Reducing Carbon Exposure in Australian Equities

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Market participants are ever more cognizant of the impacts of climate change on their investments and are seeking innovative ways to reduce the carbon footprint of their portfolios, while constraining active risk. One such approach proposed in this paper evaluates the adoption of the S&P Global Carbon Efficient Index Methodology by the broad-based S&P/ASX 300.

EXECUTIVE SUMMARY

- This paper investigates the narrow-selection-based, low-carbon portfolio construction approach and the broad-based S&P Global Carbon Efficient Index Methodology on the S&P/ASX 300, through the lens of portfolio performance and weighted average carbon intensity reduction.
- The narrow-selection-based, unconstrained low-carbon portfolio had a 92.7% reduction in carbon intensity with a high tracking error of 5.6%. The sector-neutral approach had a moderately lower tracking error of 3.8% but also a lowered carbon intensity reduction of 71.1%.
- Despite the pronounced carbon intensity reduction, the historical return of the narrow-based, low-carbon portfolios did not show strong evidence that companies with low carbon intensity were rewarded in their price performance, but the active risk was high.
- The S&P Global Carbon Efficient Index Methodology is a broad-based portfolio approach, with stock weights in the underlying index tilted toward companies with low carbon intensity within each industry group and aims to closely track performance of the underlying index.
- By applying this construction approach to the S&P/ASX 300, the carbon efficient portfolio mimicked the performance of the underlying index, with a tracking error of 80 bps over the back-tested period and an average carbon reduction of 24.5% versus the benchmark.
- As of the June 2020 rebalance, the hypothetical S&P/ASX 300 Carbon Efficient portfolio had a carbon reduction of 28% versus the S&P/ASX 300. The top three contributors to the reduction were Energy, Utilities, and Materials.
- Australian companies in Consumer Durables & Apparels, Telecommunication Services, Consumer Services, Transportation, Capital Goods, and Materials tended to be more carbon efficient than their global industry group peers. The opposite was seen in Retailing, Media & Entertainment, and Insurance companies.

INTRODUCTION

Why Is Low-Carbon Investing Relevant to Australian Market Participants?

Following 2020, climate change has been highlighted as a stand-out, long-term risk that the world faces

Following 2020, a year in which floods, droughts, and fires ravaged Australia and the Amazon, climate change has been highlighted as a stand-out, long-term risk that the world faces.[1] To prevent temperature rise beyond 1.5°C, countries have to limit carbon emissions. This may result in low-carbon transition risks such as increasing regulation of carbon emissions through taxes, emissions trading schemes, and fossil fuel extraction fees. Mitigating risks from climate change may result in newer forms of risks and shocks for business and the generation of unpriced risks in financial markets. Therefore, companies are exploring more ways to manage carbon risks, as these risks would continue to worry more carbon-conscious investors.

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Financial markets have the potential to incentivize the development of a more sustainable and resilient economy. There is increasing desire to understand and measure environmental impact in portfolios and investments. Asset owners, such as the Government Pension Investment Fund (GPIF),[2] are promoting the integration of environmental factors in their investment principles. Australian asset owners and managers are under increasing pressure to reduce their portfolio carbon footprint. Australia's AUD 2.9 trillion superannuation industry may be compelled to tilt or reconstruct its benchmark portfolios to incorporate low-carbon investing principles.[3] Retail Employees Superannuation Trust, a fund for retail workers that manages about AUD 60 billion, was sued by one of its own members for not adequately assessing the impact of climate change on its holdings.[4] The 8,100 members of UniSuper, a Melbourne-based fund that manages AUD 85 billion, are looking to discontinue investments in firms that are expanding their fossil fuel output.

Financial markets have the potential to incentivize the development of a more sustainable and resilient economy.

These efforts from market participants, including asset owners and asset managers, to transition to low-carbon portfolios are nudging companies to alter their business approaches toward more sustainable outcomes. BHP Group has pledged to power two of its copper mines in Chile via renewable energy by the middle of the decade[5] and intends to exit thermal coal production[6]. Origin Energy has disclosed that it spent more than AUD 800 million in order to source more than one-quarter of its energy-generation

Australian asset owners and managers are under increasing pressure to reduce their portfolio carbon footprint.

1   The Global Risks Report 2020: 15th Edition. *World Economic Forum*.

2   ESG Report 2019. GPIF.

3   Bloomberg. "Wildfires forcing Australian funds to be more green." *Pensions&Investments*. February 2020.

4   Fowler, Elouise. "Rest Super agrees to align portfolio to climate goals." *Financial Review*. November 2020.

5   Cox, Lisa. "BHP plans to replace coal with renewables at two huge copper mines in Chile." *The Guardian*. October 2019.

6   Hume, Neil. "BHP responds to investor pressure with thermal coal exit." Financial Times. August 2020.

To match precise investment goals, various low-carbon portfolio solutions are available.

mix from renewable energy in 2021. AGL, Australia's largest owner of coal-fired electricity assets, has created an up to AUD 3 billion fund to unlock investment in large-scale renewable energy in partnership with Queensland Investment Corp. on behalf of its clients, including Australia's Future Fund.[3]

To match precise investment goals, various low-carbon portfolio construction approaches are available. Stock selection and weighting methods can be based on carbon intensity, fossil fuel exposure,[7] future carbon price risk,[8] carbon transition risk,[9] etc. Using carbon intensity data from S&P Global Trucost,[10] we compared and analyzed narrow- and broad-based low-carbon portfolios for Australia.

EXISTING S&P DOW JONES INDICES LOW-CARBON INDICES IN AUSTRALIA

Stock selection and weighting methods can be based on carbon intensity, fossil fuel exposure, future carbon price risk, carbon transition risk, among others.

S&P Dow Jones Indices offers a suite of low-carbon indexing solutions in Australia.

S&P/ASX All Australian 50 Carbon Efficient Index: The S&P/ASX All Australian 50 Carbon Efficient Index[11] is designed to measure the performance of companies in its underlying index, while overweighting companies with lower levels of carbon emissions and underweighting companies with higher levels of carbon emissions. Constituent weights are adjusted to reflect each company's carbon footprint compared with other companies in the same Global Industry Classification Standard (GICS®) sector.

S&P DJI offers a suite of low-carbon indexing solutions in Australia.

S&P/ASX All Australian 50 Fossil Fuel Free Carbon Efficient Index: The S&P/ASX All Australian 50 Fossil Fuel Free Carbon Efficient Index[12] is designed to measure the performance of companies in its underlying index that do not own fossil fuel reserves, while overweighting or underweighting companies based on their levels of carbon emissions. Fossil fuel reserves are defined as economically and technically recoverable sources of crude oil, natural gas, and thermal coal.

Both carbon-efficient index series slightly outperformed the underlying index (the S&P/ASX All Australian 50) on an annualized return and risk-adjusted return basis (see Exhibit 7 in Appendix). The S&P/ASX All 50 Carbon-Efficient Index observed a relatively modest tracking error of 1.2%.

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[7] S&P/ASX All Australian 50 Fossil Fuel Free Index

[8] S&P/ASX 200 Carbon Price Risk 2030 Adjusted Index

[9] S&P Paris-Aligned & Climate Transition (PACT) Indices

[10] S&P Global Trucost's carbon intensity is defined as the GHG emissions from a company's direct operations and first-tier suppliers, measured in metric tons of carbon dioxide equivalent (tCO_2e) per USD 1 million of revenue (tCO_2e/USD 1 million). For S&P Global Trucost's carbon intensity data coverage and treatment on stocks without the data, please see Exhibit 9 in the Appendix.

[11] For more information on the construction and maintenance of these indices, please see the S&P/ASX Carbon Efficient and Fossil Fuel Free Indices Methodology.

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Both the standard and fossil fuel free carbon-efficient indices slightly outperformed the benchmark S&P/ASX All Australian 50 on an annualized return basis.

The fossil-fuel-free version of the index, which eliminates companies that do not own fossil fuel reserves, had a relatively higher tracking error. Compared with the S&P/ASX All Australian 50, the S&P/ASX All Australian 50 Carbon Efficient Index reduced the weighted average carbon intensity score by almost 33%, whereas the S&P/ASX All Australian 50 Fossil Fuel Free Carbon Efficient Index did so by 68.3%.

NARROW-BASED, LOW-CARBON PORTFOLIO WITH STOCK SELECTION BASED ON COMPANY CARBON INTENSITY

Data & Methodology

To understand the characteristics of a narrow-based, low-carbon portfolio in Australia, we constructed top and bottom tertile portfolios (one-third by stock count) based on the carbon intensity of the constituents of the S&P/ASX 300. These low- and high-carbon portfolios were constructed using sector-unconstrained and sector-neutral selection approaches.

We used sector-unconstrained and -neutral selection approaches to construct low- and high-carbon portfolios with the S&P/ASX 300 as the underlying universe.

With the sector-unconstrained approach, we ranked all companies in the S&P/ASX 300 universe by their carbon intensity. The tertiles of stocks with the lowest and highest carbon intensity formed the unconstrained low-carbon and high-carbon portfolios, respectively. In the sector-neutral approach, we ranked companies in the base universe[12] within each sector by their carbon intensity. The tertile of stocks with the lowest and highest carbon intensity from each sector constituted the sector-neutral, low-carbon and high-carbon portfolios, respectively.

The four hypothetical portfolios and the base universe were equally weighted, with annual rebalancing after the close of the third Friday of March.[13] Reference data such as carbon intensity, float market cap, and carbon emissions were sourced as of the third Friday of February.

Comparing Carbon Intensity Reduction and Performance Characteristics of the Unconstrained and Sector-Neutral Low-Carbon Portfolios

The unconstrained portfolio construction approach does not necessitate equitable selection from every sector but rather aims to select constituents to achieve the objective.

The unconstrained portfolio construction approach does not necessitate equitable selection from every sector but rather aims to select constituents to achieve the objective (i.e., to lower the portfolio's weighted average carbon intensity score from that of the underlying universe). On the other hand, the sector-neutral approach aims to achieve the same objective but selects constituents independently in each sector, thus mandating similar representation (by weight) in the low-carbon portfolio as in the equal-

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[12] At each rebalance date, the base universe was constructed using the constituents of the S&P/ASX 300 as of the reference date. Companies that did not have carbon intensity data or were dropped from the underlying on the effective date were excluded. Please refer to Exhibit 8 to see the coverage of the base universe.

[13] The 2020 rebalance was conducted in the month of June.

On the other hand, the sector-neutral approach aims to achieve the same objective but mandates similar sector representation as in the underlying universe.

The Financials and Communication Services sectors had narrow carbon intensity ranges, while Utilities and Materials had wider spreads, thus a higher potential for carbon reduction.

weighted underlying universe. The sector-neutral approach may thus benefit by reducing the risk of active sector allocations but may also result in less of a weighted carbon intensity reduction.

The range of carbon intensities[14] within a sector was narrow for a few sectors and wide for others (see Exhibit 1). As of June 19, 2020, sectors such as Financials and Communication Services had narrow carbon intensity ranges (24.5 and 77.2 tCO_2e/USD million revenue, respectively), while Utilities and Materials had wider spreads of 4,669 and 4,043 tCO_2e/USD million revenue, respectively. The wider the spread, the higher the potential for carbon reduction in the sector-neutral approach.

Exhibit 1 illustrates the nuances and contrasts in the construction of a sector-unconstrained versus sector-neutral selection process for the portfolio as of June 19, 2020. The top chart shows the unconstrained selection of the low- and high-carbon portfolios, while the bottom chart illustrates sector-neutral low- and high-carbon portfolio construction. The vertical axes of the charts represent carbon intensity, and the horizontal axes represent the 11 GICS sectors. The grey bars represent the carbon intensity of each constituent within each sector. The green and red bars represent the threshold carbon intensity value for the cutoff stock for the low-carbon and high-carbon portfolios, respectively. The dashed green and red lines represent the weighted average carbon intensity of the low- and high-carbon portfolios, respectively.

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[14] The carbon intensity range within a sector is calculated as the difference in the maximum and minimum carbon intensity of S&P/ASX 300 constituents within a sector.

The unconstrained, low-carbon portfolio prioritized stock selection from low-carbon sectors such as Financials and Information Technology…

The sector-unconstrained, low-carbon portfolio has historically prioritized stock selection from low-carbon sectors such as Financials and Information Technology, whereas the sector-unconstrained, high-carbon portfolio selected a higher number of stocks from the Materials and Energy sectors (see top chart in Exhibit 1). The sector-neutral, low-carbon approach ensures equal sector representation (by dividing each sector into top and bottom tertiles), thus reducing sector biases with respect to an equal-weighted base universe (see bottom chart in Exhibit 1). The sector-unconstrained approach offered a lower weighted average carbon intensity (19.1) than the sector-neutral approach (92.9).

…and offered a much lower weighted average carbon intensity (19.1) than its sector-neutral counterpart (92.9).

The sector-unconstrained, low-carbon portfolio weights tilted toward low-carbon sectors such as Financials but away from high-carbon sectors such as Materials and Energy. This resulted in high carbon intensity reduction for the unconstrained low-carbon portfolio, though with a larger sector bias compared with the base universe (see Exhibit 9 in the Appendix). During the back-tested period, on average, the unconstrained low-carbon portfolio had a carbon intensity of 27 tCO_2e/USD million revenue, which was a 92.7% reduction from the base universe, with a carbon intensity of 369.7 tCO_2e/USD million revenue.

The sector-neutral, low-carbon portfolio had an average carbon intensity reduction of 71.1%, which is still lower than unconstrained, low-carbon portfolio reduction of 92.7%.

The high-carbon portfolio tilted weights toward the Materials and Energy sectors, which amounted to a higher portfolio average carbon intensity of 965.9 tCO_2e/USD million revenue, a 161.3% increase over the base universe. Over the back-tested period, the sector-neutral, low-carbon portfolio had an average carbon intensity of 106.2 tCO_2e/USD million revenue and an average reduction of 71.1% compared with the base universe, which, though pronounced, is lower than the reduction for the sector-unconstrained approach. The high-carbon portfolio had a higher portfolio average carbon intensity of 764.6 tCO_2e/USD million revenue, a 108.1% increase over the base universe.

Exhibit 1: Carbon Intensities of Companies in Low- And High-Carbon Portfolios Based on Sector Unconstrained versus Sector-Neutral Approaches
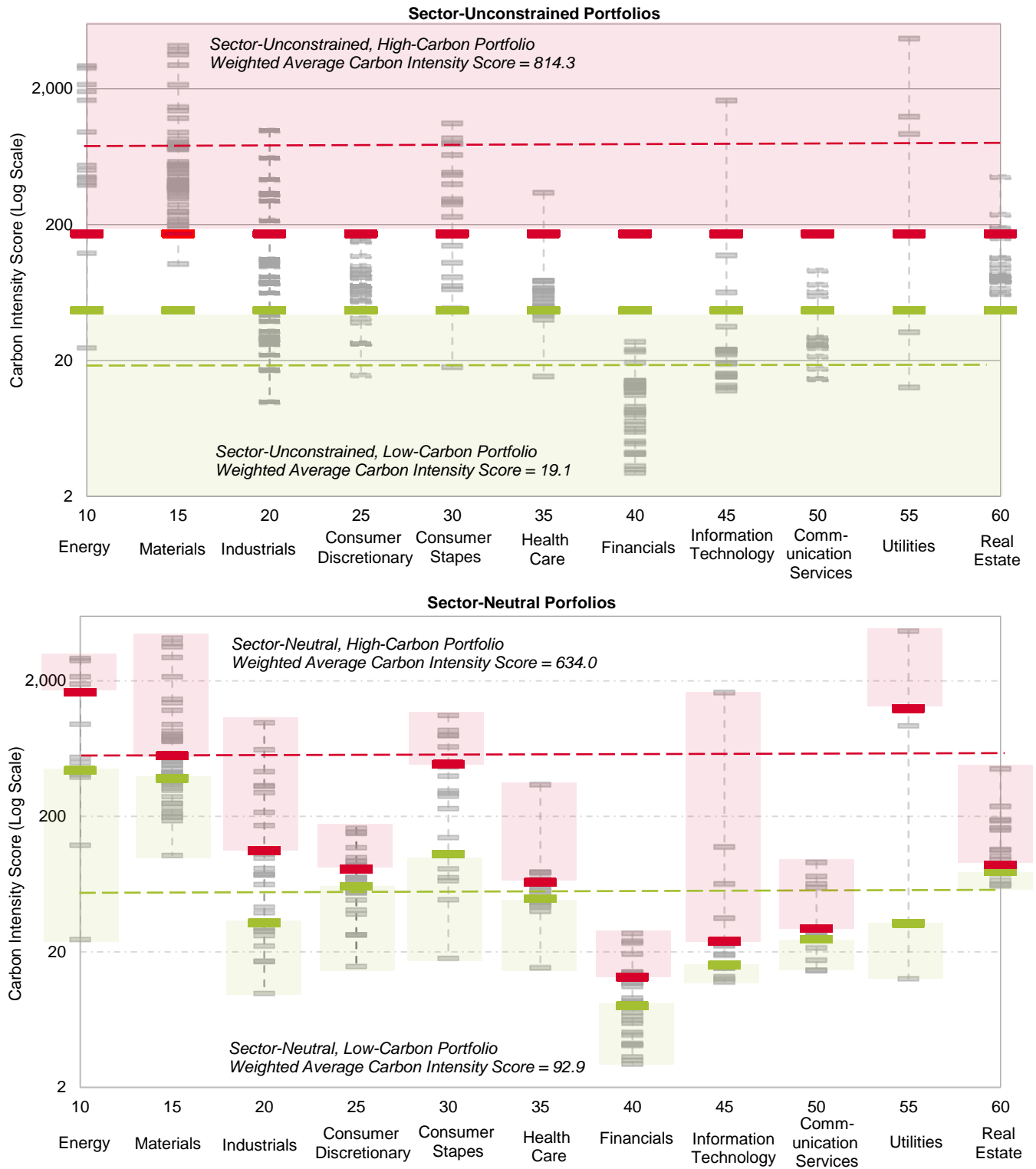
All portfolios shown are hypothetical equal-weighted portfolios.
Source: S&P Dow Jones Indices LLC, S&P Global Trucost ESG Analysis, and FactSet. Data as of June 19, 2020. The grey horizontal bars represent the carbon intensity of each constituent of the S&P/ASX 300. The green and red horizontal bars represent the upper and lower threshold carbon intensities in each sector for selection in the low- and high-carbon portfolios, respectively. The green and red shaded boxes represent the low- and high-carbon portfolios, respectively. Charts are provided for illustrative purposes.

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Using the unconstrained approach, the low-carbon portfolio (12.2%) outperformed the high-carbon portfolio (8.9%) and the underlying benchmark (11.5%)…

In addition to the differences in carbon intensity reductions, performance differences were observed between sector-unconstrained and sector-neutral approaches. Using the sector-unconstrained approach, the low-carbon portfolio had an annualized return of 12.2%, outperforming the high-carbon portfolio and the base universe (see Exhibit 2). The low-carbon portfolio also had much lower volatility and better risk-adjusted returns than the high-carbon portfolio.

…whereas the opposite was true for the sector-neutral approach.

In contrast, using the sector-neutral approach, the low-carbon portfolio had an annualized return of 10%, underperforming the high-carbon portfolio and the base universe, and similar volatilities were observed among the base universe and the high- and low-carbon portfolios. Based on these results, there seems to be no strong evidence that companies with low carbon intensity were rewarded in their price performance. The active risks of the sector-neutral low-carbon (3.8%) and high-carbon (4.0%) portfolios were much lower than those of their sector-unconstrained counterparts (5.6% and 8.0% for low- and high-carbon, respectively). In both approaches (sector-neutral and sector-unconstrained), the narrow-based portfolio had high tracking error, which may be outside the tolerance levels of active risk and may not sit well within the investment objectives for a number of asset owners.

Exhibit 2: Risk/Return Characteristics of Sector-Unconstrained and Sector-Neutral Low-Carbon and High-Carbon Portfolios (Equal Weighted)

CHARACTERISTIC	BASE UNIVERSE	SECTOR-UNCONSTRAINED		SECTOR-NEUTRAL	
		LOW-CARBON	HIGH-CARBON	LOW-CARBON	HIGH-CARBON
Annualized Return (%)	11.5	12.2	8.9	10.0	12.1
Annualized Volatility (%)	16.1	16.2	19.8	16.3	16.6
Risk-Adjusted Return	0.71	0.76	0.45	0.62	0.73
Annualized Excess Return (%)	-	0.72	-2.55	-1.45	0.65
Tracking Error (%)	-	5.6	8.0	3.8	4.0
Information Ratio	-	0.13	-0.32	-0.39	0.16
Beta	-	0.94	1.13	0.99	1.00
Weighted Average Carbon Intensity	367.5	26.8	959.3	106.2	764.6

The active risks of the sector-neutral, low-carbon (3.8%) and high-carbon (4.0%) portfolios were much lower than their unconstrained counterparts (5.6% and 8.0%, respectively).

All portfolios shown are hypothetical equal-weighted portfolios.
Source: S&P Dow Jones Indices LLC, S&P Global Trucost ESG Analysis, and FactSet. Data from March 20, 2009, to Dec. 31, 2020. Weighted average carbon intensity measured in tCO_2e/USD 1 million averaged over the back-tested period. Performance based on total return in AUD. Excess return, tracking error, and information ratio are calculated with respect to the base universe. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

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Narrow-based, low-carbon portfolios resulted in pronounced portfolio carbon intensity reduction, though with the cost of high active risk and uncertain trends in active returns.

The results from this analysis implied that narrow-based portfolios of stocks with low carbon intensity resulted in pronounced portfolio carbon intensity reduction, though with the cost of high active risk and uncertain trends in active returns. Institutional investors may want to incorporate low-carbon investing principles while reducing a portfolio's tracking error. The next section introduces the S&P Global Carbon Efficient Index Series framework, which aims to accomplish this objective.

BROAD-BASED, LOW-CARBON PORTFOLIOS WITH STOCK REWEIGHTING BASED ON COMPANIES' CARBON INTENSITIES

Data & Methodology

To examine broad-based, low-carbon portfolios, we applied the S&P Global Carbon Efficient Index Series Methodology, which has two objectives…

To examine how a broad-based, low-carbon portfolio construction approach would have performed in the Australian market, we applied the framework of the S&P Global Carbon Efficient Index Series to the S&P/ASX 300. We constructed the hypothetical S&P/ASX 300 Carbon Efficient portfolios annually from March 20, 2009, to Dec. 31, 2020, following the S&P Global Carbon Efficient Index Series Methodology.

The S&P Global Carbon Efficient Index Series was launched in 2018[15] and designed with two objectives: 1) to reduce exposure to high-carbon companies in a systematic way, and 2) to maintain a risk/return profile similar to their benchmarks. These two objectives are accomplished by tilting stock weights toward companies with lower carbon intensities within each GICS industry group while maintaining the respective industry group weight as represented in the underlying index. As of June 2020, the S&P Global LargeMidCap Carbon Efficient Index had a carbon intensity reduction of 36%, with a tracking error of only about 70 bps[16] versus the underlying index.

…to reduce exposure to high-carbon companies in a systematic way and to maintain a risk/return profile similar to the benchmark, the S&P/ASX 300.

In the S&P Global Carbon Efficient Index Series Methodology, the S&P Carbon Global Standard is developed to compare a company's carbon intensity versus its global peers within the same GICS industry group based on the S&P Global LargeMidCap universe. With this framework, all companies are sorted by their carbon intensities and assigned to carbon deciles within each GICS industry group. Companies with lower carbon intensities receive higher decile ranks and more favorable weight adjustment. In our analysis, the carbon intensity decile thresholds based on the S&P Carbon Global Standard were used to define decile ranks for companies in the S&P/ASX 300 at each portfolio rebalancing.

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[15] In 2018, Japan's GPIF selected two of the carbon efficient indices in this series— the S&P/JPX Carbon Efficient Index and S&P Global ex-Japan LargeMidCap Carbon Efficient Index—for its domestic and international ESG investment portfolios, respectively

[16] Source: S&P Dow Jones Indices LLC, Data from March 20, 2009, to June 30, 2020. Performance based on total return in AUD. Tracking error calculated with respect to the S&P Global LargeMidCap.

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In the framework, the S&P Carbon Global Standard is developed to compare a company's carbon intensity versus its global peers within the same GICS industry.

In addition, all industry groups are classified as high, mid, or low impact based on the range of their companies' carbon intensities,[17] with companies in high impact groups receiving higher weight adjustment factors. Lastly, the weight adjustment also favors companies that disclose their carbon emissions data. Company weight adjustment in the S&P Global Carbon Efficient Index Series is summarized in Exhibit 3.

Exhibit 3: Weight Adjustment Factor by Company Decile Classification, Disclosure Status, and Industry Group Impact Classification

DECILE CLASSIFICATION	DISCLOSURE STATUS	DECILE WEIGHT ADJUSTMENT (%)	CARBON WEIGHT ADJUSTMENT (%) BY INDUSTRY GROUP IMPACT FACTOR		
			LOW	MID	HIGH
			X0.5	X1	X3
1st Decile	Disclosure	40	20	40	120
	Non-Disclosure	30	15	30	90
2nd Decile	Disclosure	30	15	30	90
	Non-Disclosure	20	10	20	60
3rd Decile	Disclosure	20	10	20	60
	Non-Disclosure	10	5	10	30
4th-7th Decile	Disclosure	10	5	10	30
	Non-Disclosure	0	0	0	0
8th Decile	Disclosure	0	0	0	0
	Non-Disclosure	-10	-5	-10	-30
9th Decile	Disclosure	-10	-5	-10	-30
	Non-Disclosure	-20	-10	-20	-60
10th Decile	Disclosure	-20	-10	-20	-60
	Non-Disclosure	-30	15	-30	-90

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

Within each GICS industry group, all companies are sorted by their carbon intensities and assigned to carbon deciles…

Carbon Intensity Reduction and Performance Characteristics of the Broad-Based Carbon Efficient Portfolio

…where higher decile ranks are for lower-carbon companies and have a more favorable weight adjustment.

Averaged over the back-tested period, the S&P/ASX 300 Carbon Efficient portfolio had a carbon intensity of 257 tCO_2e/USD million revenue, a 24.5% reduction from the S&P/ASX 300, which had a carbon intensity of 340.5 tCO_2e/USD million revenue (see Exhibit 5). With no industry group weight or stock selection bias, the carbon reduction of this broad-based, low-carbon portfolio was significantly smaller than that of the narrow-based, low-carbon portfolios.

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[17] The range for each industry group is calculated as the top and bottom carbon intensity decile threshold difference for companies within the respective industry group based on the S&P Global LargeMidCap universe. High impact: range > 500 tCO_2e/USD million revenue; low impact: range < 150 tCO_2e/USD million revenue; and mid impact = all remaining industry groups.

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Exhibit 4: Carbon Intensity Reduction by Industry Group for the S&P/ASX 300 Carbon Efficient Portfolio

INDUSTRY GROUP	INDUSTRY GROUP WEIGHT (%)		WEIGHTED AVERAGE CARBON INTENSITY (TCO$_2$E/USD MILLION)		CARBON INTENSITY REDUCTION (%)	CONTRIBUTION TO CARBON INTENSITY REDUCTION (%)
	BENCHMARK	CARBON EFFICIENT	BENCHMARK	CARBON EFFICIENT		
Energy	4.1	4.1	1,434.7	726.4	-49.4	33.7
Utilities	2.1	2.1	2,146.3	1,013.2	-52.8	27.9
Materials	19.7	19.5	725.7	604.0	-16.8	27.6
Food, Beverage & Tobacco	2.2	2.3	506.0	323.4	-36.1	4.8
Transportation	4.9	4.8	201.2	172.0	-14.5	1.7
Software & Services	3.3	3.3	152.5	118.9	-22.0	1.2
Commercial & Professional Services	2.1	2.1	120.9	89.6	-25.9	0.8
Real Estate	7.0	6.8	129.4	120.7	-6.7	0.7
Health Care Equipment & Services	4.2	4.1	71.2	57.7	-18.9	0.7
Capital Goods	0.7	0.7	132.4	91.8	-30.7	0.3
Retailing	3.8	3.7	94.8	88.4	-6.8	0.3
Food & Staples Retailing	3.3	4.4	79.0	75.9	-3.9	0.1
Consumer Services	2.7	2.6	49.7	47.3	-4.8	0.1
Diversified Financials	5.1	5.1	12.7	11.6	-8.7	0.1
Banks	17.4	17.1	11.8	11.5	-2.2	0.1
Telecommunication Services	3.0	3.0	64.9	63.9	-1.4	0.0
Media & Entertainment	1.3	1.3	33.0	31.3	-5.1	0.0
Household & Personal Products	0.1	0.1	120.1	115.1	-4.2	0.0
Insurance	3.3	3.2	6.0	5.9	-2.2	0.0
Pharmaceuticals, Biotechnology & Life Sciences	9.5	9.4	63.9	63.9	0.0	0.0
Automobiles & Components	0.1	0.1	160.0	160.0	0.0	0.0
Consumer Durables & Apparel	0.1	0.1	54.4	54.4	0.0	0.0
Technology Hardware & Equipment	0.1	0.1	79.8	79.8	0.0	0.0
Semiconductors & Semiconductor Equipment	0.0	0.0	-	-	-	0.0
Total	**100.0**	**100.0**	**308.50**	**222.21**	**-28.0**	**100.0**

The S&P/ASX 300 Carbon Efficient is a hypothetical portfolio.
Source: S&P Dow Jones Indices LLC and S&P Global Trucost ESG Analysis. Data as of June 30, 2020. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

As of June 2020, the S&P/ASX 300 Carbon Efficient had a 28.0% carbon intensity reduction versus the underlying index.

As of June 19, 2020, the S&P/ASX 300 Carbon Efficient portfolio had a 28.0% carbon intensity reduction versus the underlying index (see Exhibit 4). The reweighting of companies resulted in carbon reductions in the majority of industry groups, with Utilities, Energy, Food Beverage & Tobacco, and Capital Goods seeing the most significant reductions of over 30%, while there was no carbon reduction in Automobiles & Components, Consumer Durables & Apparel, or Technology Hardware & Equipment.[18] Energy, Utilities, and Materials were the biggest contributors to the overall carbon reduction for the S&P/ASX 300 Carbon Efficient portfolio. Energy and Utilities contributed significant reductions to the portfolio due to the massive carbon reductions of those industry groups, despite their small industry group weights. In contrast, the carbon reduction of Materials was less pronounced, but it represented almost one-fifth of the overall index weight.

The S&P/ASX 300 Carbon Efficient mimicked the performance of the S&P/ASX 300 and had a tracking error as low as 0.8%.

The S&P/ASX 300 Carbon Efficient portfolio mimicked the performance of the S&P/ASX 300, with a tracking error as low as 0.8% and similar returns (see Exhibit 5). The return volatility of the S&P/ASX 300 Carbon Efficient portfolio was marginally higher than the S&P/ASX 300. Compared with the narrow-based, low-carbon portfolio, the broad-based, low-carbon portfolio achieved moderate carbon intensity reduction (about 25%), with deflated active risk and no active bets on industry groups. The carbon efficient framework may be well suited for institutional investors looking for a low-carbon strategy without taking on excess active risk and industry bets.

The volatility of the carbon efficient portfolio was marginally higher than the benchmark.

Exhibit 5: Risk/Return Characteristics of the S&P/ASX 300 Carbon Efficient Portfolio

CHARACTERISTIC	S&P/ASX 300	S&P/ASX 300 CARBON EFFICIENT PORTFOLIO
Annualized Return (%)	10.13	10.08
Annualized Volatility (%)	16.00	15.83
Risk-Adjusted Return	0.63	0.64
Annualized Excess Return (%)	-	-0.05
Tracking Error (%)	-	0.80
Information Ratio	-	-0.067
Weighted Average Carbon Intensity (tCO$_2$e/USD Million)	340.51	256.95

The S&P/ASX 300 Carbon Efficient portfolio is a hypothetical portfolio.
Source: S&P Dow Jones Indices LLC and S&P Global Trucost ESG Analysis. Data from March 20, 2009, to Dec. 31, 2020. Weighted average carbon intensity measured in tCO$_2$e/USD 1 million averaged over the back-tested period by normalizing weights for securities, for which carbon intensity is available. Performance based on total return in AUD. Excess return, tracking error, and information ratio are calculated with respect to the benchmark index. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

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[18] There is no representation from the Semiconductors & Semiconductor Equipment Industry Group in the S&P/ASX 300 as of the June 2020 rebalance.

The S&P/ASX 300 companies in Capital Goods, Transportation, and Consumer Services were the most carbon efficient industry groups…

Measuring the Carbon Efficiency of Australian Companies Relative to Their Global Peers within Each GICS Industry Group

Expanding the S&P Global Carbon Efficient Index Series framework to Australian equities also revealed how Australian companies fared against their global industry peers. Overall, 35.1%, 40.0%, and 24.9% of S&P/ASX 300 companies were ranked in the top (1st-3rd), middle (4th-7th), and bottom (8th-10th) deciles based on the S&P Carbon Global Standard as of June 19, 2020.

As seen in Exhibit 6, the S&P/ASX 300 companies[19] in Capital Goods, Transportation, and Consumer Services were the most carbon efficient compared with their global industry group peers, as more than half of the companies and index weights in these industry groups were in the top deciles. In the Materials and Telecommunication Services industry groups, more than 50% of the stocks ranked in the top deciles, but a majority of the industry group weights were in the middle deciles. In contrast, Australian companies in Retailing, Insurance, and Media & Entertainment were the least carbon efficient compared with their global industry group counterparts, as over 50% of stocks and index weight in these industry groups were in the bottom deciles.

…while Retailing, Insurance, and Media & Entertainment were the least carbon efficient industry groups.

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[19] Observation for industry groups with more than five stocks.

Exhibit 6: Carbon Decile Distribution of the S&P/ASX 300 Carbon Efficient Eligible Stock Universe by Industry Group

INDUSTRY GROUP	CLASSIFICATION BY INDUSTRY GROUP STOCK COUNT				CLASSIFICATION BY INDUSTRY GROUP WEIGHT			
	STOCK COUNT	PERCENT OF STOCKS IN DECILE GROUP			INDUSTRY GROUP WEIGHT	WEIGHT OF STOCKS IN DECILE GROUP (%)		
		TOP	MIDDLE	BOTTOM		TOP	MIDDLE	BOTTOM
Energy	16	25.0	37.5	37.5	4.1	65.8	7.6	26.6
Materials	55	52.7	38.2	9.1	19.5	31.5	66.6	1.8
Capital Goods	9	55.6	33.3	11.1	0.7	57.6	34.2	8.1
Commercial & Professional Services	11	27.3	27.3	45.5	2.1	10.9	72.8	16.4
Transportation	7	57.1	28.6	14.3	4.8	78.9	16.4	4.6
Automobiles & Components	2	0.0	100.0	0.0	0.1	0.0	100.0	0.0
Consumer Durables & Apparel	1	100.0	0.0	0.0	0.1	100.0	0.0	0.0
Consumer Services	15	73.3	26.7	0.0	2.6	83.3	16.7	0.0
Retailing	14	7.1	21.4	71.4	3.7	10.3	5.3	84.4
Food & Staples Retailing	3	33.3	33.3	33.3	4.4	7.1	27.3	65.6
Food, Beverage & Tobacco	15	20.0	40.0	40.0	2.3	37.1	42.2	20.7
Household & Personal Products	3	0.0	66.7	33.3	0.1	0.0	81.0	19.0
Health Care Equipment & Services	17	23.5	52.9	23.5	4.1	42.3	54.7	3.0
Pharmaceuticals & Biotechnology & Life Sciences	6	0.0	66.7	33.3	9.4	0.0	98.7	1.3
Banks	9	22.2	33.3	44.4	17.1	0.4	64.8	34.9
Diversified Financials	22	36.4	54.5	9.1	5.1	30.7	54.2	15.1
Insurance	7	14.3	28.6	57.1	3.2	17.9	29.4	52.7
Software & Services	18	27.8	61.1	11.1	3.3	29.1	60.6	10.3
Technology Hardware & Equipment	2	0.0	100.0	0.0	0.1	0.0	100.0	0.0
Semiconductors & Semiconductor Equipment	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Telecommunication Services	6	83.3	16.7	0.0	3.0	17.5	82.5	0.0
Media & Entertainment	10	20.0	20.0	60.0	1.3	15.7	37.2	47.1
Utilities	5	40.0	40.0	20.0	2.1	24.2	68.9	6.9
Real Estate	32	28.1	40.6	31.3	6.8	24.7	38.3	37.0
Overall	**285**	**35.1**	**40.0**	**24.9**	**100.0**	**24.9**	**54.2**	**20.9**

The S&P/ASX 300 Carbon Efficient portfolio is a hypothetical portfolio. Source: S&P Dow Jones Indices LLC and S&P Global Trucost ESG Analysis. Data as of June 30, 2020. Past performance is no guarantee of future results. Table is provided for illustrative purposes and prior to launch date, reflects hypothetical historical performance.

CONCLUSION

We compared narrow- and broad based, low-carbon portfolio construction options.

In this paper, we investigated narrow- and broad-based low-carbon portfolio construction choices that showcase the tradeoffs between tracking error and a portfolio's weighted carbon intensity reduction potential.

The narrow-based, sector-unconstrained, low-carbon construction approach reduced the weighted average carbon intensity by 92.7% (with a tracking error of 5.6%), whereas sector-neutral, low-carbon portfolio reduced the weighted average carbon intensity by 71.1% (with a tracking error of 3.8%). With the sector-unconstrained approach, the low-carbon portfolio outperformed both the high-carbon portfolio and the base universe. However, with the sector-neutral approach, the low-carbon portfolio underperformed the high-carbon portfolio and the base universe.

While the narrow-based sector-neutral and - unconstrained low-carbon portfolios provided significant weighted average carbon intensity reduction…

This implied that although narrow-based portfolios of stocks with low carbon intensity showed pronounced carbon intensity reduction, they also had a cost of high active risk and an uncertainty on active returns. This approach may not be the ideal one for institutional investors who want to integrate low-carbon investing into their core holdings.

…they also had high active risk and uncertain active returns.

The S&P Global Carbon Efficient Index Series Methodology aims to reduce exposure to high-carbon companies in a systematic manner while attempting to maintain performance characteristics similar to the underlying benchmark. As of the June 2020 rebalance, application of this methodology framework on the S&P/ASX 300 yielded a 28% carbon intensity reduction over the underlying index. The top three contributors to the portfolio carbon reduction were Energy (33.7%), Utilities (27.9%), and Materials (27.6%). Over the back-tested period, the S&P/ASX 300 Carbon Efficient portfolio mimicked performance of the S&P/ASX 300, with a tracking error as low as 0.8% and an average carbon intensity reduction of over 25%.

Companies in Telecommunication Services, Consumer Services, Transportation, Capital Goods, and Materials tended to be more carbon efficient than their global industry group peers. In contrast, Australian companies in Retailing, Insurance, and Media & Entertainment were less carbon efficient than their global industry group counterparts.

The broad-based, low-carbon portfolio still reduced average carbon intensity and mimicked the performance of the benchmark, with a tracking error as low as 0.8%.

The S&P Global Carbon Efficient Index Series framework thus offers an innovative indexing solution that achieved its objective in reducing the carbon intensity of the portfolio while maintaining the performance characteristics of the underlying benchmark. This hypothetical approach may be well suited for institutional investors looking for a low-carbon strategy without taking on excess active risk and industry bets.

APPENDIX

Exhibit 7: Performance Characteristics of S&P/ASX Carbon Efficient Indices

CHARACTERISTIC	S&P/ASX ALL AUSTRALIAN 50	S&P/ASX ALL 50 CARBON EFFICIENT INDEX	S&P/ASX ALL 50 FOSSIL FUEL FREE CARBON EFFICIENT INDEX
Annualized Return (%)	9.8	10.5	10.7
Annualized Volatility (%)	15.6	15.6	15.4
Risk-Adjusted Return	0.63	0.67	0.70
Annualized Excess Return (%)	-	0.70	0.94
Tracking Error (%)	-	1.2	3.0
Information Ratio	-	0.57	0.31
Weighted Average Carbon Intensity (tCO$_2$e/USD 1 Million)	272.8	184.3	118.4

Source: S&P Dow Jones Indices LLC and S&P Global Trucost ESG Analysis. Data from Dec. 31, 2011, to Dec. 31, 2020. Performance based on total return in AUD. Excess return, tracking error, and information ratio are calculated with respect to the benchmark index. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Exhibit 8: Coverage of Base Universe with Respect to the S&P/ASX 300

EFFECTIVE DATE	BASE UNIVERSE	COVERAGE (%)	
		BY STOCK COUNT	BY FMC
March 20, 2009	202	67.3	96.9
March 19, 2010	200	66.4	95.8
March 18, 2011	231	77.0	94.8
March 16, 2012	228	76.3	96.8
March 15, 2013	223	74.3	97.2
March 21, 2014	228	75.7	97.7
March 20, 2015	275	91.7	98.8
March 18, 2016	277	92.3	99.5
March 17, 2017	268	89.0	99.1
March 16, 2018	280	93.3	99.2
March 15, 2019	276	92.0	99.0
June 19, 2020	279	93.0	98.0
Average	**247.3**	**82.4**	**97.7**

All portfolios shown are hypothetical.
Source: S&P Dow Jones Indices LLC, S&P Global Trucost ESG Analysis, and FactSet. Data from March 20, 2009, to June 19, 2020. Performance based on total return in AUD. Excess return, tracking error, and information ratio are calculated with respect to the S&P/ASX 300. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

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Exhibit 9: Active Sector Bets of Unconstrained Low- and High-Carbon Portfolios Compared with the Base Universe

SECTOR	LOW-CARBON (%)	HIGH-CARBON (%)
Financials	15.8	-15.4
Information Technology	6.8	-3.6
Consumer Discretionary	5.3	-13.6
Communication Services	4.3	-2.7
Industrials	1.2	-6.1
Health Care	1.4	-6.1
Utilities	-2.8	3.6
Consumer Staples	-4.0	2.3
Real Estate	-3.8	-1.9
Energy	-6.2	11.1
Materials	-18.2	32.3

All portfolios shown are hypothetical.
Source: S&P Dow Jones Indices LLC and S&P Global Trucost ESG Analysis. Data from March 20, 2009, to June 19, 2020. Active sector weights averaged across rebalances over the back-tested period with regard to the base universe. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Exhibit 10: Cumulative Performance of the S&P/ASX 300 and S&P/ASX 300 Carbon Efficient
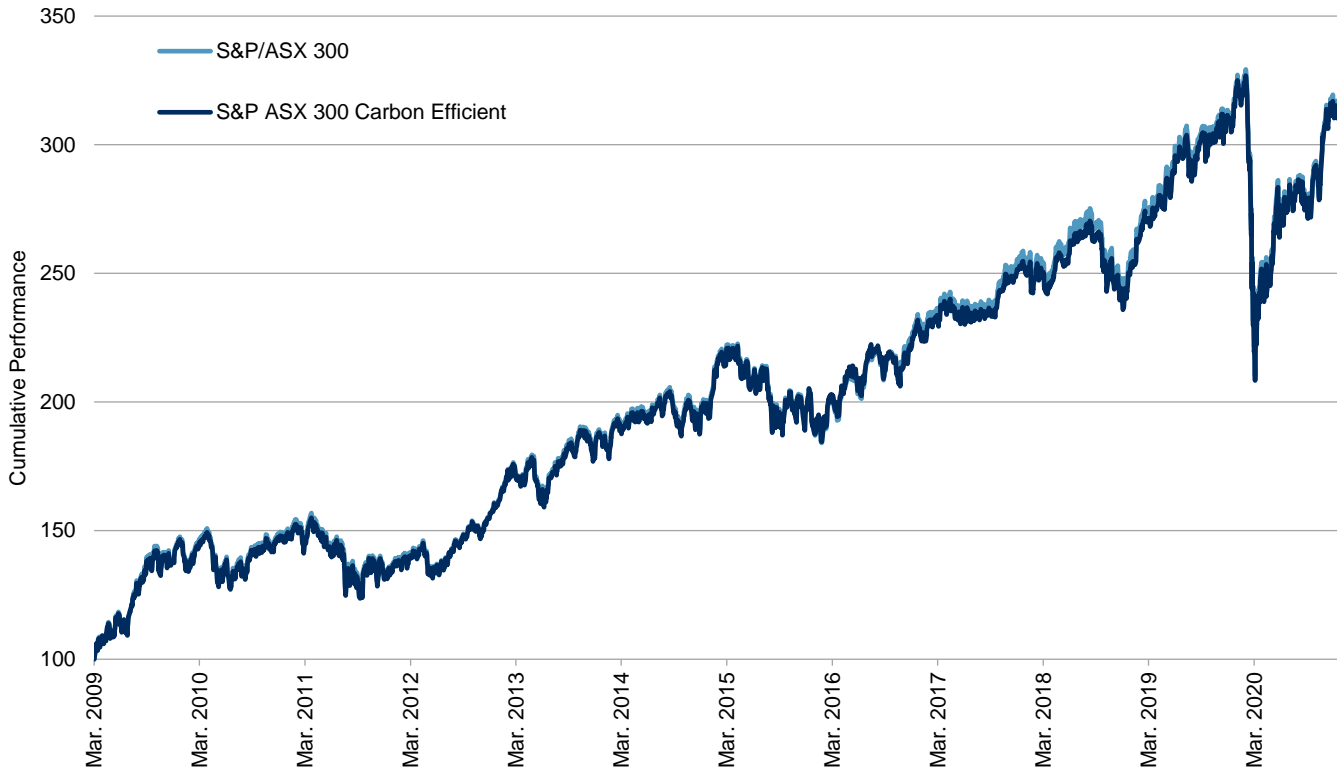
The S&P/ASX 300 Carbon Efficient portfolio is a hypothetical portfolio.
Source: S&P Dow Jones Indices LLC and S&P Global Trucost ESG Analysis. Data from March 20, 2009, to Dec. 31, 2020. Performance based on total return in AUD. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

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PERFORMANCE DISCLOSURE/BACK-TESTED DATA

The S&P/ASX All Australian 50 Carbon Efficient Index was launched August 20, 2015. The S&P/ASX All Australian 50 Fossil Fuel Free Carbon Efficient Index was launched November 16, 2015. All information presented prior to an index's Launch Date is hypothetical (back-tested), not actual performance. The back-test calculations are based on the same methodology that was in effect on the index Launch Date. However, when creating back-tested history for periods of market anomalies or other periods that do not reflect the general current market environment, index methodology rules may be relaxed to capture a large enough universe of securities to simulate the target market the index is designed to measure or strategy the index is designed to capture. For example, market capitalization and liquidity thresholds may be reduced. Complete index methodology details are available at www.spglobal.com/spdji. Past performance of the Index is not an indication of future results. Back-tested performance reflects application of an index methodology and selection of index constituents with the benefit of hindsight and knowledge of factors that may have positively affected its performance, cannot account for all financial risk that may affect results and may be considered to reflect survivor/look ahead bias. Actual returns may differ significantly from, and be lower than, back-tested returns. Past performance is not an indication or guarantee of future results. Please refer to the methodology for the Index for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations. Back-tested performance is for use with institutions only; not for use with retail investors.

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

Typically, when S&P DJI creates back-tested index data, S&P DJI uses actual historical constituent-level data (e.g., historical price, market capitalization, and corporate action data) in its calculations. As ESG investing is still in early stages of development, certain datapoints used to calculate S&P DJI's ESG indices may not be available for the entire desired period of back-tested history. The same data availability issue could be true for other indices as well. In cases when actual data is not available for all relevant historical periods, S&P DJI may employ a process of using "Backward Data Assumption" (or pulling back) of ESG data for the calculation of back-tested historical performance. "Backward Data Assumption" is a process that applies the earliest actual live data point available for an index constituent company to all prior historical instances in the index performance. For example, Backward Data Assumption inherently assumes that companies currently not involved in a specific business activity (also known as "product involvement") were never involved historically and similarly also assumes that companies currently involved in a specific business activity were involved historically too. The Backward Data Assumption allows the hypothetical back-test to be extended over more historical years than would be feasible using only actual data. For more information on "Backward Data Assumption" please refer to the FAQ. The methodology and factsheets of any index that employs backward assumption in the back-tested history will explicitly state so. The methodology will include an Appendix with a table setting forth the specific data points and relevant time period for which backward projected data was used.

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

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