DECARBONIZATION 2.0

A sustainable investing solution for the energy transition

Decarbonization 2.0

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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 have primarily focused on what we refer to as “standard decarbonization”: a reduction in exposure to carbon emissions and/or divestment from fossil fuel reserves within equity portfolios.

Our research has found that this standard decarbonization 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 decarbonization 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.

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.

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Overview

Launched in 2015, the objective of Russell Investments Decarbonization 1.0 strategy[1] is to reduce the carbon exposure of a universe by a specified percentage while minimizing 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 (UN PRI), the strategy was designed as a means for signatories to implement a preference for decarbonization across their listed equity portfolios while effectively managing risk at the stock, sector and country level.

In our original decarbonization strategy,[1] 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[1], and hence may become "stranded assets."

In Smith, Bennett & Velvadapu (2016), we compare several portfolio construction approaches to achieving these two standard decarbonization criteria and present a proprietary portfolio construction technique that avoids the common pitfalls of standard decarbonization. Currently, the two most common approaches to addressing the issues of portfolio decarbonization are naïve fossil fuel divestment, effectively divesting from any company that holds fossil fuel reserves, and standard decarbonization, or reducing the carbon footprint of a portfolio relative to benchmark.

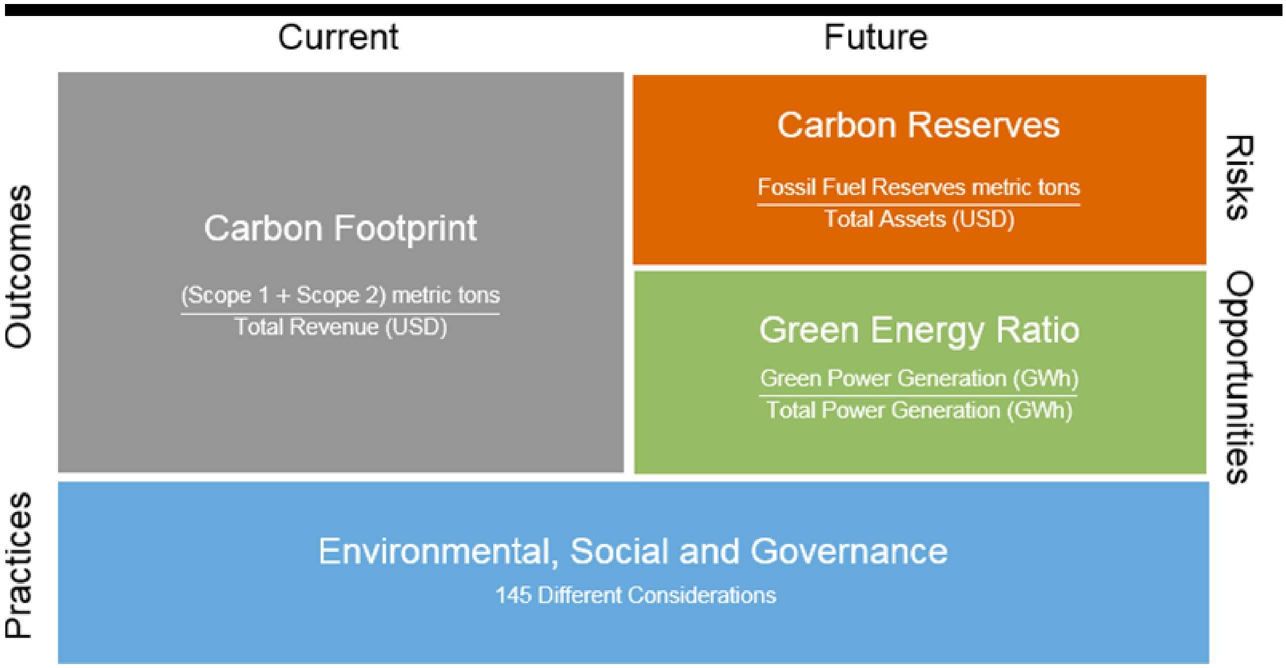
Building on our prior research, here we demonstrate that these common approaches to carbon emission and reserve reduction can lead to lower exposure to renewable energy and worse aggregate ESG profile as measured by ESG scores.

In this paper, we show that these signals can be incorporated and managed while maintaining the same risk-return neutrality of standard decarbonization. Specifically, our enhanced decarbonization 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[2,3] , 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[4] 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 summarize the interaction and dimensionality of these considerations across current and future threats and opportunities in Exhibit 1 below.

[1] Russell Investments Decarbonization Strategy: Investigating different approaches to reducing the carbon footprint (Velvadapu 2016)

Exhibit 1: Sustainability considerations



The Greenhouse Gas Protocol (GHG Protocol) is the most widely used international accounting tool to understand, quantify, and manage greenhouse gas emissions. The GHG Protocol defines Scope 1 as all direct GHG emissions and Scope 2 as indirect GHG emissions from consumption of purchased electricity, heat or steam.

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 summarize 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 are sourced from MSCI. The history we use for both is relatively limited with ESG scores and carbon footprint data available from 2009. 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.[5]

There are four primary inputs to our model: carbon footprint, carbon reserves, energy production and ESG scores. The rest of this section summarizes 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).[6]

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

Scope 3

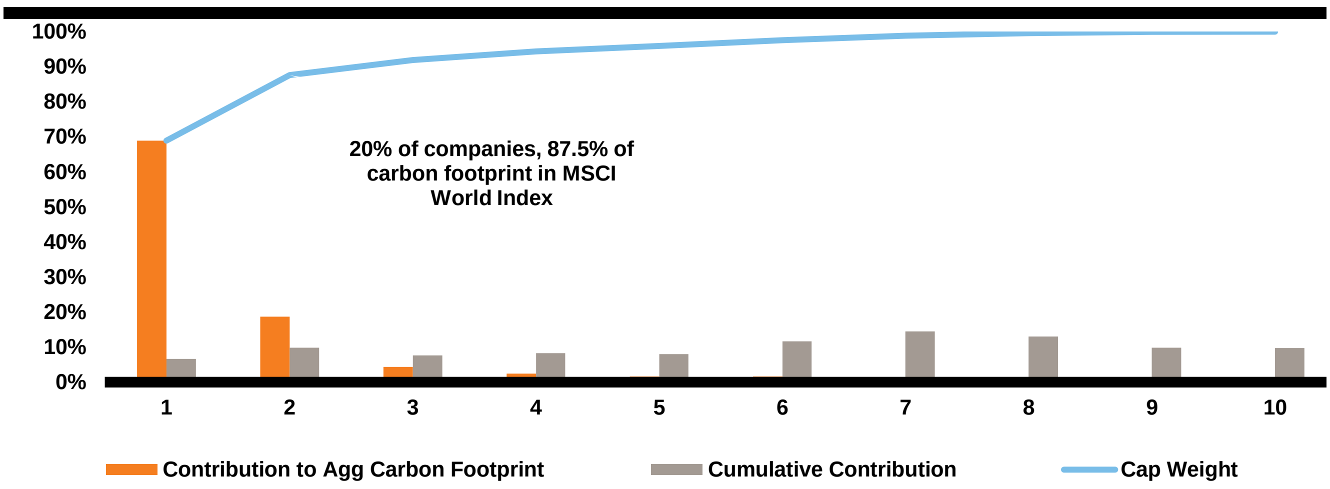
The complete carbon emissions of a company's value chain, referred to as Scope 3, is currently not included in our calculation. This is primarily due to our lower confidence in Scope 3 data availability and reliability due to lower levels of company reporting and higher levels of estimation. Scope 3 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. 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.

As highlighted in our original work on decarbonization, relative carbon footprint is highly skewed with a small 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 approximately 88% 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 exposures. 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 decarbonization: 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.

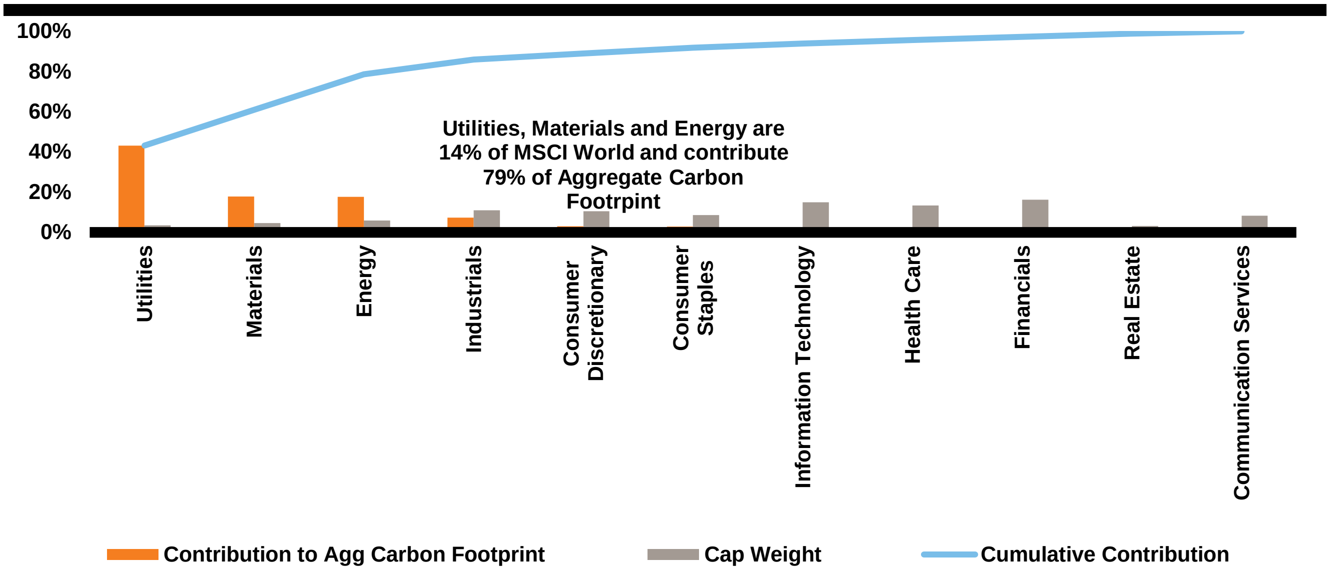
Exhibit 2: Aggregate carbon footprint by decile



Source: Russell Investments, MSCI as at Dec 31, 2018. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance. Indexes are unmanaged and cannot be invested in directly. Past performance is not indicative of future results.

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.

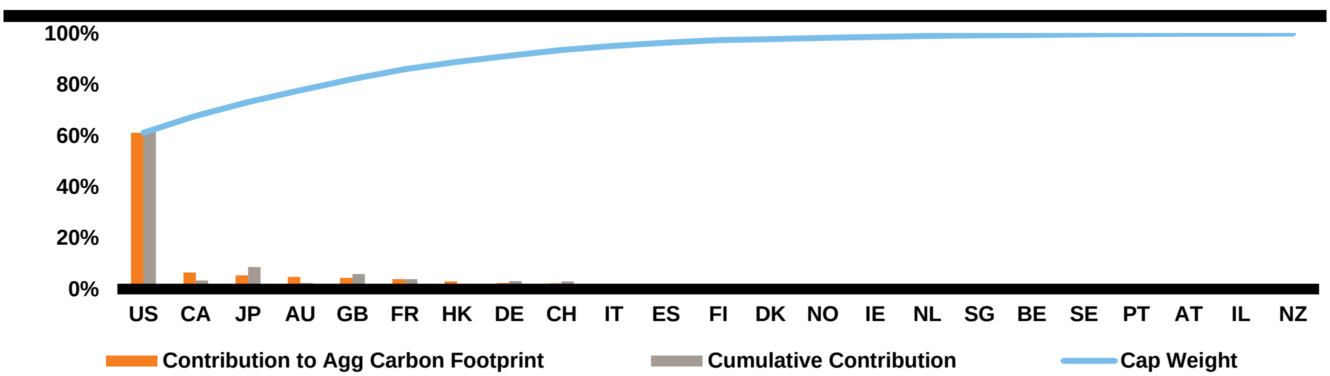
Exhibit 3: Aggregate carbon footprint by sector



Source: Russell Investments, MSCI as at Dec 31, 2018. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance.

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 capitalization weight in the portfolio. Exhibit 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, Canada, Japan, Australia and Great Britain. All of these will be potential candidates for underweighting in a decarbonization strategy that does not include country constraints.

Exhibit 4: Aggregate carbon footprint by country



Source: Russell Investments, MSCI as at Dec 31, 2018. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance.

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

Fossil fuel reserves

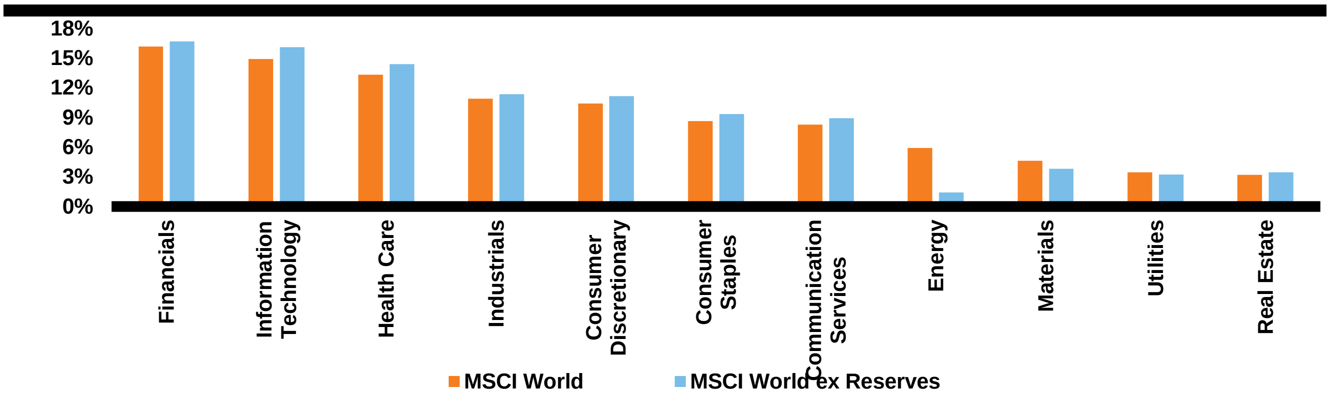
Carbon reserves are also sourced from MSCI. We refer to relative carbon reserves as the asset-relative fossil fuel reserves of a company. Specifically, it is defined as:

$$\text{Relative carbon reserves} = \frac{\text{Fossil fuel reserves (m tonnes)}}{\text{Total assets (USD)}}$$

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.

Exhibit 6 highlights the key implication of decarbonization strategies based solely on the naïve fossil fuel divestment approach: large sectoral positions. In these cases, decarbonization effectively acts as a sector bet against two sectors, energy and materials. If reserves are excluded from the portfolio, energy decreases from 5.9% of the portfolio to 1.4% and materials decreases from 4.6% to 3.8%, resulting in two large active exposures for the portfolio. These two large positions are illustrated in Exhibit 6.

Exhibit 6: Sector weights, before and after reserves exclusion



Source: Russell Investments, MSCI as at Dec 31, 2018. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance.

Renewable energy data

Following the Paris Climate Agreement, consensus has coalesced around a global warming target of less than 2 degrees Celsius. Achieving this proposal 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 decarbonization.

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:

$$\text{Green energy score} = \frac{\text{Green power generation (GWh)}}{\text{Total power generation (GWh)}}$$

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 optimization 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

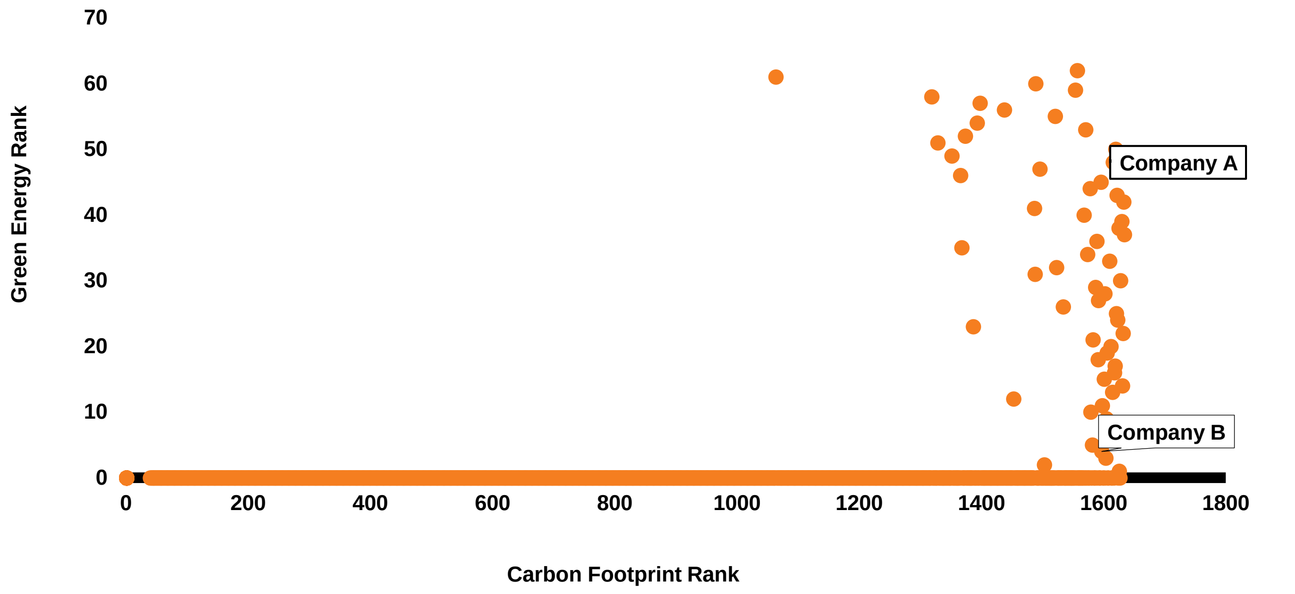
GREEN (GWH)	BROWN (GWH)	GREY (GWH)
Wind	Coal	Nuclear Power
Solar	Natural Gas	Landfill Gas
Biomass	LPG	Other Power
Geothermal	Petroleum	
Wave & Tidal	LNG Power	
Hydroelectric	Coal	

Source: Russell Investment. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance.
*GWh is a unit of electrical energy equal to one billion-watt hours, one thousand megawatt hours

It is interesting to note that decarbonizing a portfolio can, at the same time, reduce exposure to renewables if one does not consider unintended exposures. While this result may be initially unintuitive, it highlights a key point that companies currently involved in energy production are well-positioned and well-incentivized to invest in renewable energy programs and without further considerations, standard decarbonization has a tendency to underweight these companies. Our goal is to maintain the same aggregate reduction in standard carbon criteria[7] but use renewable energy as another consideration in evaluating which companies to underweight.

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

Exhibit 8: Relative carbon footprint rank vs green energy score rank



Source: Russell Investments, MSCI, Sustainalytics. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance.

First, we see that companies producing green energy tend to have large relative carbon footprints. This is consistent with the observation highlighted in Exhibit 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 decarbonization 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.

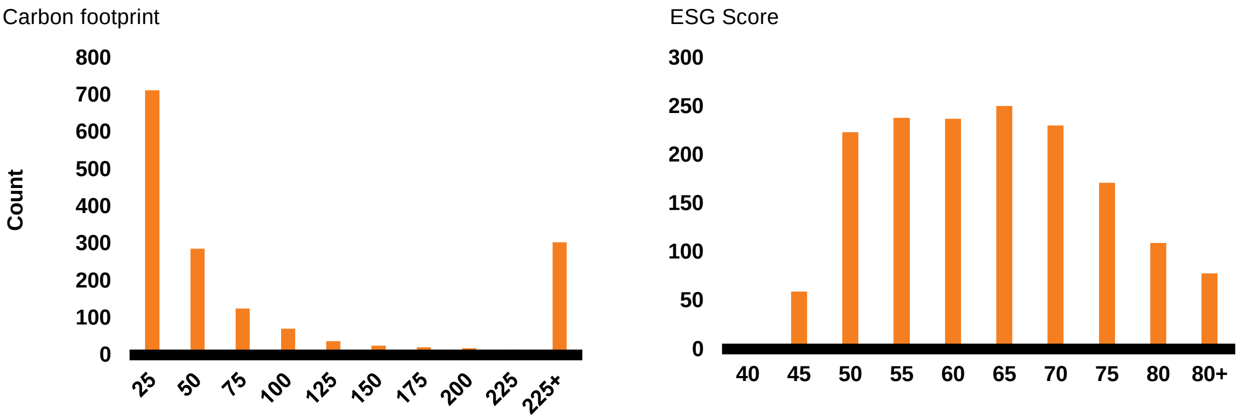
Third, this highlights why we believe the green energy score is important even though it applies to a small subset of the universe. The energy produced by companies with a green energy score theoretically represents the entire Scope 2 (electricity generation) emissions for the universe. So, while there 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, Exhibit 9 demonstrates that ESG scores approximate a bell-shaped distribution. Aggregated ESG scores are based on over 100 underlying characteristics which when summarized leads to an averaging effect in the aggregate score.

Exhibit 9: Comparing equal-weighted histograms of relative carbon footprint and ESG scores



Source: Russell Investments, MSCI, Sustainalytics. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance.

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 Exhibit 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.

Exhibit 10: Sector relative carbon footprint (CF) and ESG score ranks

	CF RANK	ESG RANK
Utilities	11	1
Energy	9	2
Materials	10	3
Consumer Staples	6	4
Real Estate	7	7
Industrials	8	8
Information Technology	4	6
Financials	1	5
Consumer Discretionary	5	9
Communication Services	2	10
Health Care	3	11

Source: Russell Investments. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance.

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 decarbonization 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, communication services 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

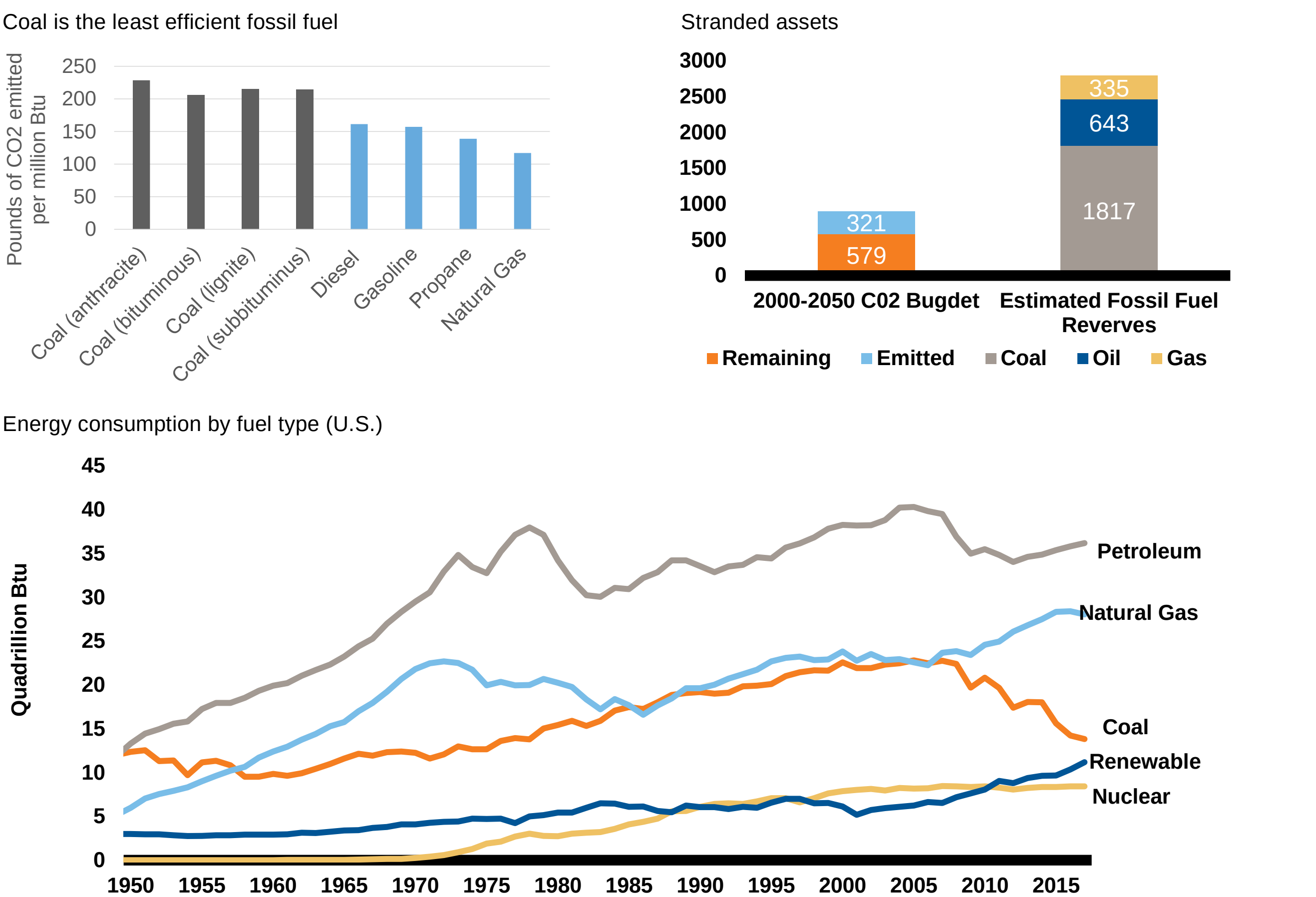
In addition to the criteria outlined above which are used to tilt the portfolio, our enhanced decarbonization strategy also includes a coal restriction. Exhibit 11 presents the foundation of the coal exclusion.

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 CO2 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.[8] 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 coal-related activities.

Exhibit 11: Coal and the energy transition



Source: Energy Information Administration from Annual Energy Outlook 2016. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance.

We use data supplied by Sustainalytics to identify:

- Companies with more than 10% of their revenue derived from mining thermal coal
- Companies with more than 10% of their power generation from coal

In addition to the above criteria, we also consider forward-looking information about a company's overall positioning for an energy transition. Specifically, companies who produce a significant share of their power generation from renewable sources may be exempt and companies who have made public commitments to divest from their coal-related activities and have made tangible progress towards that goal may also be exempt.

Methodology

The strategy we have developed builds directly on insights gained from our previous research on decarbonization strategies and existing client mandates. Specifically, we have previously argued and continue to maintain that an active share minimization approach is more relevant than the standard decarbonization alternatives[9] in that it allows us to meet multiple objectives while maintaining benchmark-like returns without introducing a risk model or variance matrix.

For decarbonization 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 maximizing the commonality (minimizing active share) of the strategy.[10]

The portfolio construction process begins with the parent benchmark or underlying strategy as the starting universe for our optimization process. The optimization 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	Minimize	This parameter enables us to only take on active share when it is necessary and to ensure that active risk remains low.
Transaction costs	Minimize	We use simple cost model where all costs are assumed to be 50 bps of traded value. This penalizes the optimizer from inducing unnecessary turnover.
Ticket charges	Minimize	This allows us to minimize the number of trades made at each rebalance.

Our optimization 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 utilize broader risk constraints and for broader and more diversified universes, we will utilize narrower constraints. The following two tables summarize 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%	

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 decarbonization 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 Decarbonization 2.0 signals

	CARBON FOOTPRINT	RESERVES	ESG SCORE	GREEN ENERGY RATIO
Rel. Carbon Footprint	1.00	0.29	-0.08	-0.31
Reserves		1.00	-0.09	-0.05
ESG Score			1.00	0.10
Green Energy Ratio				1.00

Source: Russell Investments, MSCI, Sustainalytics. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance.

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, favorable 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 decarbonization strategies we consider, highlighting that not explicitly considering these criteria can lead to potentially unfavorable 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 summarized in the table below.

Objectives vs results: Aug 2009 – Dec 2018

FACTOR	OBJECTIVE	RESULTS VS MSCI WORLD
Carbon emissions	50% reduction	Average carbon footprint reduction of 57%
Carbon reserves	50% reduction	Average carbon reserves reduction of 54%
Active risk	Less than 1%	Annualized tracking error over the period was 0.42%
Coal related exclusions	Zero holding of companies with significant involvement in coal	No holdings of excluded stocks
Energy transition	Positive exposure	Green energy power generation is 65% higher than MSCI World
ESG	Greater than benchmark	Average ESG score 64 (vs 63 for MSCI World)

Source: Russell Investments. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance.

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 Exhibit 12. During the period Sept 2009 – Dec 2018, the annualized return was higher than the benchmark, likely due to the small underweight to the energy sector, which underperformed during this period. Despite the outperformance observed during this period, we do not hold a return expectation or target for this strategy.

Exhibit 12: Return summary

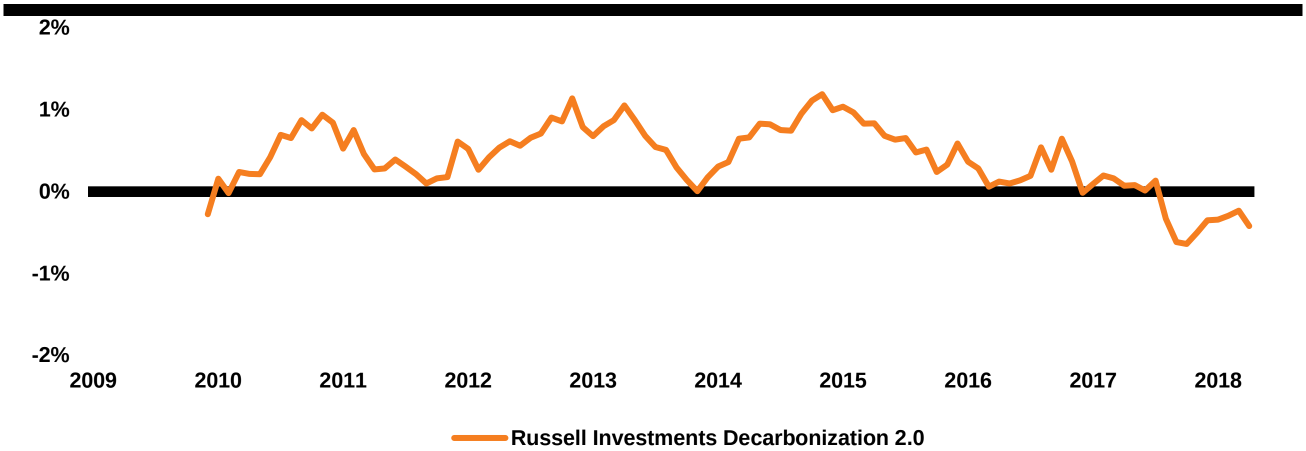
30 SEPT 09 - 31 DEC 2018	RUSSELL INVESTMENTS DECARBONIZATION 2.0	MSCI WORLD INDEX
Annualized return	9.25%	8.90%
Annualized volatility	12.93%	12.90%
Sharpe ratio	0.74	0.72
Semi-deviation	9.53%	9.51%
Sortino ratio	0.98	0.95
Maximum drawdown	-19.34%	-19.37%
Historical beta	1.00	1.00
Excess return	0.35%	
Excess return (arithmetic average)	0.32%	
Tracking error	0.42%	
T-stat	2.37	
Information ratio	0.77	
Active semi-deviation	0.29%	
Active sorting ratio	1.11	
Maximum active drawdown	-0.48%	
P (Active Return <0)	42.9%	

Source: Russell Investments. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance.

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.

Exhibit 13: Rolling one-year active return of Decarbonization 2.0 Strategy vs MSCI World Index

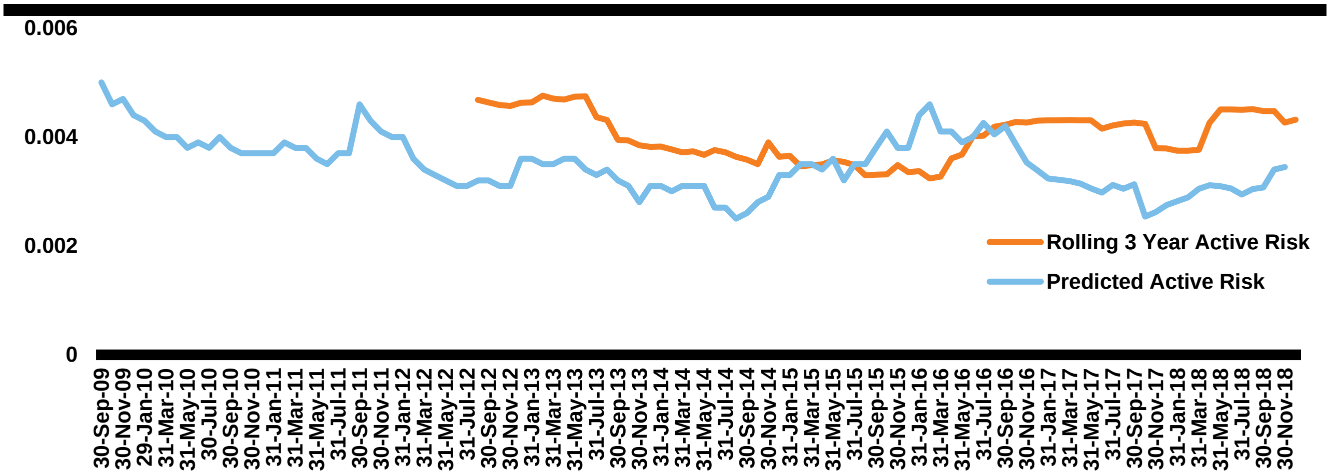


Source: Russell Investments, MSCI as at 31, December 2018. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance. Indexes are unmanaged and cannot be invested in directly. Past performance is not indicative of future results.

Active risk

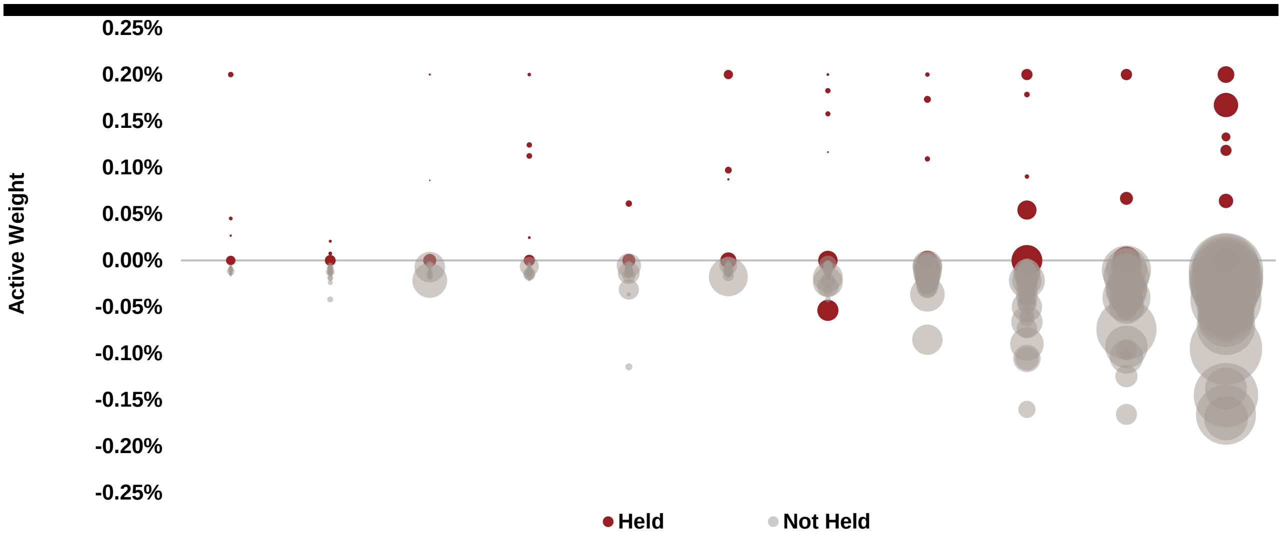
Unlike other optimized decarbonization solutions, our strategy explicitly minimizes active share rather than tracking error. As Exhibit 14 below highlights, an implication of this approach is that realized tracking error does not systematically overshoot predicted tracking error and we can see that the active share targeting is successful in keeping tracking error within the range of a tracking error optimization even though it is not explicitly targeted.

Exhibit 14: Active Risk: Predicted vs three-year rolling realized



Source: Russell Investments, MSCI, Axioma, as at 31, December 2018. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance.

Exhibit 15: Stock level positioning across sectors



Source: Russell Investments, Axioma, Trucost, as at 31, December 2018. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance.

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 need to have a meaningful impact on carbon reduction. In fact, the strategy specifically targets and prioritizes 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 Exhibit 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 represents the relative carbon footprint of each individual stock, with larger bubbles having relatively higher carbon footprints.

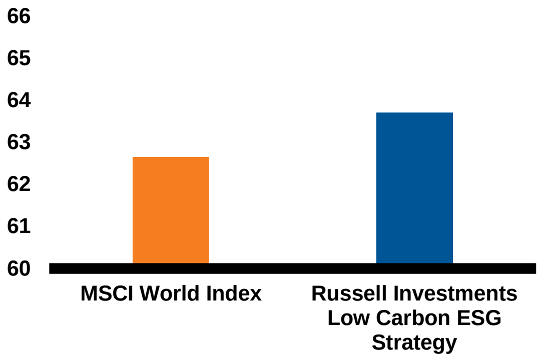
In Exhibit 15 we can clearly see that the strategy is more active across the high carbon footprint EMU sectors and less active in the lower carbon footprint sectors.

Sustainability results summary

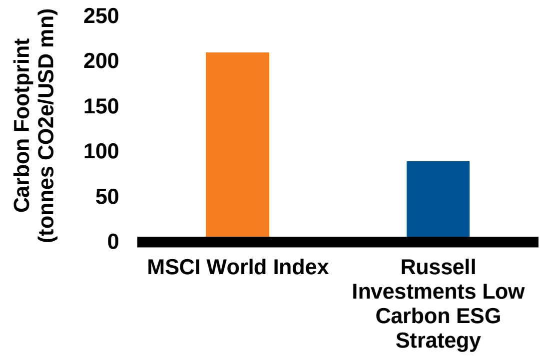
In addition to meeting risk and return objectives, the strategy is also successful in consistently improving the aggregate ESG score, carbon footprint, reserves and green energy exposure to the targeted levels. Below we report the average ESG outcomes of the low carbon ESG strategy relative to benchmark through the testing period.

Exhibit 16: Carbon and ESG outcomes

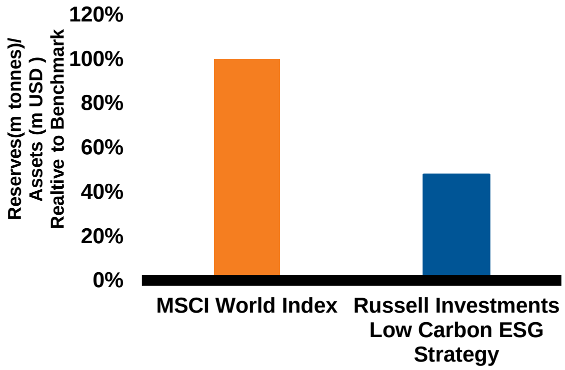
ESG Score



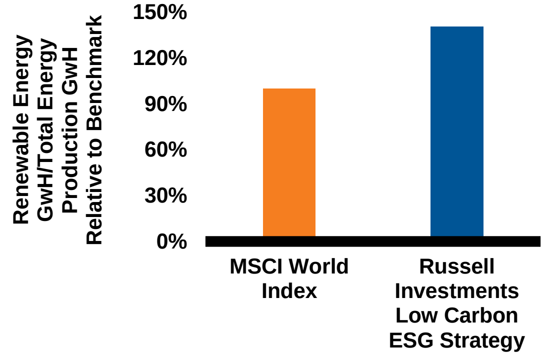
Carbon footprint



Fossil fuel reserves



Green energy ratio



Source: Russell Investments, MSCI, Sustainalytics, average over testing period Aug 2009 – Dec 2018. Simulated past performance data is presented for illustrative purposes only and is not necessarily a guide to future performance. Indexes are unmanaged and cannot be invested in directly. Past performance is not indicative of future results.

Conclusion

As outlined in the Montreal Pledge and the Portfolio Decarbonization Coalition, the decarbonization initiative looks to “mobilize a critical mass of institutional investors committed to gradually decarbonizing their portfolios” in the ‘financial economy’ that will help facilitate and incentivize decarbonization of the ‘real economy’.[11][12] To this end, we argue that decarbonization 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.

Developing solutions to incorporate climate change into a portfolio 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 water intensity metrics. Since first releasing our research on decarbonization, we have expanded on the question of how to evaluate companies on the basis of ESG performance with the introduction of our new ESG metric: the material ESG score.

In our research piece,[13] we explain how we take an industry-specific lens when evaluating a company’s ESG performance. The relevance of ESG issues varies industry to industry, company by company. For example, fuel efficiency has a bigger impact on the bottom line of an airline than it does for an investment bank. So, rather than adopt a one-size-fits-all-approach, we have worked to develop an ESG scoring methodology that focuses on the issues that are material to a company and their profitability.

To generate our new score, we leverage ESG data from Sustainalytics combined with the industry-level materiality map developed by SASB. See our research paper Materiality Matters: Targeting the ESG issues that can impact performance – the material ESG score for more details about our ESG scoring approach.

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 Decarbonization 2.0 approach has taken us further, we are cognizant 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.

Appendix A: Active risk

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

By incorporating a "minimize active risk" objective it would introduce an additional dimension to the portfolio which is the co-variance matrix of the risk model. Thus, differences in individual security weights are driven not just by CO2 emissions but also by their covariance. 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 optimizations with solutions that have large underweights across the energy sector (e.g. Shell[2], 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 Exxon Mobil (for example) is the desired intent of a decarbonization 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 minimize 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 realized tracking error.

[1] Russell Investments Decarbonization Strategy: Investigating different approaches to reducing the carbon footprint, (Velvadapu 2016).
[2] "Analysis of the Impacts of Clean Power Plan", U.S. Department of Energy, Energy Information Administration, Independent Statistics & Analysis. (May 2015).
[3] United Nations, Paris Agreement, 21st Conference of the Parties, Paris. (Dec 2015).
[4] ESG information utilized is sourced from Sustainalytics.
[5] 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).
[6] 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.
[7] See "Portfolio Carbon. Measuring, disclosing and managing the carbon intensity of investments and investment portfolios. UNEP Finance Initiative - Investor Briefing. 2013".
[8] 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.
[9] "The Russell Investments Decarbonization Strategy: Investigating different approaches to reducing the carbon footprint of an equity portfolio without materially impacting performance", (Smith, Bennett, Velvadapu 2016).
[10] See Appendix A for a further discussion of active share or our earlier research for an analysis of its benefits relative to other decarbonization methodologies.
[11] "Portfolio Carbon. Measuring, disclosing and managing the carbon intensity of investments and investment portfolios." UNEP Finance Initiative Investor Briefing. (2013).
[12] "The Portfolio Decarbonization Coalition, Mobilizing financial markets to catalyze economic decarbonization". UNEP Finance Initiative. (2014).
[13] Bennett, S. & Steinbarth, E. (February 2018). Materiality Matters: Targeting the ESG issues that can impact performance – the material ESG score. Russell Investments Research.

[2] Any stock commentary is for illustrative purposes and is not a recommendation to purchase or sell any security.

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First used: March 2017. Revised: July 2019 CORPCA-00156 [EXP 07-2021]