	NEE	Utilities	US	1.00%	1,049	Medium	97.62	102,376
Electricite de France	EDF.PA	Utilities	France	1.00%	4,843	High	43.59	211,132
Dominion Resources	D	Utilities	US	1.00%	1,469	Medium	56.97	83,673
Bayer AG	BAYGn.DE	Materials	Germany	1.00%	777	High	10.13	7,870
BHP Billiton Ltd	BBL	Materials	Australia	1.00%	2,934	High	17.54	51,479
BASF	BASFn.DE	Materials	Germany	1.00%	1,299	High	24.86	32,298
China Mobile	CHL	Telecom	Hong Kong	1.00%	1,691	High	2.85	4,814
Ltd AT&T Inc	T	Telecom	US	1.00%	3,094	High	1.48	4,583
Vodafone Group PLC	VOD	Telecom	UK	1.00%	2,971	High	1.01	2,995
								1,003,273

[1] Based on a total portfolio value of USD 10 million and closing share prices as of 1 September 2015
Source: Credit Suisse, South Pole Group

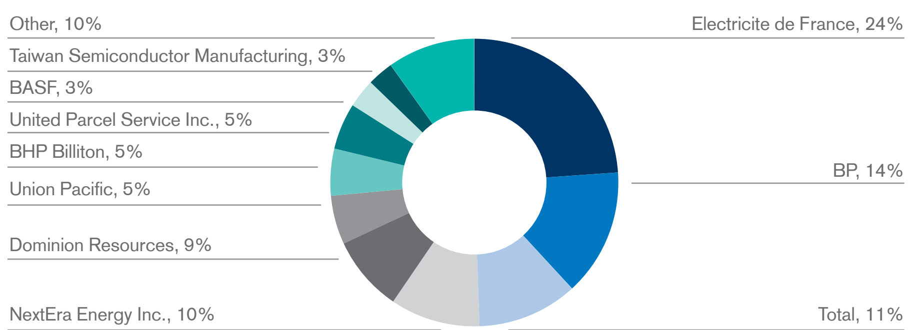
Carbon footprinting of the hypothetical portfolio provides a number of initial observations. To start, the investments in energy, utilities and materials sectors comprise only 14 percent of the value of the portfolio, yet they account for 77% of the carbon footprint (figure 7). Similarly, though the portfolio is comprised of 30 investments, the 10 equity positions with the largest footprint account for 90 percent of the total carbon footprint of the portfolio (figure 8). In other words, the embedded carbon in the portfolio is concentrated into carbon "hot spots".

Sector weighting vs. sector carbon footprint for hypothetical portfolio (figure 7)



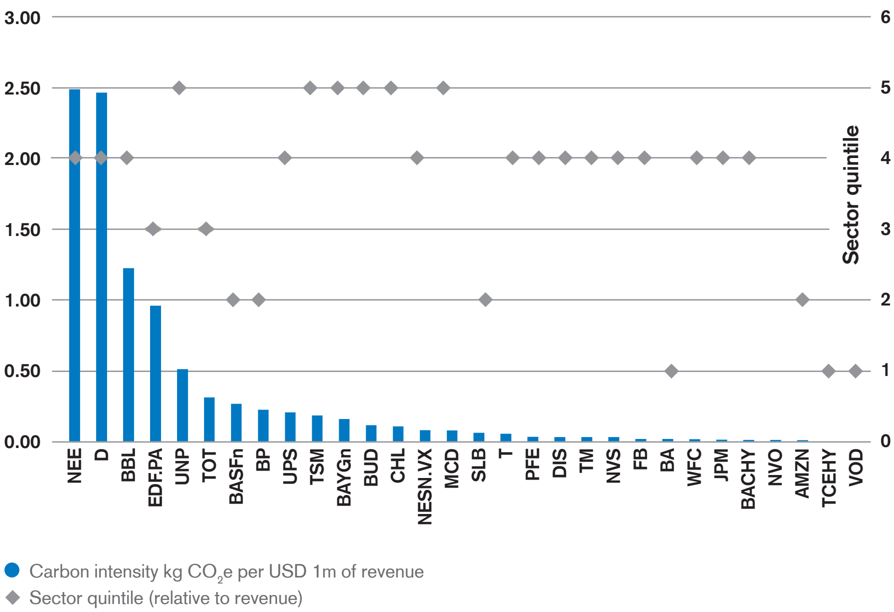
Scale: Percentage (%)
Source: Credit Suisse, South Pole Group

Carbon footprint by company/position, percentage of total portfolio carbon footprint (figure 8)



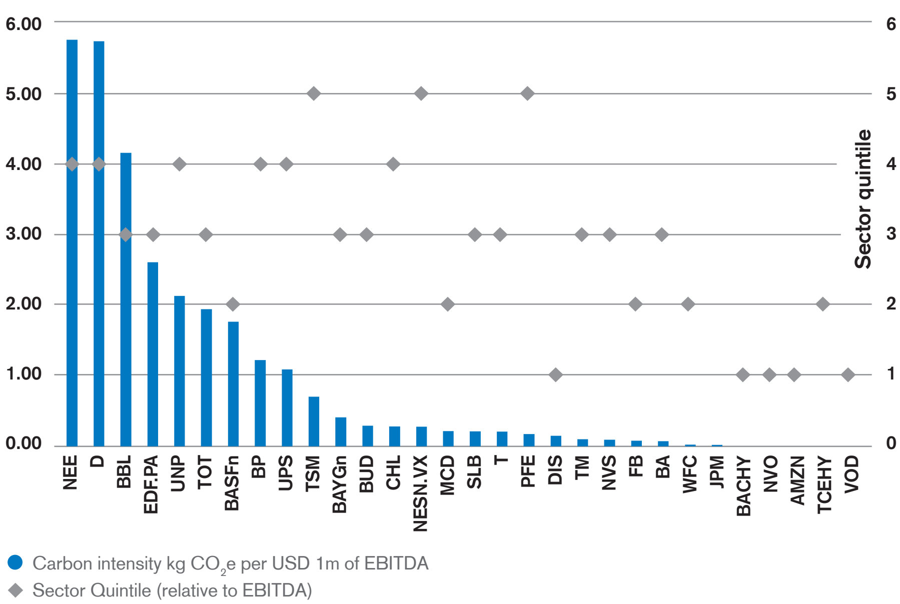
Scale: Percentage of total portfolio carbon footprint
Source: Credit Suisse, South Pole Group

Carbon intensity and sector quintiles relative to revenue[1] (figure 9)



Scale: Kg of CO_2e per USD 1m of revenue
Source: Credit Suisse, South Pole Group
[1] 12 months forward revenue forecast based on IBES consensus as of September 2015

Carbon intensity and sector quintiles relative to EBITDA[1] (figure 10)

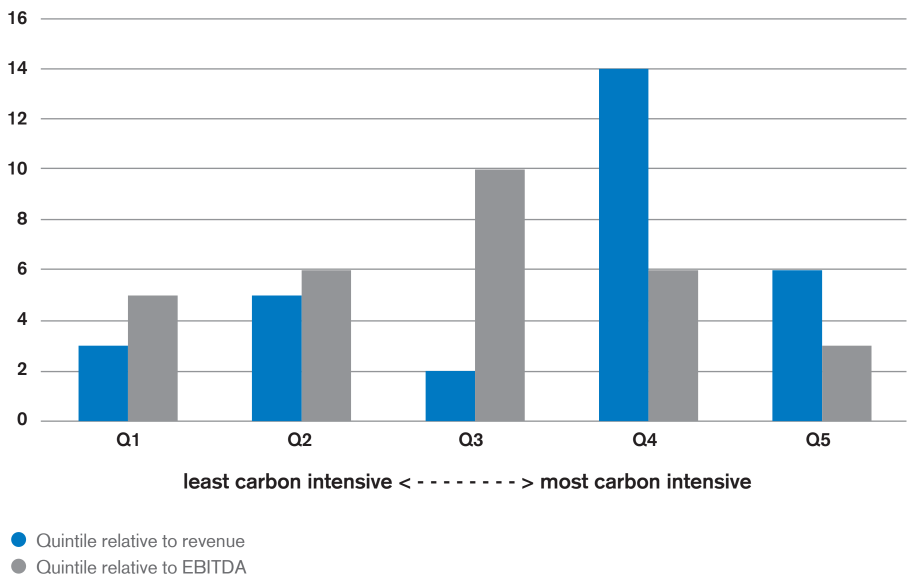


Scale: Kg CO_2e per USD 1m EBITDA
Source: Credit Suisse, South Pole Group
[1] 12 months forward EBITDA forecast based on IBES consensus as of September 2015

Drilling in further, the investments in the portfolio show notable differences in exposure to carbon risk. The carbon intensity of portfolio companies relative to revenue and EBITDA varies significantly both within and between sectors (figures 9 and 10). For example, within the Industrials sector, the carbon intensity of Union Pacific is more than double that of United Parcel Service on a revenue basis, though the difference is almost negligible relative to EBITDA. Also, BP's exposure is relatively modest on a revenue basis, and the company falls in the second quintile (meaning lower carbon intensity than the sector average), but relative to EBITDA the company's exposure is significantly higher and BP drops into the fourth quintile.

A review of the sector quintiles (which are based on carbon intensity) also reveals that the portfolio contains an over-representation of companies that fall below their sector medians relative to revenue, meaning the portfolio is relatively carbon intensive, though the distribution is fairly even on the basis of EBITDA (figure 11). On both a revenue and EBITDA basis, the analysis suggests that the portfolio could be better protected against carbon risk without necessarily changing the sector weights but rather replacing high carbon intensity stocks with low carbon intensity stocks on a sector by sector basis.

Distribution of sector quintiles of portfolio companies based on carbon intensity (figure 11)



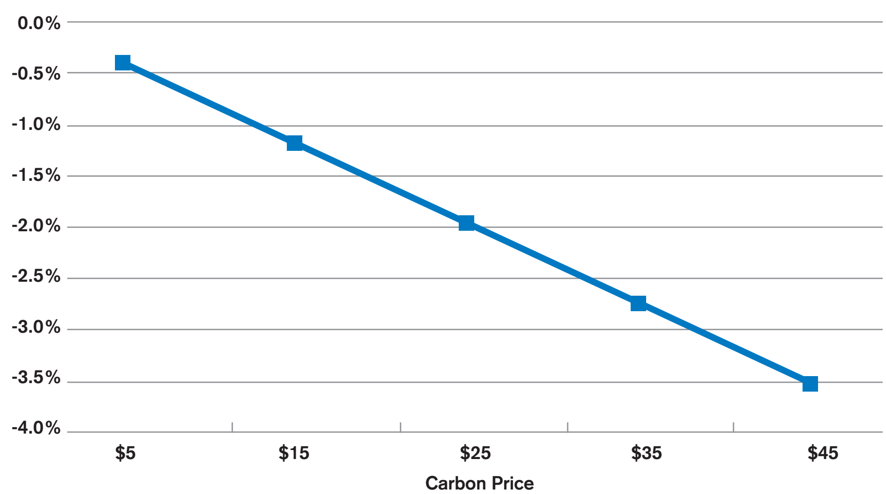
Source: Credit Suisse, South Pole Group

Considering the domicile and key markets of the portfolio companies, another observation is that the portfolio is significantly exposed to carbon pricing/ regulation in jurisdictions that have established or proposed limits on carbon emissions. In attempting to quantify the financial risk, carbon prices can be assumed based on empirical data from existing carbon pricing/regulatory systems as well as shadow carbon prices used by many corporates in capital expenditure decision processes. Notably, over 1,000 companies currently price their carbon emissions or intend to do so within the next two years.[xii]

Regulatory carbon pricing that currently exists across various markets has been predominantly below USD 35/tonne and the EU carbon price notably collapsed in recent years to below €10, though prices could rise significantly in the near term if policy action continues to gain momentum. Interestingly, shadow carbon prices used by corporates are frequently higher than current empirical carbon prices owing to the fact that long-lived assets, such as power plants, oil refineries and steel mills, are expected to experience higher carbon prices during their lifetimes.

Recognizing that actual prices, assumptions and forecasts will vary, we use an escalating series of carbon prices to test a simplistic question: If each company in the portfolio was required to pay for each tonne of carbon in its footprint, either as a pay-to-pollute privilege or a requirement to purchase carbon offsets to achieve "carbon neutrality", what would be the annual expense, consequent impact on company valuation, and ultimate impact on value the hypothetical portfolio? This analysis is rudimentary in its assumptions about how carbon costs may carry through to enterprise value and market capitalization[xiii], and it ignores certain realities with respect to how regulations have historically been applied, but the analysis serves as a type of "carbon stress test" on the portfolio and a useful starting point for considering the magnitude of the impact. Shown in figure 12, a realistic range of carbon prices reduces the value of the portfolio by 0.4 to 3.5 percent.

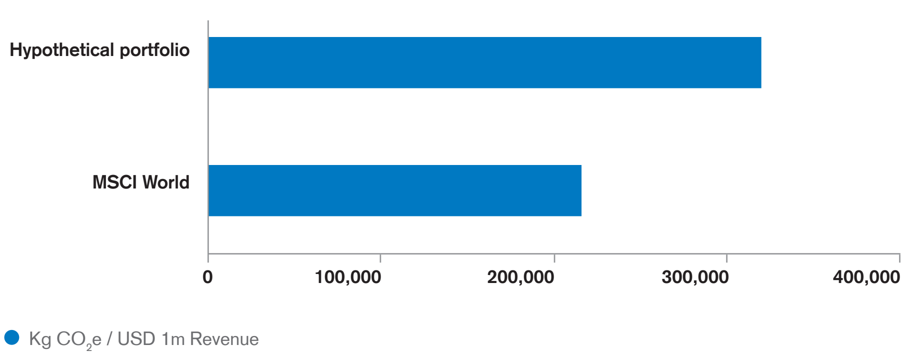
Sensitivity of portfolio value to carbon price (figure 12)



Scale: Percentage impact on portfolio value
Source: Credit Suisse, South Pole Group

For further perspective, the carbon intensity of the hypothetical portfolio can also be compared to a benchmark. In 2015, for example, MSCI published the carbon footprints and intensities of all of its major indices.[xiv] Using the MSCI World Index as a benchmark, our randomly-selected hypothetical portfolio turns out to be 48% more carbon intensive based on revenue (figure 13), suggesting that the portfolio is significantly more exposed to carbon regulatory risk as compared to the global equity markets broadly. The portfolio may have significant room for improvement in terms of carbon optimization and should be tested against alternative low-carbon portfolios to examine relative financial and carbon performance.

Carbon intensity of hypothetical portfolio vs. MSCI World Index (figure 13)



Source: Credit Suisse, South Pole Group

Conclusion

Carbon regulatory risk is now established in many key jurisdictions and will be an increasingly relevant return variable over time. The United Nations Climate Change Conference in Paris (COP21) is an important reminder of persistent efforts at both national and global levels to shift to low-carbon energy supplies. Regardless of the outcome of that conference, policy action on climate change—and the risks and opportunities that it creates—will continue into the foreseeable future. We recommend that investors begin screening their equity portfolios for carbon intensity. Sufficient carbon data and tools exist to run a set of carbon analytics on an investment portfolio, considering, for example:

- the portfolio's carbon footprint,
- carbon intensity of the equity investments relative to key financial metrics,
- identification of carbon hot spots,
- carbon stress tests based on various carbon pricing scenarios, and
- portfolio performance relative to low-carbon portfolio alternatives.

Empowered with the information from carbon analytics, investors may then evaluate different approaches to carbon optimization, for example, adjusting sector weights, tilting toward less carbon-intensive companies within sectors, exiting very carbon-intensive sectors and/or hedging.

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Endnotes

i World Economic Forum (2015) Global Risks Report 2015
ii World Bank Group (2014) State and Trends of Carbon Pricing
iii http://newsroom.unfccc.int/unfccc-newsroom/major-oil-companies-letter-to-un/
iv http://globalinvestorcoalition.org/investor-statements-on-climate-change/
v https://medium.com/@ClimateCEOs/open-letter-from-global-ceos-to-world-leaders-urging-concrete-climate-action- e4b12689cddf
vi Mercer (2015) Investing in a Time of Climate Change
vii The Mercer study included four risk factors: Policy, Technology, Resource Availability and (physical) Impact. The results of the analyses integrate all of these factors are not based solely on Policy and Technology. However, this research brief only discusses the results in relation to Policy and Technology.
viii Credit Suisse, World Wildlife Fund & McKinsey (2011) Transition to a Low-Carbon Economy
ix Based on MSCI Global Industry Classification System
x See Montreal Carbon Pledge and mandatory carbon reporting by institutional investors in France.
xi See http://www.ghgprotocol.org.
xii Carbon Disclosure Project (2015) Putting a price on risk: Carbon pricing in the corporate world. CDP Report 2015 v.1.1
xiii To test the impact of a carbon price on the hypothetical portfolio, the calculation relies on number of rudimentary assumptions such as: It is based on enterprise value (EV) divided by EBITDA, which may not be an appropriate valuation approach for all companies; It assumes that the EV impact translates directly into a reduction into market capitalization on a 1:1 basis, meaning debt and cash levels are assumed to be a constant; It does not account for the tax reduction that would be associated with the carbon expense; and It does not account for the fact that some companies are already paying for carbon emissions either via a compliance market or on a voluntary basis.
xiv See: https://www.msci.com/index-carbon-footprint-metrics

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