State Street S&P Global Institutional Investor Carbon Indicator

2024 Annual Report

Highlights

- The carbon emission exposures of institutional portfolios increased slightly between March 2023 and March 2024 (from 4.27 million tonnes to 4.34 million tonnes); above COVID-era lows but below 2019 levels.
- The efficiency with which portfolios use carbon emissions to generate revenues, however, continued to increase, with carbon intensity exposure falling over 20% from approximately 137 to 108 tonnes emitted per $1 million of revenue in March 2024.
- From March 2023 to March 2024, high-carbon sectors such as Energy, Utilities, and Materials underperformed the overall market. This relative underperformance of high carbon sectors has reduced carbon intensity exposure and also reduced emissions exposures. However, these emissions exposure reductions were offset by increases in Consumer Discretionary, Communications, and Financial sector contributions, leading to the mild increase in emissions exposure versus last year. Oil prices have remained rangebound during this period, while carbon prices have fallen sharply in Europe.[1]
- In the US, while carbon-intensive sectors themselves underperformed the market over the past year, decarbonization strategies that maintain index-level sector exposures, but underweight high carbon firms within each sector, also saw negative performance. Within Europe, however, all decarbonization strategies earned positive returns.

[1] https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/021324-european-carbon-prices-plunge-to-28-month-lows

Indicators at a glance

The **State Street S&P Trucost Institutional Investor Carbon Indicator** captures the degree to which global institutional investors are exposed to carbon risk in their equity portfolio investments.[2] This exposure can increase in three ways: 1) if investors sell shares in companies with a lower emissions profile and buy shares with a higher emissions profile, 2) if underlying companies in the portfolio emit more carbon due to changes in their operations, or 3) if carbon emitters take on greater weight in the portfolio due to price appreciation. Carbon risk is realized when companies incur additional financial costs from emitting carbon into the atmosphere, which could take the form of explicit costs (such as a carbon tax) or implicit costs (such as consumer preferences for greener products or investor preferences for greener stocks) that impact their bottom line. Investors around the world—including some of the world's largest pension funds, sovereign wealth funds, and investment managers—are increasingly taking this risk into account.

What is Carbon Risk and Why Does it Matter

As with other market risks, securities prices (and therefore, portfolio values) move in advance of carbon risk being realized as investor views on the severity and likelihood of outcomes evolve. Imagine that a new bill calling for a $1,000 annual tax on gas-powered cars was introduced in the U.S. Congress. All else equal, automaker stocks would drop based on the probability that investors, in aggregate, place on the bill's passage. If it secured the requisite votes in Congress, and the President was expected to sign the bill, automaker stocks would drop further as the outcome became more likely. But if the constitutionality of the bill were challenged and appealed the Supreme Court, automaker stocks might rise again. Whatever their views on climate change, investors need to manage these risks in their portfolios, whether they stem from government policy, regulations, corporate responses, or changes in consumer preferences and behavior. The more carbon exposure in a portfolio, the more it is exposed to carbon risk.

[2] We focus on equity investments because realized carbon will tend to impact equity investors, who stand to bear the costs of carbon taxes, changing consumer preferences, or changes in the cost of capital before bondholders.

What is the Carbon Indicator?

The **Carbon Indicator**, the first bellwether of its kind, will help investors, the media, policymakers, and the public at large understand how some of the world's most influential investors are managing carbon risk. It brings together aggregated and anonymized custodial holdings information from State Street, drawn from a pool of over $41.8 trillion in institutional assets[3], with Trucost carbon emissions data from S&P Global. At its highest level, the indicator has two variants: **emissions**, tonnes of carbon emitted by portfolio companies, and **intensity**, calculated as tonnes of carbon divided by company revenue.[4] Whereas emissions captures the overall volume of carbon emitted, intensity measures how efficiently companies "use" carbon to generate revenues. Beneath these headline measures, we can break down movements in the Carbon Indicator into several components to better understand what is driving them:

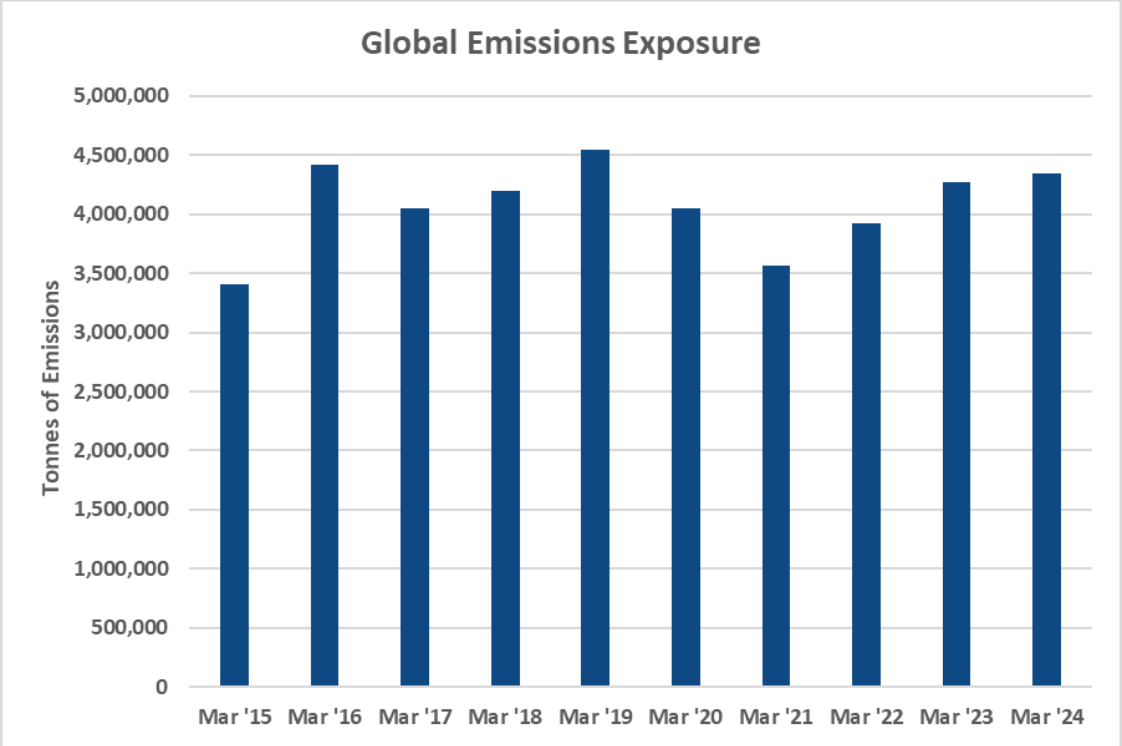
- **Flow effects** represent the decisions of portfolio managers (investors) to buy and sell specific companies, which changes the overall carbon profile of their portfolios. If a portfolio manager sells a low-emissions company and buys a high-emissions company, the overall carbon exposure of her portfolio will rise.
- **Company effects** represent the decisions of the underlying company management to change their operations, thereby changing the carbon profile of their companies. If the management of one company in the portfolio decides to use new technology in its operations that reduces emissions, this will reduce the overall carbon exposure of the portfolio even though the portfolio manager took no action.
- **Price effects** represent the changing valuations of companies due to a range of market factors, which changes their weight in the portfolio and therefore the weighted-average carbon calculation. If utility stocks rise, this will increase the portfolio's carbon exposure, all else equal, because higher emissions companies now have a larger weight. As a result, if carbon risk is realized, the portfolio is now going to be hit harder than it would have been if those companies had a lower weight. In other words, a larger share of the portfolio's value is exposed to carbon risk. This is akin to the notion that an increase in real estate taxes will have a bigger negative impact on a portfolio that is 75% real estate than a portfolio that is 25% real estate.

[3] Assets under custody and administration as of December 31, 2023.
https://investors.statestreet.com/files/doc_financials/2023/q4/stt-2023-12-31-10-k-with-exhibits.pdf

[4] Emissions is the carbon analogue of a firm's earnings in dollars, while intensity can be thought of as analogous to a firm's price to earnings ratio. High intensity means the firm "pays" a high amount (in carbon units) to earn a dollar of revenue, just as a high P/E multiple means an investor must pay a high amount for a dollar of earnings.

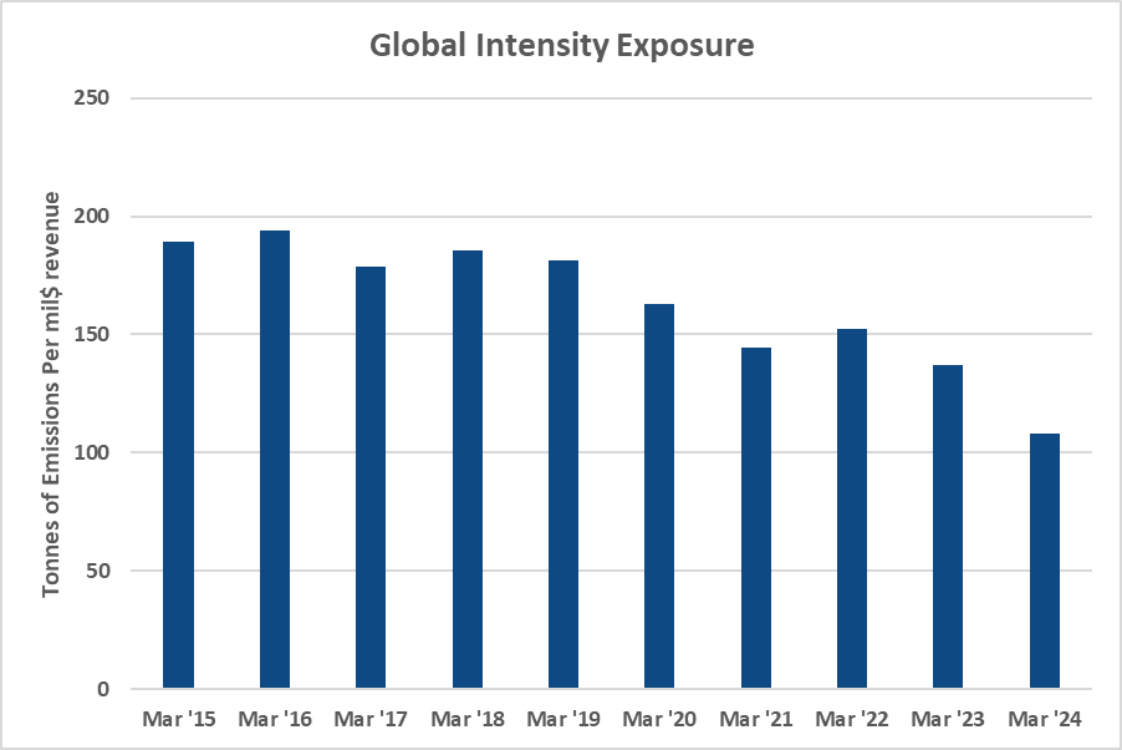
The Carbon Indicator: Where Investors Stood and Stand

Portfolio carbon emissions and intensity both exhibited declining trends from 2018-2021. Post COVID, we saw a recovery in economic activity, energy prices, and emissions exposures. However, from 2023-2024, the rate of increase has abated. The current level of portfolio carbon emissions exposure has risen slightly, from 4.27 million tonnes in March 2023 to 4.34 million tonnes in March 2024.



Source: State Street, S&P Global

Meanwhile, revenues have increased without equivalent amounts of incremental carbon being used to earn them. This has led carbon efficiency to increase, and carbon intensity exposure to fall from 137 tonnes per million USD revenue to 108 in March 2024.



Source: State Street, S&P Global

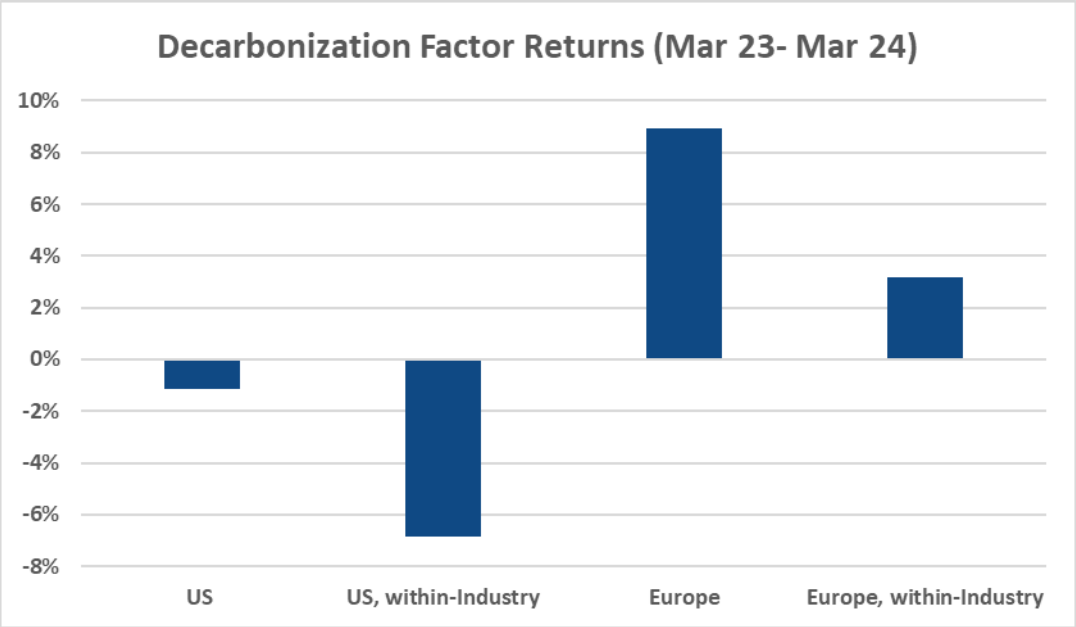
How Did Decarbonization Strategies Perform?

Some investors seek to reduce their carbon exposure by tilting their portfolios toward companies with lower carbon intensity profiles.[5] These portfolios can be formed in two ways: across all stocks without regard to industry, or balanced within each industry (underweighting high carbon firms within the industry). Portfolios formed using the former approach tend to hold much smaller positions in carbon-heavy industries. However, the latter approach results in portfolios that have the same overall exposure to each industry but are tilted toward the more carbon-efficient companies within that industry.

Decarbonization model portfolios exhibited mixed returns over the past year. In the US, strategies formed across all stocks without industry balancing were down slightly (1.1%) for the year, while industry-neutral strategy returns earned more negative returns (down 6.9%). In Europe we saw positive performance for both flavors of decarbonization strategy, with the within-industry strategy earning 3.2% and the basic

[5] Cheema-Fox, A., B.R. LaPerla, G. Serafeim, D. Turkington, and H. Wang. 2021(a). "Decarbonization Factors." Journal of Impact & ESG Investing 2 (1): 47-73

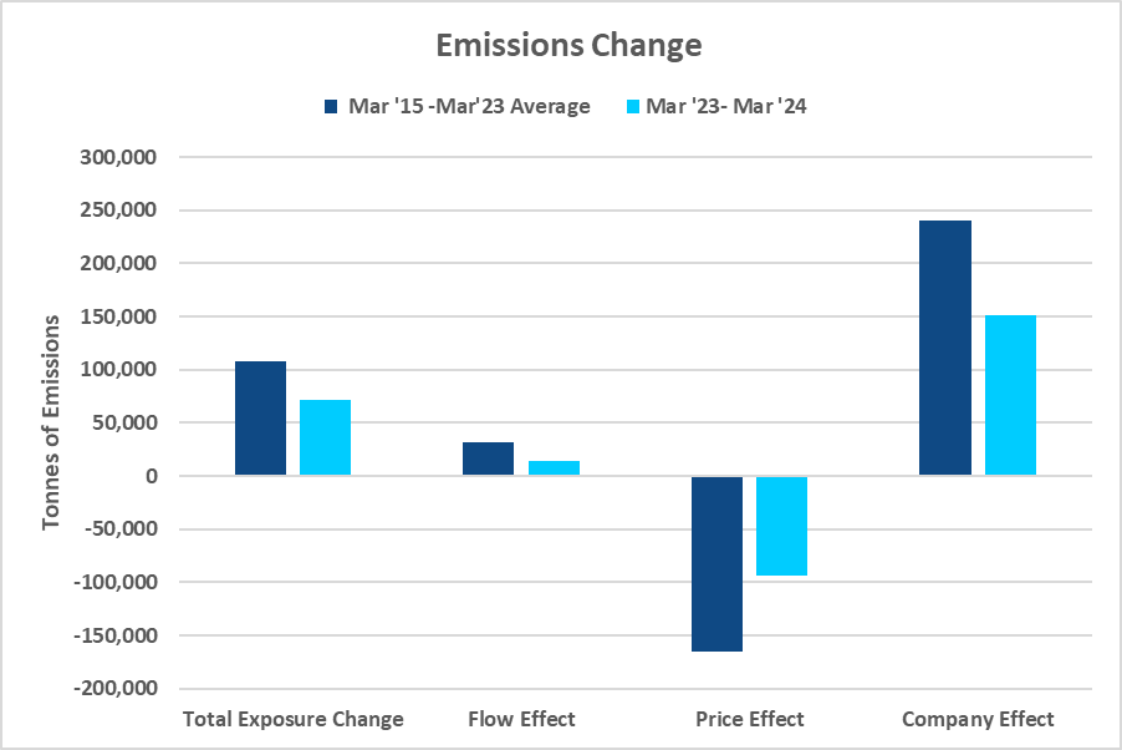
strategy earning 8.9%. Regionally, decarbonization strategies earned positive returns in Europe but not the US, while industry-neutral strategies were less extreme in each region.

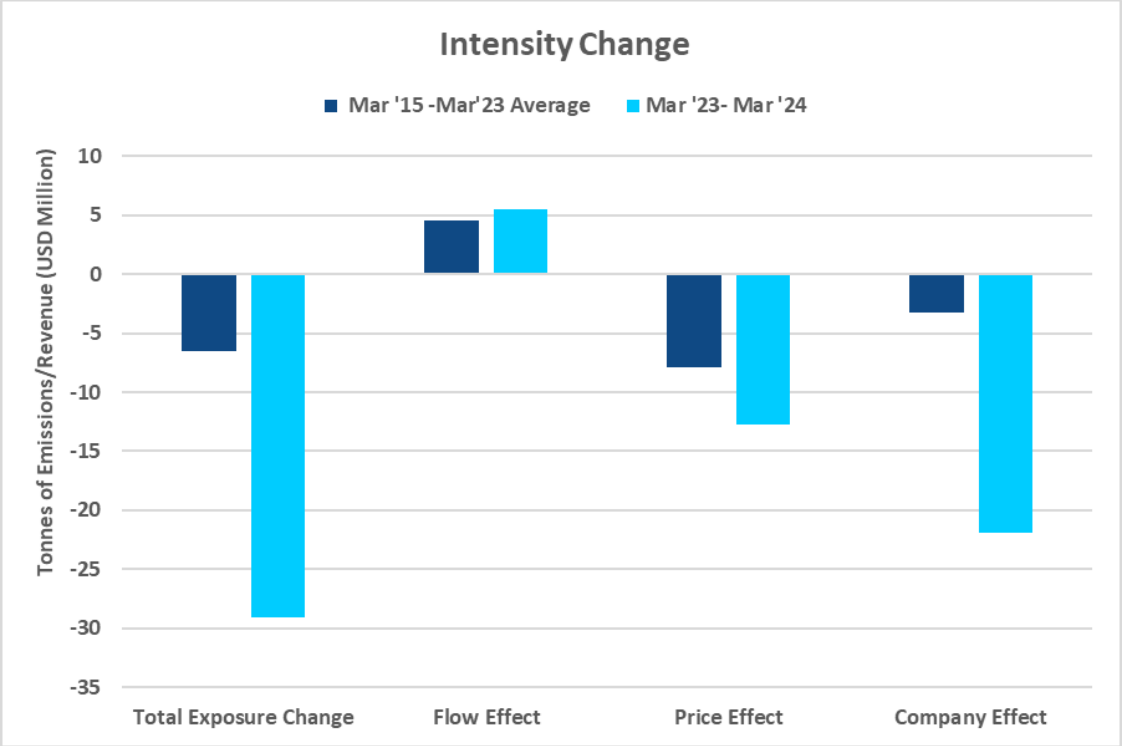


Source: State Street, S&P Global

What Moved the Carbon Indicator in 2024?

We can decompose the indicator to determine what is driving the trend toward slightly increased exposure to carbon emissions and decreased intensity exposure in 2024. The primary driver of the increase in emissions exposure was the company effect, which was largely offset by price effects. Flow effects were smaller and positive. This means that company emissions rose while the prices of high emitters tended to fall, and institutions bought carbon emitters to a limited extent. When we contrast what we saw in the last year with historical averages, there is a directional alignment of 2023-2024 with the historical trend. While the emissions behavior of companies drove an increase in emissions exposure, it did so to a lesser extent than was seen historically. The rate of total exposure change was lower than average in line with our observations above.



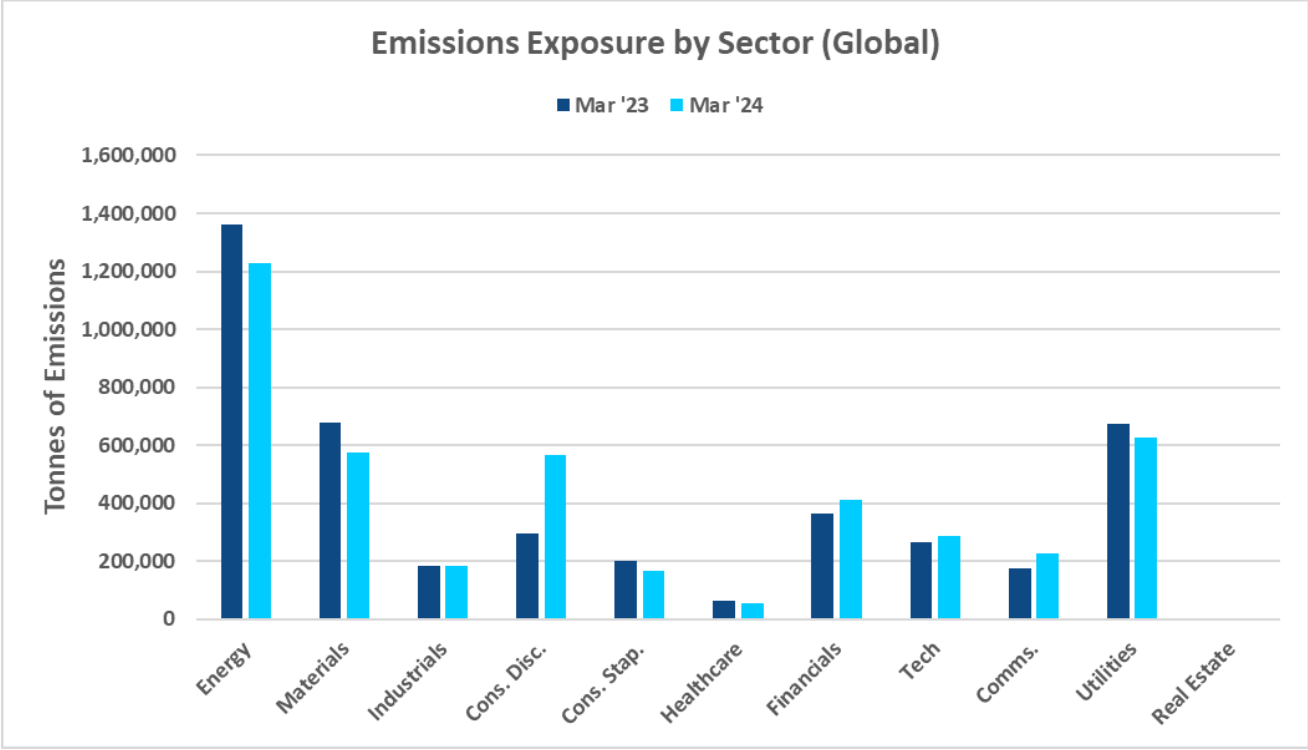


Source: State Street, S&P Global

The intensity change chart shows us the same breakdown for carbon intensity, but shows a very different picture. When it comes to carbon efficiency, the story is more broadly one of reduced exposure, albeit with some buying of carbon-intensive firms (flow effects are positive). Both price and company effects are quite negative, with company effects contributing more to the overall reduction in intensity exposure. Companies with some heft in institutional portfolios exhibited greater carbon efficiency, driven in part by increased earnings without an accompanying rise in carbon emissions. Relative to historical trends, the rate of reduction in intensity exposure accelerated.

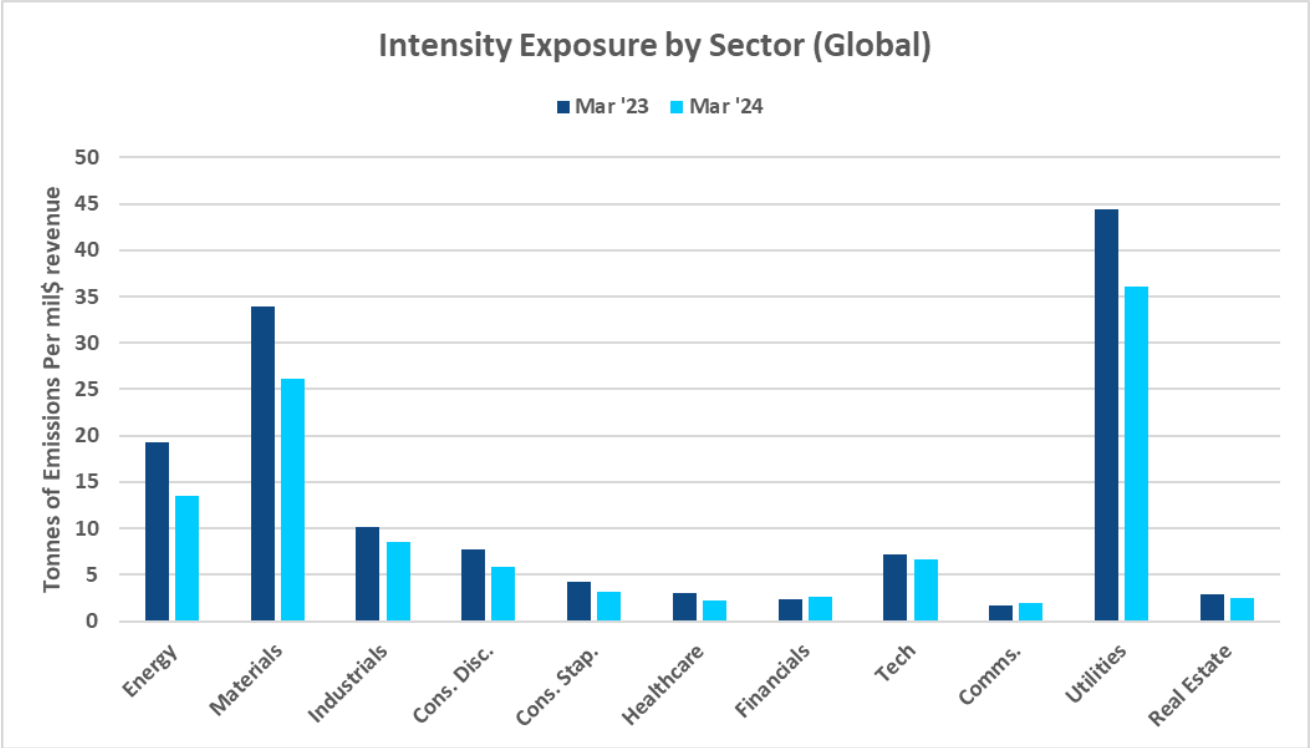
Carbon Indicator: Sectoral Breakdown

On a sectoral basis, Energy, Materials, Utilities and Consumer Discretionary sectors have driven changes in exposures but in differing ways. Emissions exposures fell for the high carbon sectors (in part driven by lower returns), but rose for Consumer Discretionary, which broadly kept pace with market returns and also saw increased company emissions.



Source: State Street, S&P Global

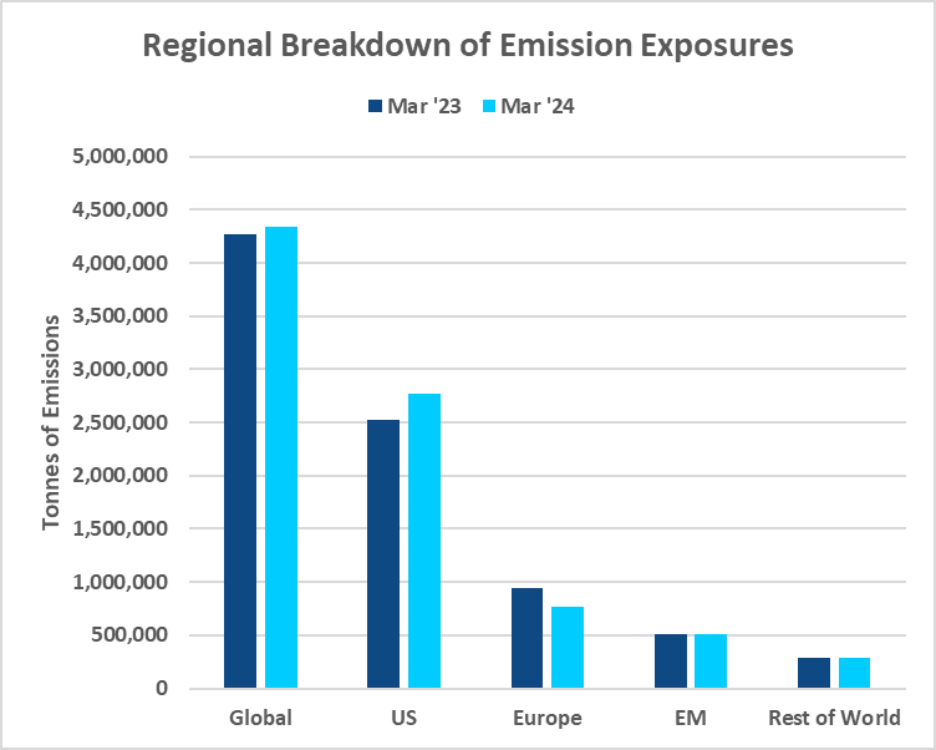
The reduction in intensity exposures unfolded broadly across Energy, Materials, and Utilities driven both by negative company and price effects partially offset by an overall positive flow effect.

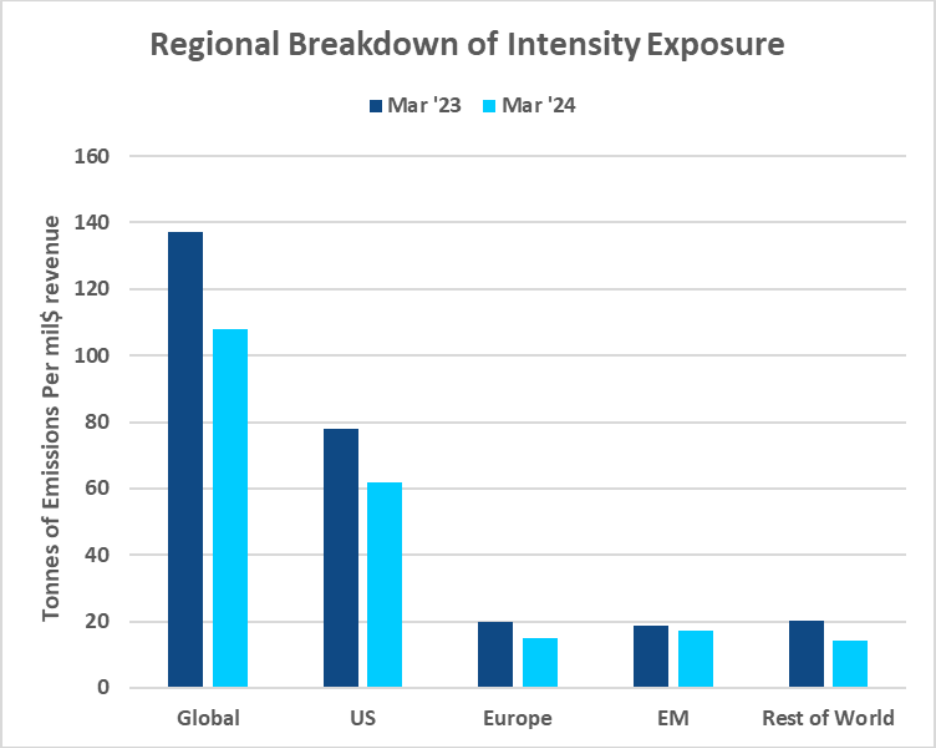


Source: State Street, S&P Global

Carbon Indicator: Regional Breakdown

Regionally, intensity exposures fell across all regions, while emissions exposures rose somewhat in the US, offset by a decline in Europe.





Source: State Street, S&P Global

APPENDIX:

Carbon Data Dictionary

Measure	Formula/ Description
Carbon Intensity	Issuer's Carbon Emissions divided by its revenue, covering Scope 1 and 2 GHG emissions under the Greenhouse Gas Protocol. Carbon Intensity denominates a quantity of GHG emissions metric by a company's annual consolidated revenues in millions of U.S. dollars: [tCO_2e] / USD 1 million revenue (the numerator is measured in tonnes also known as metric tons).
Carbon Emissions	Covers Scope 1 and 2 GHG emissions under the Greenhouse Gas Protocol. These are the emissions from the direction operations of the business and from the purchased electricity, steam, or other sources of energy generated upstream from a company's direct operations. We report these in tonnes (also called metric tons).
Emissions Exposure (tonnes)	$\sum_{stocks} weight_{stock} * emissions_{stock}$ in tonnes of GHG emissions
Intensity Exposure (tonnes/ million USD)	$\sum_{stocks} weight_{stock} * intensity_{stock}$ in tonnes of GHG emissions per million dollar revenue

Concept Explainer

Following the methodology of "We'll Always Have Paris: How Institutional Exposures to Carbon Emissions Have Evolved Since 2015" by Alexander Cheema-Fox, George Serafeim and Hui (Stacie) Wang we report **exposures** and their changes, which we decompose into flow, price, and company components. To summarize: the exposure of a portfolio to a given characteristic (of assets) is the weighted average of asset weights and feature values. For example, if a given portfolio has a 10% allocation to Apple, and Apple has a price to book value ratio of 42, the price to book value exposure of this position in the portfolio is 10% X 42 = 4.2%. To obtain the overall portfolio exposure to the price to book feature, we

would compute this product for all positions in a given fund. Our methodology applies this idea to not one portfolio but an aggregate portfolio including thousands of institutional investors. This gives us the *level* of exposure at a given point in time. We further examine how exposures change through time.

Instead of price to book, we use our two carbon risk measures: ***emissions***, the carbon emissions of a company in tonnes (metric tons), and the carbon ***intensity*** of a stock, which is defined as emissions of the firm divided by revenue of the firm in millions USD. While often behaving similarly, these metrics tell us two different things. **Intensity** tells us how "carbon efficient" a firm is, and tilts towards carbon efficient firms would imply lower carbon intensity. **Emissions** gives us the raw exposure to the quantity of carbon emitted by portfolio companies. If the economy is growing quickly enough, we might see weighted average emissions rise even as intensity falls; companies may increase their efficiency, but if they also upscale their output, emissions will still increase.

Carbon Exposures are defined as the weight of an asset in the aggregate institutional portfolio (comprised of thousands of portfolios representing trillions in assets under management) multiplied by the carbon risk value of the asset (either a company's carbon intensity or its carbon emissions). For an individual portfolio, an exposure tells us the degree to which a portfolio's investments tilt towards a given risk or security attribute. Consider, as analogues to emissions and carbon intensity respectively, company earnings and P/E ratios: a portfolio with a P/E ratio of 30 is on average holding expensive stocks; a portfolio with an earnings exposure of 10 billion USD is holding companies that, on average, earn 10 billion USD. This is distinct from how large a stake the investor (or group thereof) holds in their companies – an investor with a 10 billion dollar portfolio can have the same exposure as an investor with a 1 million dollar portfolio. In our case, we are reporting the aggregate portfolio representing thousands of investors, and reporting their collective exposures to carbon intensity and carbon emissions. An emissions exposure of 4 million tonnes means that the institutional portfolio holds companies that, on average, emit 4 million tonnes of carbon; an intensity exposure of 150 means that the institutional portfolio holds companies that, on average, require carbon expenditure of 150 tonnes per million USD revenue generated. We sum these exposures across the equity market to produce the aggregated series below, which are dissected regionally and by sector.

Since exposures are a defined as a weight multiplied by a feature, changes in exposures are determined by how weights change over time and how company features (carbon emissions and intensity) change over time. Weights are affected by two forces: relative returns and flows. For instance, suppose I have a portfolio with two assets each held at 50% weight: if one dollar has been invested, I hold 50 cents of each

stock. If stock 1 doubles in value while stock 2 remains the same, I now have 75 cents in stock 1 and 50 cents in stock 2, leading to weights of 75/125 = 60% and 50/125 = 40%. Relative returns alone move weight substantially. Buying or selling of assets will also affect weights and thereby affect exposures.

Of course, changes in the company-level attributes for which we measure exposure (intensity and emissions) also affect portfolio exposures. Now suppose the company weights were held constant at 50% each, and that stock 1 had a carbon intensity of 20 while stock 2 had a carbon intensity of 30. The portfolio's carbon intensity would come to .5 * 20 +.5 * 30 = 25. If stock 1 cuts its carbon intensity in half, to 10, without any change in portfolio weight (suppose returns and flows are both the same at zero), then the portfolio's carbon intensity becomes .5 * 10 + .5 * 30 = 20.

Carbon risk evolves based on companies altering their emissions or, in the case of carbon intensity, generating revenue with fewer concomitant emissions per dollar. Disentangling these drivers from one another can be effected analytically: further details may be found in "We'll Always Have Paris: How Institutional Exposures to Carbon Emissions Have Evolved Since 2015" by Alexander Cheema-Fox, George Serafeim and Hui (Stacie) Wang.

Disclaimers and Important Risk Information [2024.01]

This communication is provided only to professional clients or eligible counterparties or their equivalent by State Street Bank and Trust Company or, where applicable and permissible, its bank and non-bank affiliates ("State Street"). State Street Bank and Trust Company is authorized and regulated by the Federal Reserve Board, registered with the Commodity Futures Trading Commission as a Swap Dealer, and is a member of the National Futures Association. State Street Bank International GmbH ("SSBI") is regulated by the European Central Bank ("ECB"), the German Federal Financial Supervisory Authority ("BaFin") and the Deutsche Bundesbank. Details about the extent of SSBI's regulation by the ECB, the BaFin and Deutsche Bundesbank are available from us on request. Products and services described herein may not be available in all jurisdictions or through all State Street entities. Activities described herein may be conducted from offshore. Information provided is of a general nature only and has not been reviewed by any regulatory authority.

This communication is intended for general marketing purposes, and the information contained herein has not been prepared in accordance with legal requirements designed to promote the independence of investment research. It is for clients to determine whether they are permitted to receive research of any nature. Market commentary provided by trading desks is not investment research. This communication is not intended to suggest or recommend any transaction, investment, or investment strategy, does not constitute investment research, nor does it purport to be comprehensive or intended to replace the exercise of an investor's own careful independent review and judgment regarding any investment decision.

This communication is not intended for retail clients, nor for distribution to, and may not be relied upon by, any person or entity in any jurisdiction or country where such distribution or use would be contrary to applicable law or regulation. This communication or any portion hereof may not be reprinted, sold or redistributed without the prior written consent of State Street. This communication and the information herein does not constitute investment, legal, or tax advice and is not a solicitation to buy or sell securities or any financial instrument nor is it intended to constitute a binding contractual arrangement or commitment by State Street of any kind. The information provided does not take into account any particular investment objectives, strategies, investment horizon or tax status.

The views expressed herein are the views of State Street as of the date specified and are subject to change, without notice, based on market and other conditions. The information provided herein has been obtained from sources believed to be reliable at the time of publication, nonetheless, we make no representations or assurances that the information is complete or accurate, and you should not place any reliance on said information. State Street hereby disclaims any warranty and all liability, whether arising in contract, tort or otherwise, for any losses, liabilities, damages, expenses or costs, either direct, indirect, consequential, special, or punitive, arising from or in connection with any use of this document and/or the information herein.

State Street may from time to time, as principal or agent, for its own account or for those of its clients, have positions in and/or actively trade in financial instruments or other products identical to or economically related to those discussed in this communication. State Street may have a commercial relationship with issuers of financial instruments or other products discussed in this communication.

This communication may contain information deemed to be forward-looking statements. These statements are based on assumptions, analyses and expectations of State Street in light of its experience and perception of historical trends, current conditions, expected future developments and other factors it believes appropriate under the circumstances. All information is subject to change without notice.

Participating in trading any financial instrument, including but not limited to foreign exchange, equities, futures, fixed income or derivative instruments, or investments in non-liquid or emerging markets, or digital assets, or participating in securities lending, repurchase transactions or other collateral services present risks, which may include but are not limited to counterparty, collateral, investment loss, tax, and accounting risks. Where applicable, returns may increase or decrease as a result of currency fluctuations. Derivatives may be more volatile than the underlying instruments. Certain foreign exchange business, including spot and certain forward transactions, may not be regulated in all jurisdictions. Past performance is no guarantee of future results.

Please contact your State Street representative for further information. To learn how State Street looks after your personal data, visit: https://www.statestreet.com/utility/privacy-notice.html.

6499727.1.1.GBL.

Expiration Date: 4/10/2025

Global Markets Research Disclaimer Supplement [2024.01]

Australia: This communication is provided to wholesale clients by State Street Bank and Trust Company (Australian Business Number 70 062 819 630, Australian Financial Services License 239679).

Brazil: The products in this marketing material have not been and will not be registered with the Comissão de Valores Mobiliários - the Brazilian Securities and Exchange Commission ("CVM"), and any offer of such products is not directed to the general public within the Federative Republic of Brazil ("Brazil"). The information contained in this marketing material is not provided for the purpose of publicly soliciting investments from investors residing in Brazil and no information in this marketing material should be construed as a public offering or unauthorized distribution of the products within Brazil, pursuant to applicable Brazilian law and regulations.

Israel: State Street Bank and Trust Company is not licensed under Israel's Regulation of Investment Advice, Investment Marketing and Portfolio Management Law, 1995. This communication may only be distributed to or used by investors in Israel which are "eligible clients" as listed in the First Schedule to Israel's Regulation of Investment Advice, Investment Marketing and Portfolio Management Law 1995.

Japan: This communication is made available in Japan by State Street Bank and Trust Company, Tokyo Branch, which is regulated by the Financial Services Agency of Japan and is licensed under Article 47 of the Banking Act.

Oman: State Street Bank and Trust Company is not a bank or financial services provider registered to undertake business in Oman and is not regulated by the Central Bank of Oman or the Capital Market Authority.

Qatar: The information in this communication has not been reviewed or approved by the Qatar Central Bank, the Qatar Financial Markets Authority or the Qatar Financial Centre Regulatory Authority, or any other relevant Qatari regulatory body.

Singapore: This communication is made available in Singapore by State Street Bank and Trust Company, Singapore Branch ("SSBTS"), which holds a wholesale bank license by the Monetary Authority of Singapore. In Singapore, this communication is only distributed to accredited, institutional investors as defined in the Singapore Financial Advisers Act 2001 ("FAA") and its regulations. Note that SSBTS is exempt from Sections 27 and 36 of the FAA. When this communication is distributed to overseas investors as defined in the FAA, note that SSBTS is exempt from Sections 26, 27, 29 and 36 of the FAA. This advertisement has not been reviewed by the Monetary Authority of Singapore.

South Africa: State Street Bank and Trust Company is authorized in South Africa under the Financial Advisory and Intermediary Services Act, 2002 as a Category I Financial Services Provider; FSP No. 42671.

United Arab Emirates: The information contained within this communication is not intended to lead to the conclusion of any contract of whatsoever nature within the territory of the United Arab Emirates.

United Kingdom: State Street Bank and Trust Company is authorised and regulated by the Federal Reserve Board of the United States, authorised by the Prudential Regulation Authority ("PRA") and subject to regulation by the Financial Conduct Authority and limited regulation by the PRA. Details about the extent of our regulation by the PRA are available from us on request.

State Street Bank International GmbH is authorised and regulated by the European Central Bank and the BaFin, deemed authorised by the Prudential Regulation Authority, and subject to regulation by the Financial Conduct Authority and limited regulation by the Prudential Regulation Authority. Details of the Temporary Permissions Regime, which allows EEA-based firms to operate in the UK for a limited period while seeking full authorisation, are available on the Financial Conduct Authority's website.