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Decarbonisation 2.0:

Russell Investments' sustainable investing solution for the energy transition

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Abstract

As investors increasingly look to incorporate Environmental, Social and Governance (ESG) criteria into their decision-making process, tackling the investment implications of a transition to a low carbon economy has been at the forefront of this movement. Investment solutions addressing the energy transition[1] have primarily focused on what we refer to as "standard decarbonisation": a reduction in exposure to carbon emissions and/or divestment from fossil fuel reserves within equity portfolios. Our research has found that this standard decarbonisation approach can unintentionally lead to reduced exposure to renewable energy and a reduction in the aggregate ESG profile of a portfolio. In this paper, we present an enhancement to Russell Investments' original decarbonisation strategy that incorporates three additional sources of insight informative to the sustainability profile of a portfolio: increased exposure to renewable energy, incorporation of ESG scores and a targeted reduction in coal exposure. In the spirit of our original decarbonisation strategy, we show that this solution can be achieved while maintaining the return profile of the underlying benchmark. Our objective is to help investors align portfolios with the transition to a low carbon economy without changing the return profile or introducing unintentional risks. Going beyond reduction of carbon footprint alone, the portfolio is designed to have both a higher aggregate ESG score as well as higher exposure to renewables relative to the benchmark. In doing so, the solution tilts a global equity portfolio away from those companies with greatest exposure to carbon related risks and towards those companies expected to contribute to, and benefit from, the energy transition.

Our research has found that a standard decarbonisation approach can unintentionally lead to reduced exposure to renewable energy and a reduction in the aggregate ESG profile of a portfolio.

Overview

Launched in 2015, the objective of Russell Investments Decarbonisation 1.0 strategy[2] is to reduce the carbon exposure of a universe by a specified percentage while minimising the active risk. Specifically, the strategy achieves a 50% reduction in relative carbon footprint and 50% reduction in the carbon reserves while targeting a tracking error of less than 1%. A direct response to the initiatives outlined by the United Nations supported Principles for Responsible Investment (PRI)[3], the strategy was designed as a means for

[1] Energy transition is generally defined as a long-term structural change in energy systems.

[2] "The Russell Investments Decarbonisation Strategy: Investigating different approaches to reducing the carbon footprint of an equity portfolio without materially impacting performance", (Smith, Bennett, Velvadapu 2016).

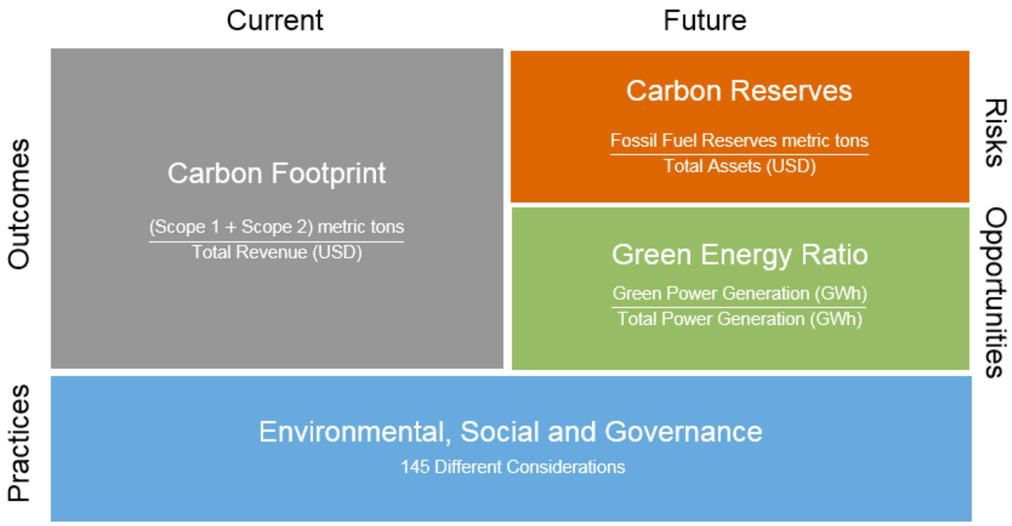
[3] "Discussion Paper: Reducing Emissions across the Portfolio" UN PRI Climate Change Strategy Project. (2015).

signatories to implement a preference for decarbonisation across their listed equity portfolios while effectively managing risk at the stock, sector and country level[4].

In our original decarbonisation strategy[2], we highlight how combining carbon footprint and reserves incorporates both current and future carbon criteria into our solution. We reduce exposure to companies with poor current environmental impact by reducing portfolio exposure to carbon emissions. We mitigate future carbon risks through reduced exposure to carbon reserves, many of which can never be extracted in a reduced emission scenario[5], and hence may become "stranded assets". In Smith, Bennett & Velvadapu (2016) (SBV), we compare several portfolio construction approaches to achieving these two standard decarbonisation criteria and present a proprietary portfolio construction technique that avoids the common pitfalls of standard decarbonisation. Currently, the two most common approaches to addressing the issues of portfolio decarbonisation are naïve fossil fuel divestment, effectively divesting from any company that holds fossil fuel reserves, and standard decarbonisation, or reducing the carbon footprint of a portfolio relative to benchmark.

Building on our prior research, here we demonstrate that these common approaches to carbon emission and reserve reduction can lead to lower exposure to renewable energy and worse aggregate ESG profile as measured by ESG scores. In this paper, we show that these signals can be incorporated and managed while maintaining the same risk-return neutrality of standard decarbonisation. Specifically, our enhanced decarbonisation 2.0 strategy incorporates three additional criteria. In addition to incorporating future risks of an energy transition through carbon reserves, future opportunities are also now incorporated through the addition of renewable energy production in the form of our Green Energy Score. Building on evidence that coal energy use in particular will need to be dramatically reduced to meet a 2 degree warming scenario[6,7] we also increase the precision of our carbon reserve reduction through an explicit coal exclusion. In order to incorporate not only carbon outcomes, as measured by these three criteria, but also sustainable practices, the portfolio is designed to have a higher ESG[8] score relative to the benchmark. The purpose of these additional criteria is to provide a wider view of how a portfolio aligns with sustainability goals beyond carbon emission reductions. We summarise the interaction and dimensionality of these considerations across current and future threats and opportunities in Figure 1 below.

Figure 1: Sustainability Considerations



[4] For a full discussion of the initiatives surrounding decarbonisation including UN PRI, Montreal Pledge and the Portfolio Decarbonisation Coalition, refer to "A novel solution to help you manage climate change exposures in your portfolio" (Forbes and Kothare 2016).

[5] Unburnable Carbon 2013: Wasted capital and stranded assets (Carbon Tracker, 2013).

[6] "Analysis of the Impacts of Clean Power Plan", U.S. Department of Energy, Energy Information Administration, Independent Statistics & Analysis. (May 2015).

[7] United Nations, Paris Agreement, 21st Conference of the Parties, Paris. (Dec 2015).

[8] ESG information utilised is sourced from Sustainalytics.

These objectives are combined in our proprietary portfolio construction process, which solves for the combination of securities that achieves the aggregate carbon footprint, carbon reserves, green energy score and ESG profile targets with the minimum amount of active share and transaction costs.

In this paper, we provide a summary of the data and metrics considered, review the portfolio construction process and summarise the performance and portfolio characteristics for this new strategy.

Data

This study uses two primary data sources: ESG data is sourced from Sustainalytics and carbon and energy data is sourced from Trucost. The history we use for both is relatively limited with ESG scores available from August 2009, carbon footprint data available from May 2009 and reserves and energy production data available from December 2012. Due to this restriction, our testing begins in August 2009 with ESG and carbon footprint data and introduces reserves and green energy ratios from 2013 onwards[9].

There are four primary inputs to our model: carbon footprint, carbon reserves, energy production and ESG scores. The rest of this section summarises the data and key considerations for each of these items.

Carbon Footprint

We define relative carbon footprint as Scope 1 (direct) carbon emissions plus Scope 2 (electricity consumption) carbon emissions measured in metric tons of carbon dioxide equivalent (CO2-e), divided by company revenue (USD)[10].

$$\text{Relative Carbon Footprint} = \frac{(\text{Scope 1} + \text{Scope 2})\ \text{metric tons}}{\text{Total Revenue (USD)}}$$

SCOPE 3

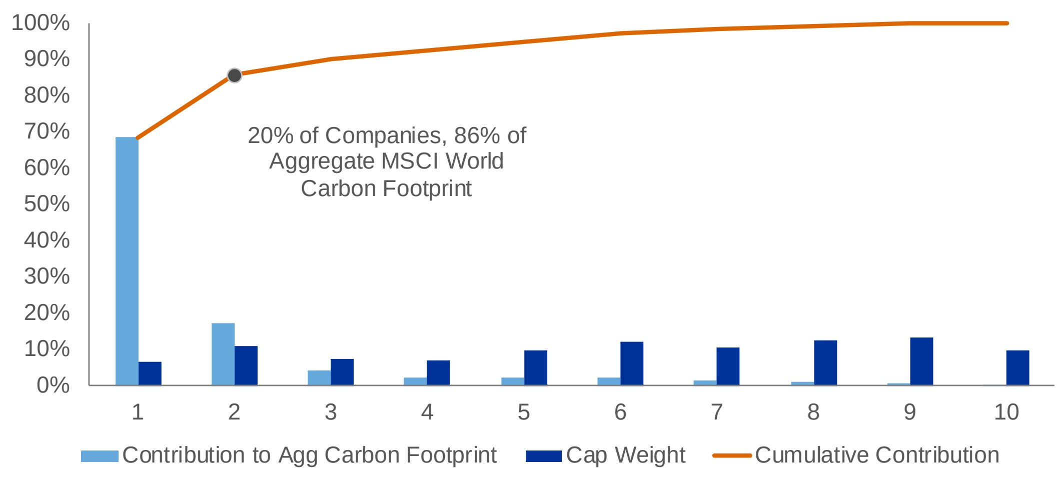
The complete carbon emissions of a company's value chain, referred to as Scope 3, is currently not included in our calculation. This is primarily due to our lower confidence in Scope 3 data availability and reliability due to lower levels of company reporting and higher levels of estimation. Scope 3 emissions are also inherently more complicated to estimate because of the need first to identify and map a company's complete value chain. As data availability and robustness improves for measuring Scope 3 carbon emissions, we will continue to evaluate incorporating this data into our process. In the meantime, we take a targeted approach to addressing specific points in the value chain where carbon emissions are particularly substantial. As explained in further detail in the sections that follow, we incorporate renewable energy production, coal, and other fossil fuel reserves exposure specifically because these are significant sources of complete value chain emissions for not only the companies impacted by these metrics but indirectly for the entire security universe. Our research agenda includes continually evaluating and expanding this targeted approach. For example, in 2017 we will research vehicle emission efficiency, another important source of value chain emissions. We believe this methodology addresses material sector-specific issues that have an impact on aggregated value chain emissions while at the same time maintains a high standard for data quality.

[9] We attempt to preserve the as-was nature of the data as much as possible. For ESG and carbon footprint data this is possible and the data is used as it was available for any a given research date after August 2009. Reserves and energy production data become available in 2015 and refers to years 2012 to present. For example, in August, 2015 data was released for Exxon Mobil for 2012 and 2013 fiscal years. Given the limited scope of as-was data for reserves and energy production we have elected to use the reported data back to 2012 as a proxy in an effort to incorporate these criteria into our testing. The Sustainalytics ESG ranking data coverage and methodology was materially changed in 2011 (August).

[10] The relative carbon footprint, reserves and green energy score formulas presented in this paper refer to security-level characteristics. To generate a portfolio-level score we take the sum product of portfolio weight and security-level scores divided by coverage.

As highlighted in our original work on decarbonisation, relative carbon footprint is highly skewed with a handful number of companies responsible for the vast majority of a portfolio's carbon footprint. The skewness of the data is observed not only at an asset level but also when grouped categorically by sector and to a lesser extent, by country. As shown below, 20% of companies are responsible for 86% of the aggregate carbon footprint in the MSCI World universe. This makes it possible to substantially reduce the carbon footprint of a portfolio by reducing exposure to a relatively small number of names. This highlights a key opportunity of working with carbon data: high skew makes it possible to dramatically reduce carbon footprint and reserves characteristics while maintaining low benchmark-relative exposure. The fact that this skewness is observed across multiple dimensions (security-, sector-, industry-, and country-levels) also highlights a key risk associated with naïve approaches to standard decarbonisation: without controlling for the size of active bets made across these dimensions, simply divesting from the largest emitters will lead to large sector, industry and country bets relative to the benchmark.

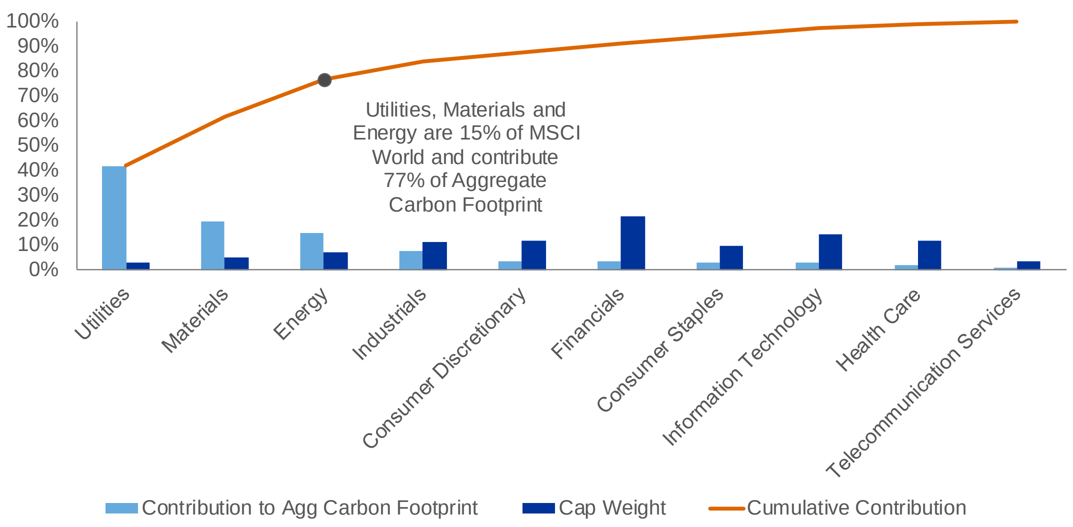
Figure 2: Aggregate Carbon Footprint by Decile



Source: Russell Investments, Trucost as of Dec 31, 2016

Unsurprisingly, high emitters tend to be concentrated in three sectors: utilities, materials and energy and simple exclusion of the worst emitters will lead to large underweights to these sectors.

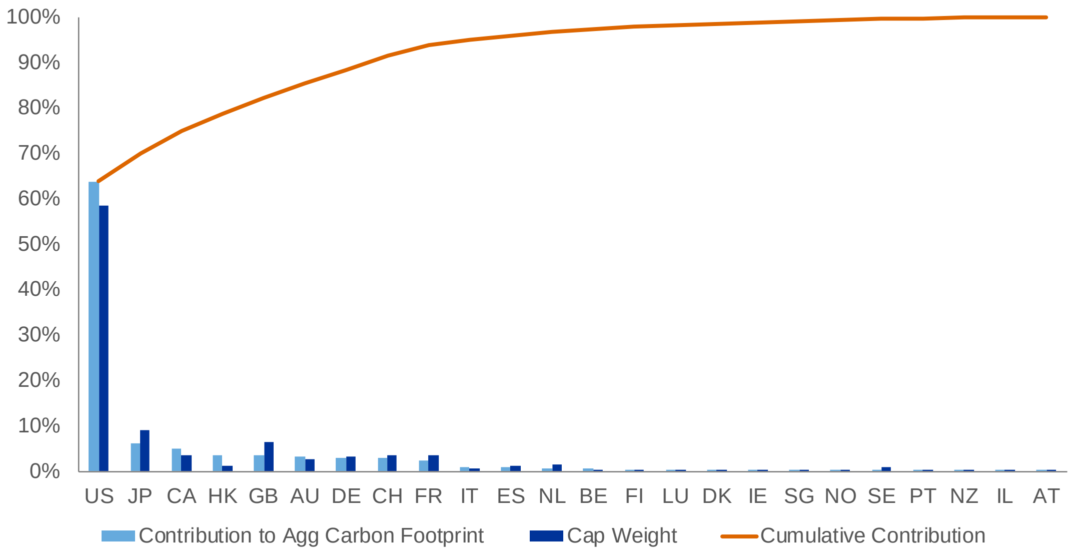
Figure 3: Aggregate Carbon Footprint by Sector



Source: Russell Investments, Trucost as of Dec 31, 2016

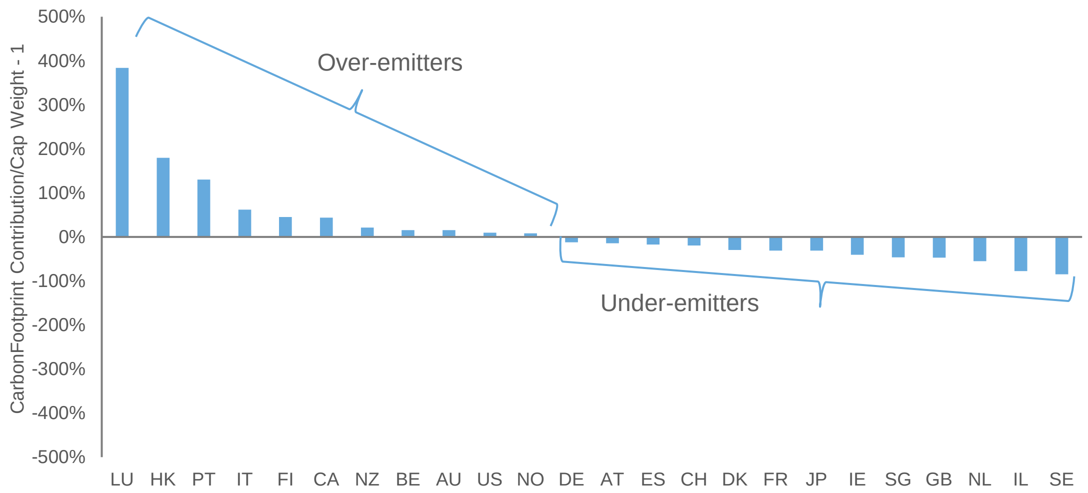
Relative carbon footprint also varies across countries although the distribution is more uniform as compared with distribution across sectors. If relative carbon footprint was uniform across countries, we would observe that contribution to portfolio relative carbon footprint was equal to country capitalisation weight in the portfolio. Figure 4 below highlights that the difference between country cap weight and relative carbon footprint contribution is indeed lower than either the decile or sector cases above. Here we see that in aggregate terms, the largest emitters are the US, Japan, Canada, HK, Great Britain and Australia. Although carbon and cap weight are more closely aligned for country than decile or sector, we do observe gaps between contribution to relative carbon footprint and country weight with Luxembourg, Hong Kong, Portugal contributing several times their cap-weight to relative carbon footprint, as demonstrated in Figure 5. All of these will be potential candidates for underweighting in a decarbonisation strategy that does not include country constraints.

Figure 4: Aggregate Carbon Footprint by Country



Source: Russell Investments, Trucost as of Dec 31, 2016

Figure 5: Contribution to Carbon Footprint Relative to Cap Weight



Source: Russell Investments, Trucost as of Dec 31, 2016

To summarise across these categorical variables, we can see that a naïve exclusion of the highest emitters can lead to both sector and country active positions, jeopardising the return-neutrality that we consider a central tenet of our decarbonisation strategy. In the methodology section below, we will outline our approach for addressing the issue.

Fossil Fuel Reserves

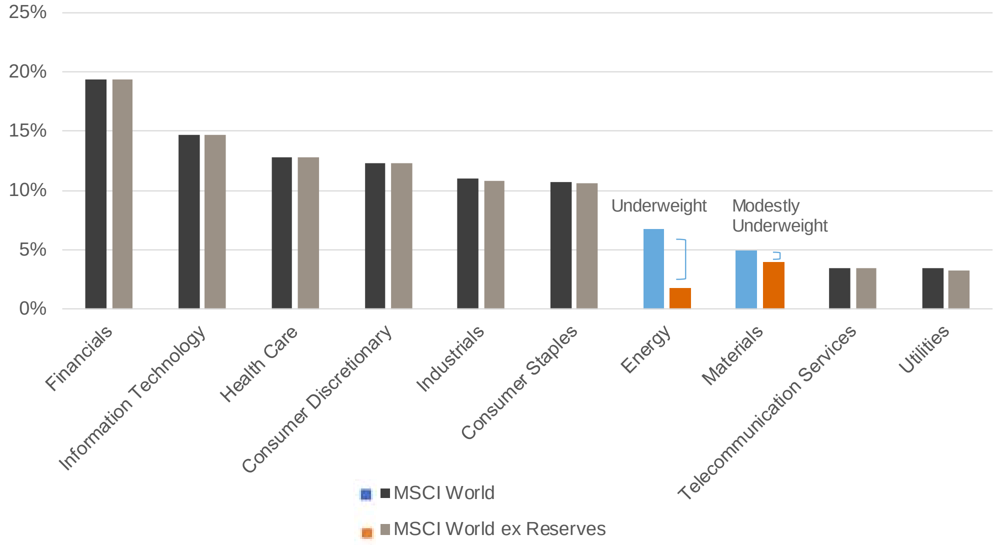
Carbon reserves are also sourced from Trucost. We refer to relative carbon reserves as the asset relative fossil fuel reserves of a company. Specifically it is defined as:

$$\text{Relative Carbon Reserves} = \frac{\text{Fossil Fuel Reserves (m tonnes)}}{\text{Total Assets (USD)}}$$

Whereas carbon footprint data is (theoretically) applicable to the entire universe, reserves data only applies to the subset of companies holding reserves implying that reserves data has a theoretical upper limit well below 100% and will be even more concentrated than carbon footprint in a few sectors.

Figure 6 highlights the key implication of decarbonisation strategies based solely on the naïve fossil fuel divestment approach: large sectoral positions. In these cases, decarbonisation effectively acts as a sector bet against two sectors in particular, energy and materials. If reserves are excluded from the portfolio, energy decreases from 6.8% of the portfolio to 1.8% and materials decreases from 5.0% to 4.0%, resulting in two large active exposures for the portfolio. These two large positions are illustrated in Figure 6.

Figure 6: Sector Weights, Before and After Reserves Exclusion



Source: Russell Investments, MSCI, Trucost as of Dec 31, 2016

Renewable Energy Data

Following the Paris Climate Agreement, consensus is coalescing around a global warming target of less than 2 degrees Celsius. Achieving this proposal by will involve a shift in energy production away from traditional sources of energy such as coal and oil to more renewable sources of energy. The green energy score was developed to ensure that in the process of reducing exposure to high carbon emitters, utility and energy companies that are investing in renewable technologies are not inadvertently excluded from the portfolio. This type of information is potentially relevant to positioning for the energy transition and goes beyond looking at carbon footprint and reserves metrics. Our analysis highlights that some of the companies with the highest carbon footprints also have high green energy scores, making them easily targets for exclusion in standard decarbonisation.

Specifically the green energy score calculates the percentage of total energy produced from renewable energy sources. Classification of different energy sources is defined in the table below. This score ranges from a maximum score of 1 (entirely green sourced energy) to a minimum of 0 (entirely sourced from brown or grey energy), as defined in the table below.

Green Energy Score:

$$Green\ Energy\ Score = \frac{Green\ Power\ Generation\ \ (GWh)}{Total\ Power\ Generation\ (GWh)}$$

In our process we calculate the green energy score for all applicable companies in the universe and calculate an aggregate score for the universe. In our optimisation process we constrain the final portfolio to have green energy score that is greater than the parent universe score. This additional piece of information allows us to distinguish between two otherwise similar companies, one of which has invested in renewable power generation and is positively exposed to the energy transition. This ensures that our strategy is targeting those firms that are positively exposed to the energy transition.

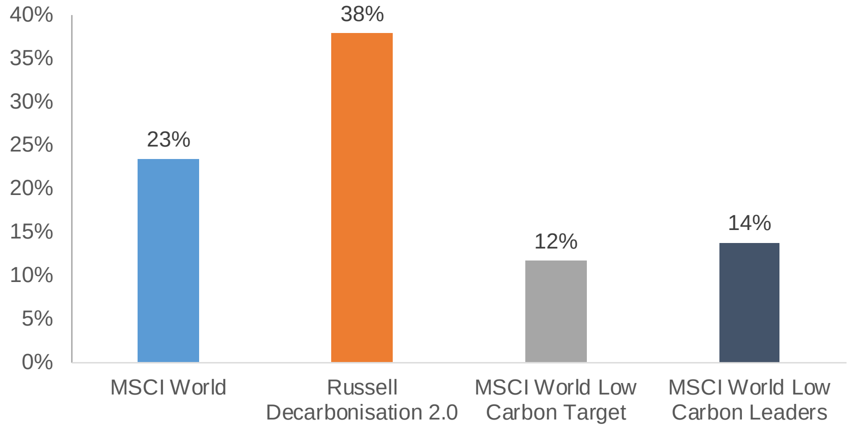
Table 1: Energy Sources Classification

Green (GWh)	Brown (GWh)	Grey (GWh)
Wind	Coal	Nuclear Power
Solar	Natural Gas	Landfill Gas
Biomass	LPG	Other Power
Geothermal	Petroleum	
Wave & Tidal	LNG Power	
Hydroelectric	Coal	

*GWh is a unit of electrical energy equal to one billion watt hours, one thousand megawatt hours

It is interesting to note that decarbonising a portfolio can, at the same time, reduce exposure to renewables if one does not consider unintended exposures. Figure 7 compares the renewable energy exposure of Decarbonisation 2.0 to two standard decarbonisation strategies that target at least 50% reduction in carbon emissions. Relative to the benchmark, MSCI World, we see that decarbonisation based on a reserve and emission reduction does not automatically lead to improved renewables exposure and can in fact cause the renewable energy mix to be worse than benchmark.

Figure 7: Green Energy Score of Decarbonisation Strategies



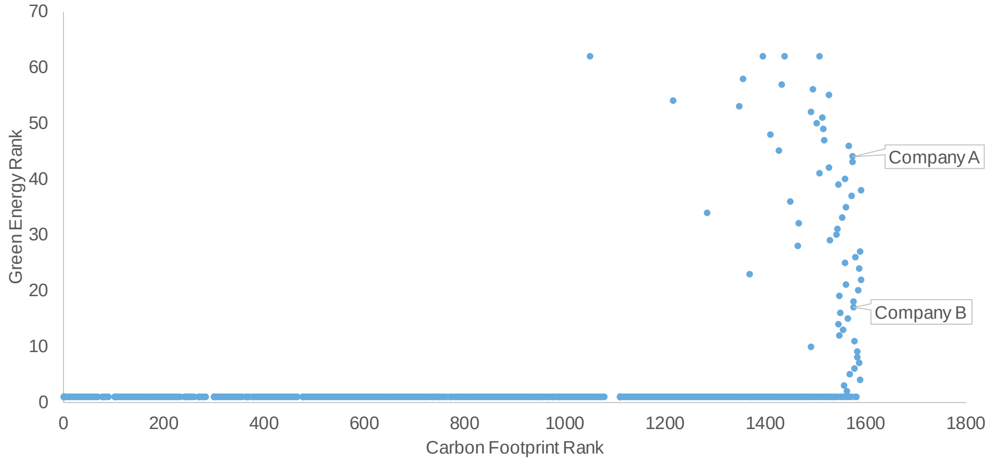
Source: Russell Investments, MSCI, Trucost

While this result may be initially unintuitive, it highlights a key point that companies currently involved in energy production are well-positioned and well-incentivised to invest in renewable energy programs and without further considerations, standard decarbonisation has a tendency to underweight these companies. Our goal is to maintain the same aggregate reduction in standard carbon criteria[11] but use renewable energy as another consideration in evaluating which companies to underweight.

[11] See "Portfolio Carbon. Measuring, disclosing and managing the carbon intensity of investments and investment portfolios. UNEP Finance Initiative - Investor Briefing. 2013"

Figure 8 highlights three key considerations for renewable energy production that provide insight into why standard decarbonisation can lead to reduce exposure.

Figure 8: Relative Carbon Footprint Rank vs Green Energy Score Rank



Source: Russell Investments, Trucost, Sustainalytics

First, we see that companies producing green energy tend to have large relative carbon footprints. This is consistent with the observation highlighted in Figure 3 above that utilities, the primary producers of energy, have the largest sector emissions at 45% of aggregate MSCI World carbon footprint. Because renewable energy production is correlated with high emissions, a decarbonisation strategy based on emissions reduction would potentially exclude renewable energy production from the universe.

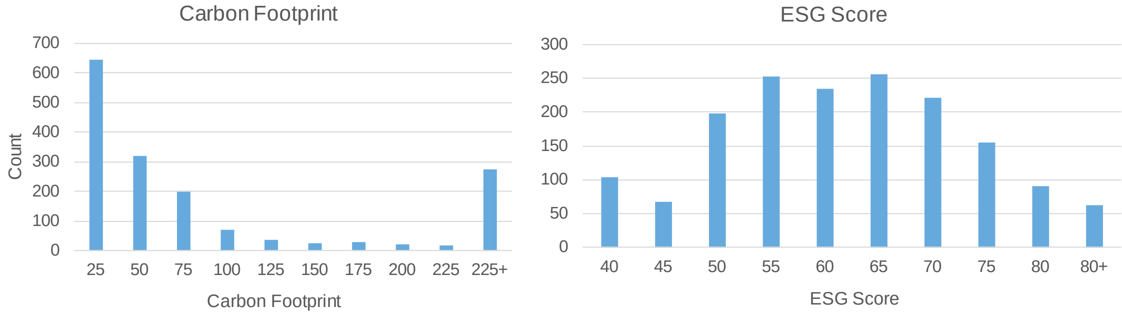
Secondly, we see that without the green energy score, we would be just as likely to underweight company B as company A even though company A has much higher exposure to renewables. Third, this highlights why we believe the green energy score is important even though it applies to a small subset of the universe. The energy produced by companies with a green energy score theoretically represents the entire Scope 2 (electricity generation) emissions for the universe. So while there are less than 100 companies for which the green energy score directly applies, these securities are the source of Scope 2 emissions for the remaining 1500+ securities in the universe. Making a meaningful reduction in the Scope 2 emissions through increased reliance on renewables will depend on the renewable energy production of these energy producing companies. Carbon footprint reduction based on a naïve underweight to utilities without regard for renewables effectively ignores the opportunity to impact Scope 2 emissions at their source. Given Scope 2 emissions make up 63% of total emissions for non-utilities sectors, our approach targets an essential component of the energy transition.

Environmental, Social, Governance (ESG) Characteristics

Our strategy also incorporates aggregated ESG scores provided by Sustainalytics. Sustainalytics' ESG ratings provide a measure of how well issuers proactively manage the environmental, social and governance issues that are the most material to their business. The ratings reflect three dimensions: Preparedness, Disclosure and Performance. The ESG scores range from 0 – 100 based on a balanced scorecard approach, where the overall ESG score for a company is the sum of the weighted average of underlying indicator scores.

Unlike the carbon data that is highly skewed, Figure 9 demonstrates that ESG scores approximate a bell shaped distribution. Aggregated ESG scores are based on over 100 underlying characteristics which when summarised leads to an averaging effect in the aggregate score.

Figure 9: Comparing Equal-Weighted Histograms of Relative Carbon Footprint and ESG Scores



Source: Russell Investments, Trucost, Sustainalytics

Where the high skewness of carbon data represents an opportunity for making large reductions with minimal tracking error, the bell shaped distribution of ESG scores represents a challenge in that it is not possible to make large improvements in aggregate scores without materially impacting active share. In our portfolio construction process, we look to achieve an aggregate ESG profile that is higher than the underlying universe.

It would be reasonable to assume that a dramatic reduction in reserves and relative carbon footprint would result in an upward bias in the Environment sleeve and, ultimately, the aggregate ESG score of a portfolio, rendering this constraint redundant. However, our analysis of the data showed this was not the case. In Figure 10 we present a sector-level ranking of relative carbon footprint and ESG scores to highlight how these inputs interact at the sector level where rank = 1 is the best scoring sector.

Figure 10: Sector Relative Carbon Footprint and ESG Score Ranks

	CF Rank	ESG Rank
Materials	9	1
Telecommunication Services	4	2
Consumer Staples	6	3
Utilities	10	4
Energy	8	5
Industrials	7	6
Health Care	2	7
Information Technology	1	8
Financials	3	9
Consumer Discretionary	5	10

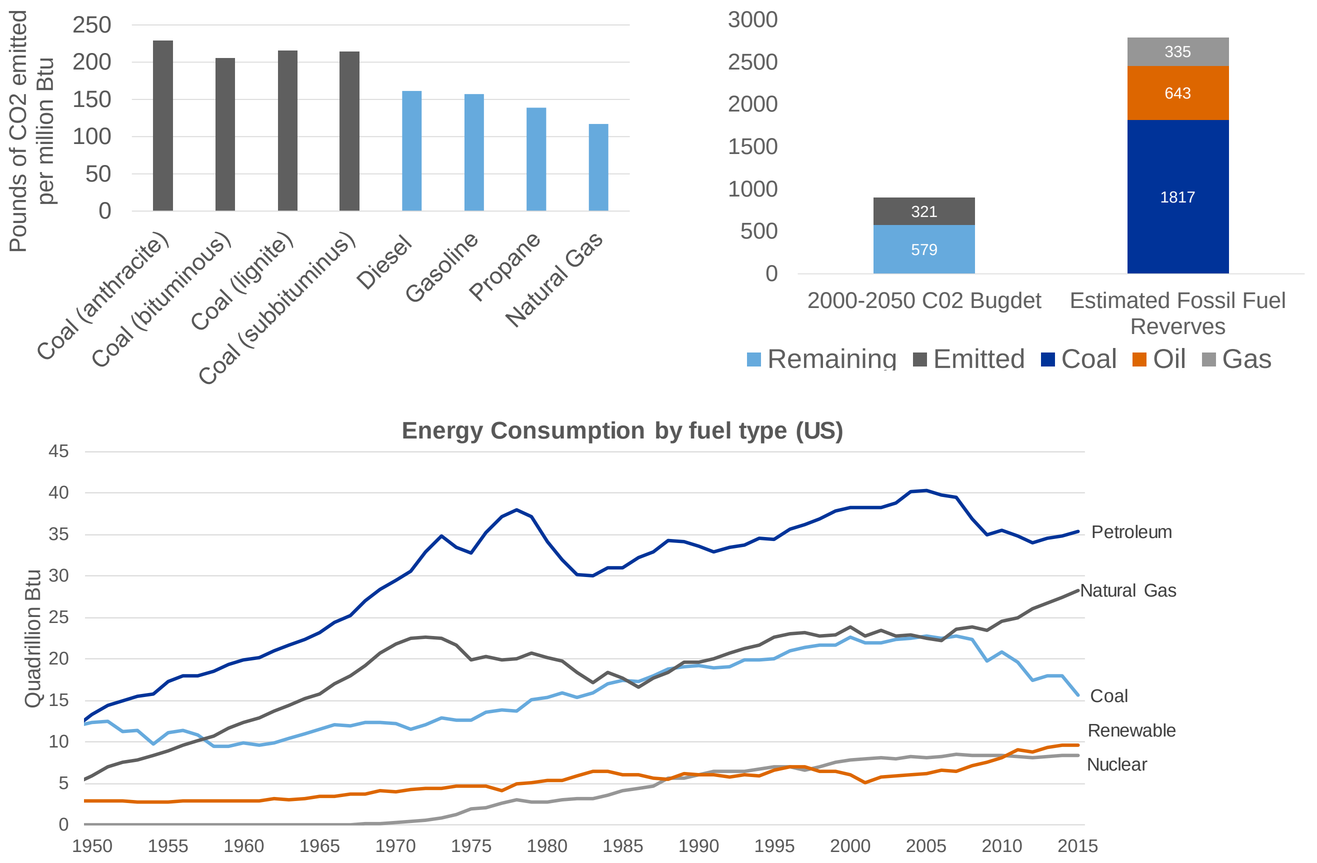
Materials and utilities are the highest carbon emitting sectors (ranks 9, 10) but simultaneously score highly on ESG criteria. Some of the lowest ESG scoring sectors tends to be financials, IT and healthcare and their low relative carbon footprint makes all of these a natural overweight in a decarbonisation strategy. These patterns highlight important differences in the ESG and relative carbon footprint data. In constructing an ESG score, performance is evaluated on issues that are material to the industry and on a peer-relative basis. This means that a utility company with a higher relative carbon footprint than a financials firm can still have a higher environmental score if it is a leader within the utilities industry. Furthermore, the level and quality of a company's ESG-relevant disclosures is a large input to ESG scores. Energy, Materials and Utilities (EMU) companies are under significant pressure to disclose frequently and extensively perhaps because their stakeholders view their environmental disclosures as particularly material to their business and have responded with a level of disclosure that exceeds the sector standard as compared to health care, IT, financials and consumer discretionary. Together these characteristics imply that if not directly accounted for low carbon solutions will not systematically have an ESG profile that meets or exceeds the benchmark.

In contrast to the other data included in our strategy which look exclusively at outcomes, the ESG score is aimed to give insight into practices. Our goal is to ensure that in the process of excluding carbon emitters and fossil fuel reserve holders we do not inadvertently increase our exposure to low ESG stocks. The inclusion of an ESG consideration which applies to all companies and sectors can result in more discerning positions when reallocating weights across the portfolio. Instead of making uninformed decisions about how active share is spent, we are now using the active share to target those companies that are relatively strong ESG performers, as represented by high ESG scores.

Coal Exclusions

In addition to the criteria outlined above which are used to tilt the portfolio, our enhanced decarbonisation strategy also includes a coal restriction. We use data supplied by Trucost to identify coal-related revenue as a percentage of total revenue. Companies generating more than 20% of revenue from coal-related activities are excluded from the portfolio.

Figure 11: Coal and the Energy Transition



Source: Energy Information Administration *Annual Energy Outlook 2016*

Figure 11 presents the foundation of the coal exclusion. In the first sub chart we see coal is the least efficient fossil fuel in terms of carbon emission efficiency, emitting the highest amount of CO_2 for each BTU generated. Worldwide, coal supplies 30% of energy use and is responsible for 44% of global CO_2 emissions. The second sub chart translates this problem into the case for stranded assets[12]. Of the earth's proven reserves, 65% of the total potential emissions from burning these proven reserves come from coal. In total, the world's proven reserves represent five times the carbon budget for the next 40 years, suggesting up to 80% are unburnable in a 2 degree warming scenario. Finally, sub chart 3 translates these into coal usage. Coal usage is already declining in its share of energy mix and projections extend this decline even more precipitously. In the US, coal production is projected to decline by 26% between 2015 and 2040. In recognition that coal contributes disproportionately to climate change, our strategy excludes companies with substantial revenues from coal-related activities.

[12] An asset that is worth less on the market than it is on a balance sheet due to the fact that it has become obsolete in advance of complete depreciation.

Methodology

The strategy we have developed builds directly on insights gained from our previous research on decarbonisation strategies and existing client mandates. Specifically, we have previously argued and continue to maintain that an active share minimisation approach is more relevant than the standard decarbonisation alternatives[13] in that it allows us to meet multiple objectives while maintaining benchmark-like returns without introducing a risk model or variance matrix. For decarbonisation and ESG related strategies we believe that it is extremely important to have a direct relationship between a company's exposure and the subsequent weight in the portfolio. The use of a risk model can compromise this direct relationship and provide unintuitive positions at the company level. To avoid the pitfalls of using a risk model we have focused on maximising the commonality (minimising active share) of the strategy[14].

The portfolio construction process begins with the parent benchmark or underlying strategy as the starting universe for our optimisation process. The optimisation methodology and objective function are the same regardless of whether the starting universe is a market-cap weighted benchmark, a smart beta strategy or another active strategy. In the table below, we detail the key components of our objective function.

Objective Function:

Parameter	Target	Description
Active Share	Minimise	This parameter enables us to only take on active share when it is necessary and to ensure that active risk remains low.
Transaction Costs	Minimise	We use simple cost model where all costs are assumed to be 50 bps of traded value. This penalises the optimiser from inducing unnecessary turnover.
Ticket Charges	Minimise	This allows us to minimise the number of trades made at each rebalance.

Our optimisation process solves for the combination of securities that achieves the aggregate carbon footprint, carbon reserves, green energy score and ESG profile targets with the minimum amount of active share and transaction costs. We employ several risk related constraints including maximum asset, country, sector and industry deviations. Unlike the objective function, carbon and ESG criteria, the portfolio risk constraints will differ depending on the starting universe. Typically for narrower and more concentrated universes we will utilise broader risk constraints and for broader and more diversified universes we will utilise narrower constraints. The following two tables summarise these parameters.

Portfolio ESG and Carbon Criteria:

Parameter	Absolute/Benchmark Relative	Min Allocation	Max Allocation
Carbon Footprint	Benchmark Relative (Portfolio Level)		50%
Carbon Reserves	Benchmark Relative (Portfolio Level)		50%
Coal Exclusion	Absolute	0%	0%
ESG	Benchmark Relative (Portfolio Level)	>100%	
Green Energy Ratio	Benchmark Relative (Portfolio Level)	>100%	

[13] "The Russell Investments Decarbonisation Strategy: Investigating different approaches to reducing the carbon footprint of an equity portfolio without materially impacting performance", (Smith, Bennett, Velvadapu 2016).

[14] See Appendix A for a further discussion of active share or our earlier research for an analysis of its benefits relative to other decarbonisation methodologies.

Portfolio Risk Constraints (MSCI World example):

Parameter	Absolute/Benchmark Relative	Min Allocation	Max Allocation
Industry Exposure	Benchmark Relative	-0.5%	0.3%
Sector Exposure	Benchmark Relative	-0.5%	0.3%
Country Exposure	Benchmark Relative	-0.2%	0.2%
Company Exposure	Benchmark Relative	-0.5%	0.2%

Bringing the data items together

At a high level, we are interested in targeting these characteristics because in aggregate they represent the qualities we want to embed in a sustainable portfolio. A fair question is whether these signals are all necessary or whether the additional variables described here are redundant. As outlined in earlier sections, intuitively we may expect standard decarbonisation to lead to higher ESG scores and higher renewable energy exposure. Our response to this is twofold. First, to the extent that there is overlap between the signals, we want to set up guard rails around the existing strategy to prevent moving into undesirable positions (low ESG or reduced renewable exposures). Secondly and to further drive home our earlier arguments on ESG and renewables, we show that these signals can in fact move in opposite directions. Signals that point in opposite directions are bolded in the table below.

Table 2: Spearman's Rank-Order Correlation of Decarbonisation 2.0 signals

	Carbon Footprint	Reserves	ESG Score	Green Energy Ratio
Rel. Carbon Footprint	1.00	0.27	**-0.09**	**-0.31**
Reserves	0.27	1.00	**-0.10**	**-0.05**
ESG Score	**-0.09**	**-0.10**	1.00	0.11
Green Energy Ratio	**-0.31**	**-0.05**	0.11	1.00

Source: Russell Investments, Trucost, Sustainalytics

Table 2 presents the Spearman Rank correlation of the variables. The variables are adjusted for direction so that positive correlation means the signals point in the same direction. All of these are significant at the 5% level and all but the correlation between reserves and green energy is significant at the 1% level. Consistent with the evidence provided previously in our discussion of the data, favourable carbon footprint and reserves is not correlated with higher ESG scores, and if anything, appear to be negatively correlated. Good carbon footprint scores are negatively correlated with good green energy exposure, again consistent with our previous discussion on the need for incorporating energy production signals. In the results section that follows, we show that these relationships are not only true in theory but also in practice for the standard decarbonisation strategies we consider, highlighting that not explicitly considering these criteria can lead to potentially unfavourable outcomes on the basis of ESG Score and renewable energy exposure.

Results

We evaluate the strategy on the basis of its ability to meet the carbon and ESG objectives while keeping active risk low. These results are summarised in the table below.

Objectives vs Results Aug 2009 – Dec 2016

Factor	Objective	Results vs. MSCI World
Carbon Emissions	50% reduction	Average carbon footprint reduction of 59%
Carbon Reserves	50% reduction	Average carbon reserves reduction of 54%
Active Risk	Less than 1%	Annualised tracking error over the period was 0.42%
Coal Related Exclusions	Zero Holding of companies with >20% revenue related to coal	No holdings of excluded stocks
Energy Transition	Positive Exposure	Green energy power generation is 66% higher than MSCI World
ESG	Greater than benchmark	Average ESG score 63 (vs 62 for MSCI World)

Over the period the strategy displayed low levels of active risk with tracking error well below 1%. Given a goal of replicating the return profile of the underlying strategy, we do not have excess return expectations for the strategy. Full risk and return summary statistics are provided in Figure 12. During the period Sept 2009 – Dec 2016, the annualised return was higher than the benchmark, likely due to the small underweight to the energy sector, which underperformed during this period, as well as a modest quality bias we attribute to the ESG tilt. Despite the outperformance observed during this period, we do not hold a return expectation or target for this strategy.

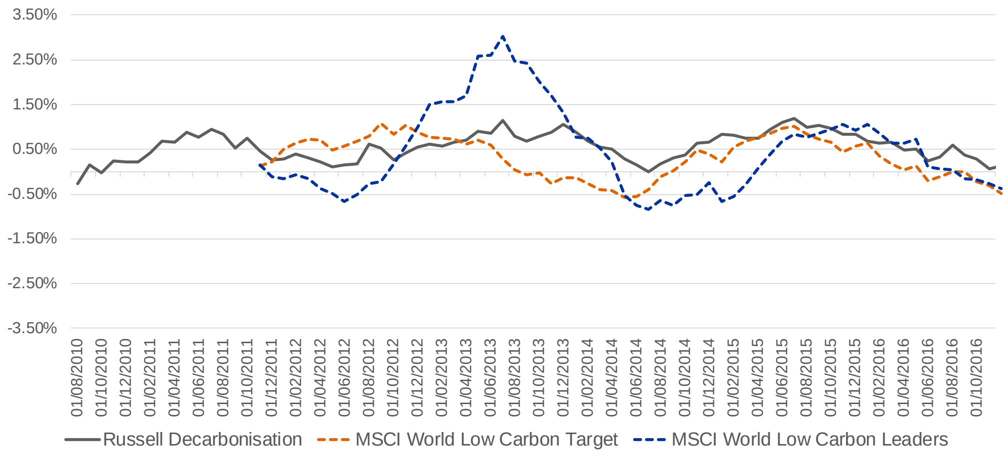
Figure 12: Return Summary

30 Sept 09 - 31 Dec 2016	Russell Investments Decarbonisation 2.0	MSCI World
Annualised Return	10.13%	9.62%
Annualised Volatility	13.55%	13.52%
Sharpe Ratio	0.78	0.74
Semi-Deviation	9.7%	9.7%
Sortino Ratio	1.08	1.03
Maximum Drawdown	-19.3%	-19.4%
Historical Beta	1.00	1.00
Excess Return	0.50%	
Excess Return (arithmetic average)	0.47%	
Tracking Error	0.42%	
T-stat	2.98	
Information Ratio	1.10	
Active Semi-Deviation	0.3%	
Active Sortino Ratio	1.63	
Maximum Active Drawdown	-0.5%	
P (Act. Ret<0)	39.8%	

Active Return

As stated previously, an objective of the strategy is to offer a return profile similar to the underlying benchmark and so here we report the rolling one year active return of the strategy, or the difference between benchmark and the actual return. The strategy is effective in matching the return pattern of the underlying portfolio. Two other standard approaches to decarbonisation are provided for comparison.

Figure 13: Rolling 1 Year Active Return of Decarbonisation Strategies vs MSCI World

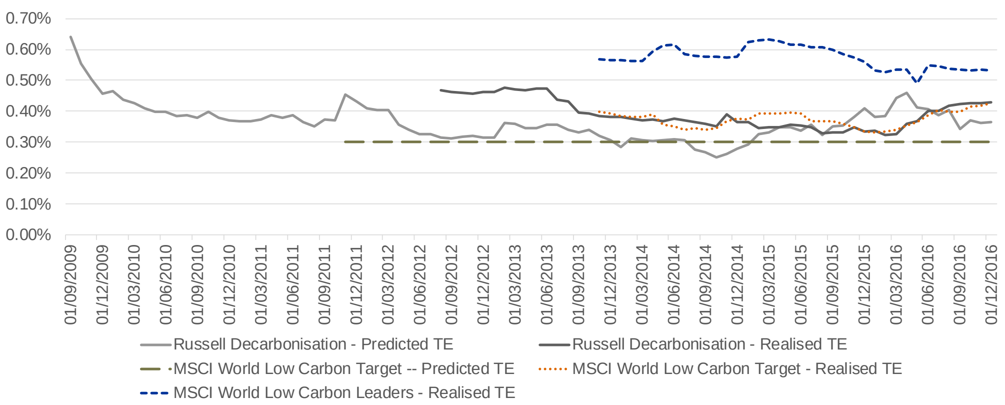


Source: Russell Investments, MSCI

Active Risk

Unlike other optimised decarbonisation solutions, our strategy explicitly minimises active share rather than tracking error. As Figure 14 below highlights, an implication of this approach is that realised tracking error does not systematically overshoot predicted tracking error the way it does in an explicit tracking error optimisation. Additionally, we can see that the active share targeting is successful in keeping tracking error within the range of a tracking error optimisation even though it is not explicitly targeted.

Figure 14: Active Risk: Predicted vs 3-Year Rolling Realised



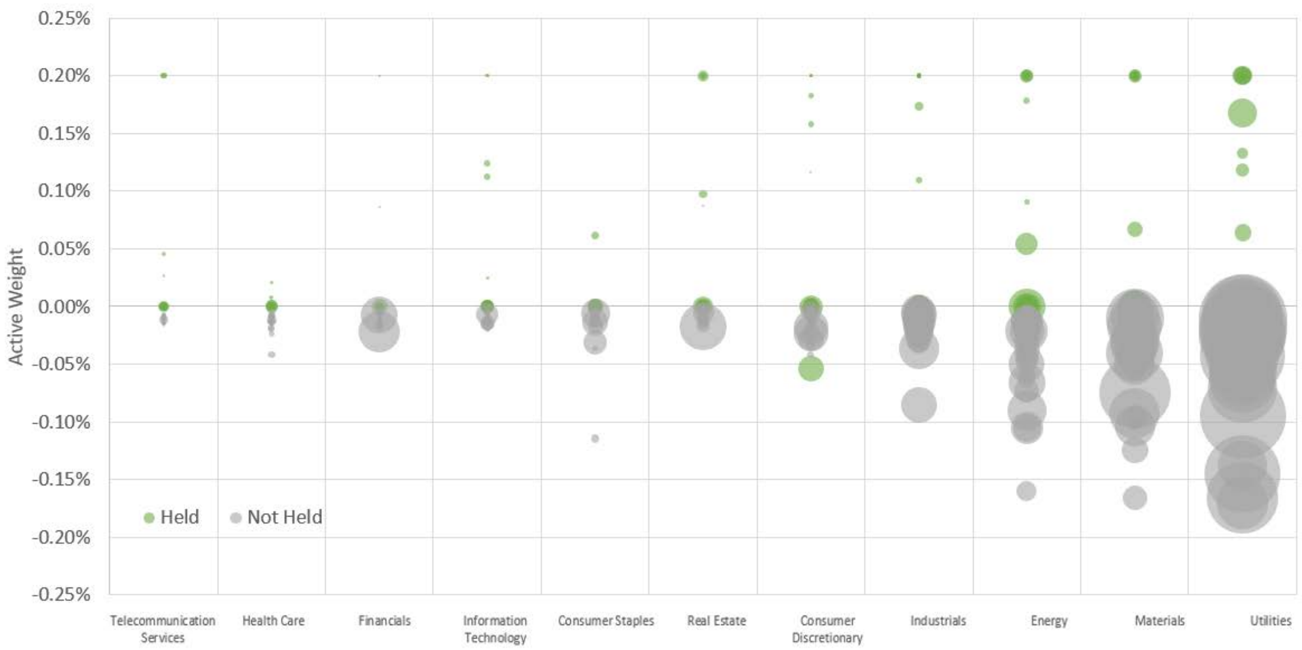
Source: Russell Investments, MSCI, Axioma

Sector and Stock level positioning

To achieve such a large reduction in the carbon footprint with such low levels of active risk means that the positions taken have to have a meaningful impact on carbon reduction. In fact, the strategy specifically targets and prioritises high impact positions. A result of this is that the strategy will be more active across sectors where carbon footprints are large and more passive in sectors that have less of an exposure to carbon. This is seen in Figure 16 below where we plot our active positions across sectors. In the chart we have ordered the Sectors by their relative carbon footprint (in ascending order, left to right). The size of the bubbles represent the relative carbon footprint of each individual stock, with larger bubbles having relatively higher carbon footprints.

In Figure 15 we can clearly see that the strategy is more active across the high carbon footprint EMU sectors and less active in the lower carbon footprint sectors.

Figure 15: Stock level positioning across sectors

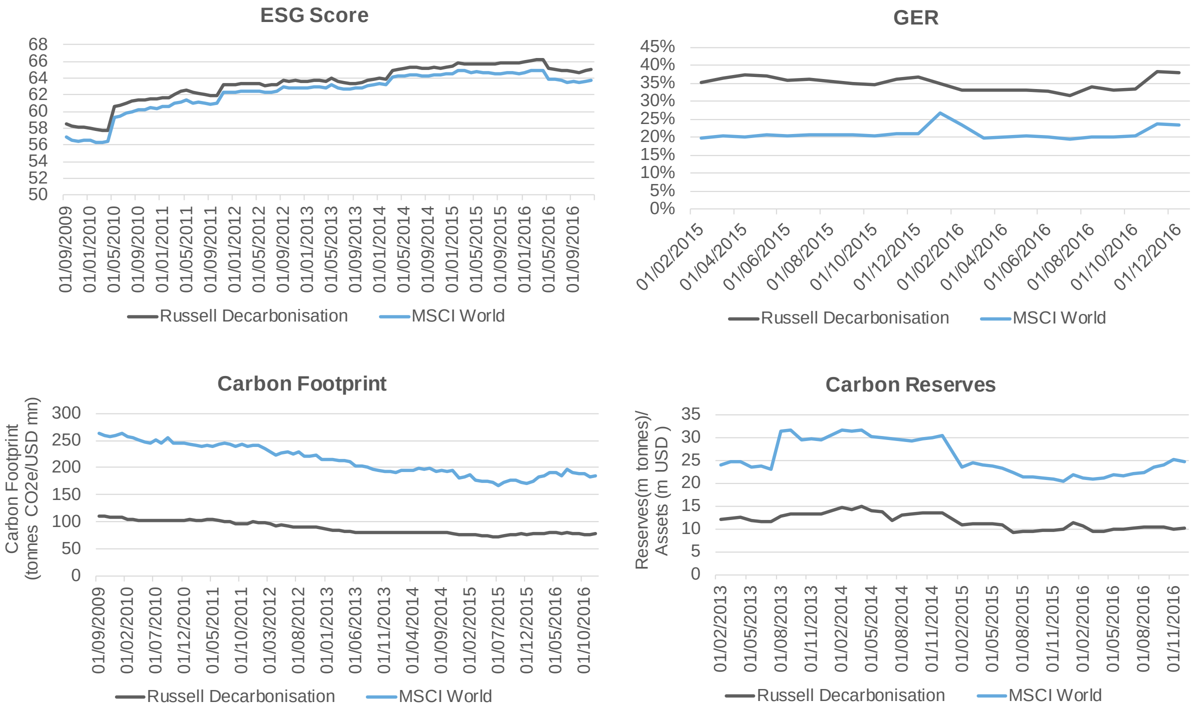


Source: Russell Investments, Axioma, Trucost

Sustainability Results Summary

In addition to meeting risk and return objectives, the strategy is also successful in consistently improving the aggregate ESG score, carbon footprint, reserves and green energy exposure to the targeted levels.

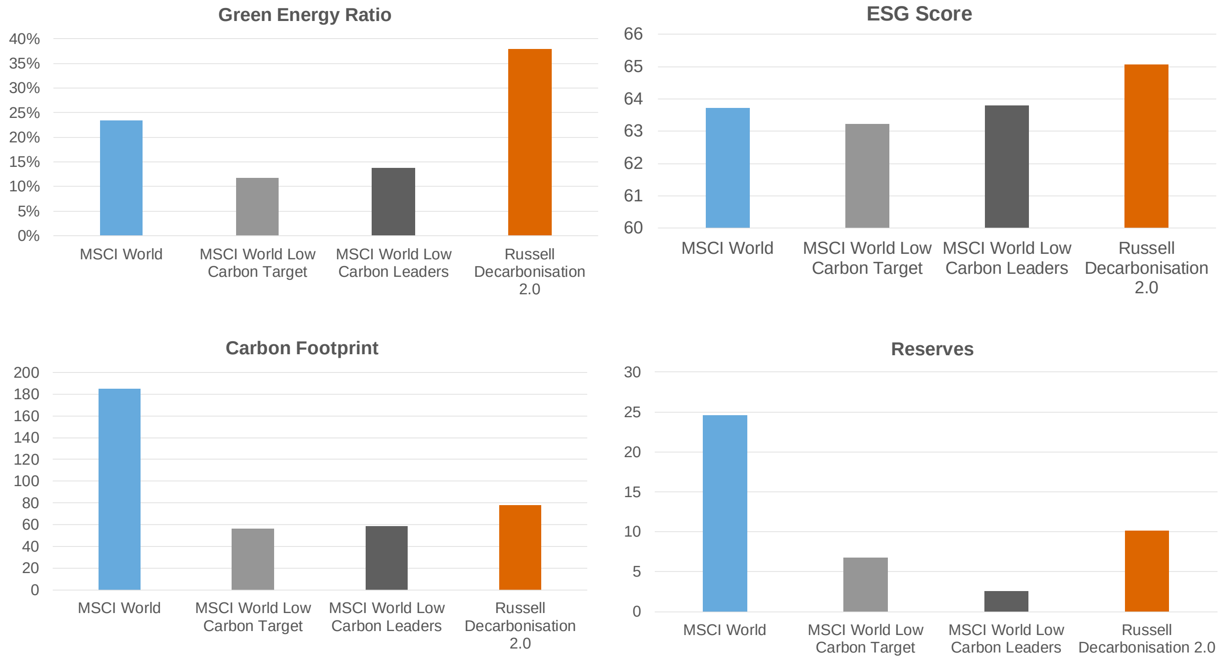
Figure 16: Carbon and ESG Criteria Historical Performance



Source: Russell Investments, Trucost, Sustainalytics

Bringing the data together once again, we highlight that this approach incorporates multiple dimensions relevant to the energy transition in a way that goes beyond standard decarbonisation. Specifically, by incorporating additional sources of data we are able to meet more targets and, as demonstrated above, this is done while incurring similar levels of active risk. In Figure 17 below we summarise the ESG and carbon characteristics of the strategy as compared to the benchmark and two standard decarbonisation strategies. Renewable energy exposure is improved, whereas it is reduced in standard decarbonisation, the ESG profile is improved, in contrast to standard decarbonisation, and carbon reserves and carbon footprint exposures are dramatically reduced.

Figure 17: Portfolio Characteristics -- Comparison across decarbonisation portfolios



Source: Russell Investments, MSCI, Trucost, Sustainalytics as of December 31, 2016

Conclusion

As outlined in the Montreal Pledge and the Portfolio Decarbonisation Coalition, the decarbonisation initiative looks to “mobilise a critical mass of institutional investors committed to gradually decarbonising their portfolios” in the ‘financial economy’ that will help facilitate and incentivise decarbonisation of the ‘real economy’[15][16]. To this end, we argue that decarbonisation portfolios can and should go beyond just carbon reduction to incorporate a broader sustainable development, including exposure to renewable sources of energy and responsible business practices in support of a more sustainable ‘real economy’. Further, we seek to enable investors to meet goals of positively positioning their portfolios to the potential effects of the energy transition without changing their investment objectives.

Decarbonisation is a relatively new area for institutional investors and one that will continue to develop and evolve. We maintain an active research agenda on these topics with the goal of continuously fine-tuning our knowledge base and evolving our approach. Specific opportunities for further research include incorporating a broader criteria for resource efficiency starting with the introduction of water intensity metrics and fleet efficiency. On the ESG side, evaluating subcategory materiality for the criteria used in constructing industry specific ESG scores will be an exciting area for further developing our understanding of how ESG scores are related to financial performance[17]. As data quality improves and new concepts and challenges arise we believe that these strategies will need to evolve and adapt accordingly. Russell Investments is committed to being at the forefront of these developments and actively engaging the investment community in this area. While we have conviction that our Decarbonisation 2.0 approach has taken us further, we are cognisant that as data availability continues to evolve, we will undoubtedly be able to do better. This commitment to research and strategy evolution is at the heart of our approach to sustainable investing for the energy transition.

[15] “Portfolio Carbon. Measuring, disclosing and managing the carbon intensity of investments and investment portfolios.” UNEP Finance Initiative Investor Briefing. (2013).

[16] “The Portfolio Decarobnisation Coalition, Mobilising financial markets to catalyse economic decarbonisation”. UNEP Finance Initiative. (2014).

[17] Khan, Serafeim, and Yoon. “Corporate Sustainability: First Evidence on Materiality.” Harvard Business School Working Paper Number 15-073. March 2015.

About Russell Investments

Signatory of:

Russell Investments recognises the importance of environmental, social, and corporate governance (ESG) issues to our clients and is committed to continual capability enhancement in partnership with our clients and other industry organisations. As of 31 January 2017, Russell Investments manages $29.4B in systematic, rules-based investment strategies. Of that amount, $1.4B in assets are managed with ESG investment objectives and $421m specifically in low carbon mandates.

A UNPRI[18] Signatory since 2009, Russell Investments aims to integrate each of the UN-supported principles into our investment processes and decision-making.

As a member of the Institutional Investors Group on Climate Change, Russell Investments collaborates with investors to encourage public policies, investment practices, and corporate behaviour that address long-term risks and opportunities associated with climate change.

Russell Investments has also been a signatory of Carbon Disclosure Project (CDP) since 2010, which includes CDP Climate Change, CDP Forest, and CDP Water.

[18] United Nations backed Principles for Responsible Investing.

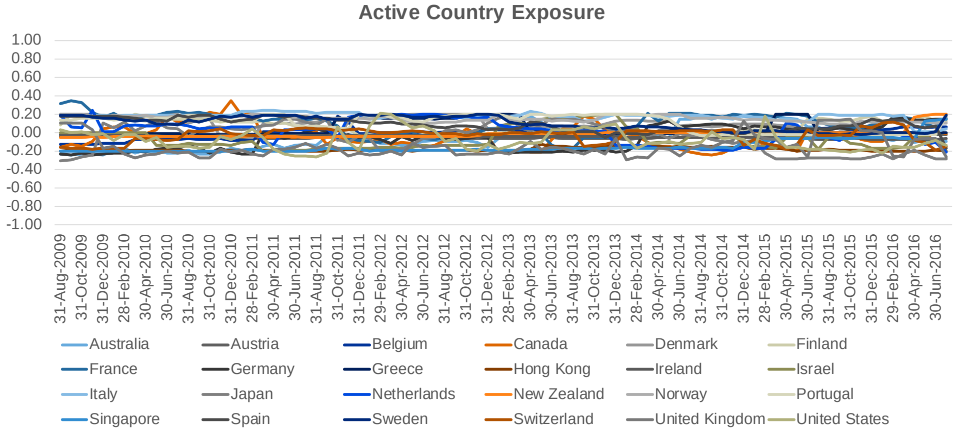
Appendix A: Active Risk

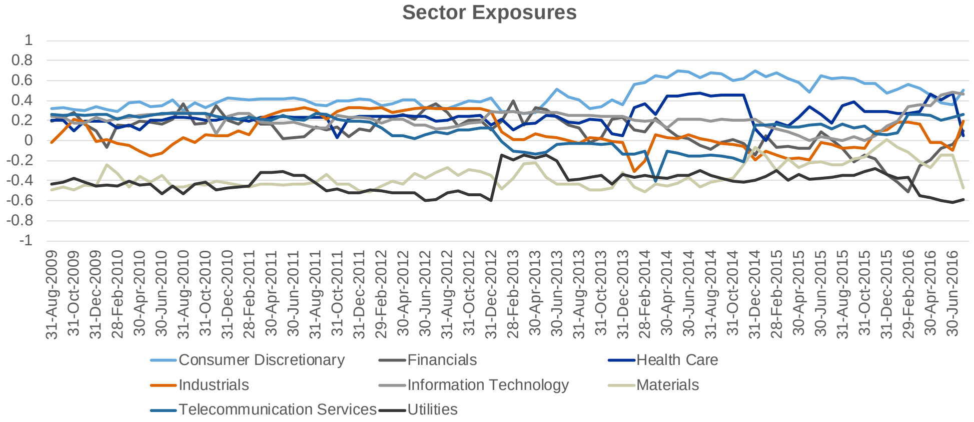
Tracking error is a measure that we utilise for monitoring the portfolio, but it is not explicitly targeted in the optimisation. There are a number of reasons why we do not target tracking error as our measure of active risk in the optimisation process.

- By incorporating a "minimise active risk" objective it would introduce an additional dimension to the portfolio which is the co-variance matrix of the risk model. So differences in individual security weights are driven not just by CO2 emissions but by their covariance also. This can result in two securities with the same CO2 emissions having opposing active positions (i.e. same carbon footprint but directionally different positions). For example, we often see risk model based optimisations with solutions that have large underweights across the energy sector (e.g. Shell, Total and Chevron etc.) and a single large offsetting position in one energy company (e.g. Exxon Mobil). These positions are driven primarily by the stocks' co-variance driven by their return and risk characteristics as opposed to their carbon footprints; we don't believe that a strategy that holds a large position in ExxonMobil (for example) is the desired intent of a decarbonisation strategy.
- The underlying risk models that provide the co-variance matrix and subsequent tracking error can be very unstable over time. This can lead to dramatic changes in the portfolio despite no changes in the underlying carbon footprint characteristic.
- As this strategy explicitly targets a low carbon footprint, to the degree that this factor is uncorrelated with other risk model factors, the risk model treats the reduction in aggregate carbon footprint as risk-free. This can result in the under-prediction of tracking error and is referred to as the alignment problem in Ceria, Saxena and Stubbs (2012).

We control tracking error (active risk) by ensuring that we have the highest possible commonality with the underlying benchmark (i.e. lowest possible active share). We further minimise the tracking error through conservative asset, sector, industry and country constraints. These pragmatic constraints ensure that the strategy delivers consistently low tracking error and that our forecasted tracking error is very close to the realised tracking error.

Appendix B: Country and Sector Exposures





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