Index Insights | Sustainable Investment – Climate

Weighted Average Green Revenue (WAGR): Integrating climate solutions into portfolio construction

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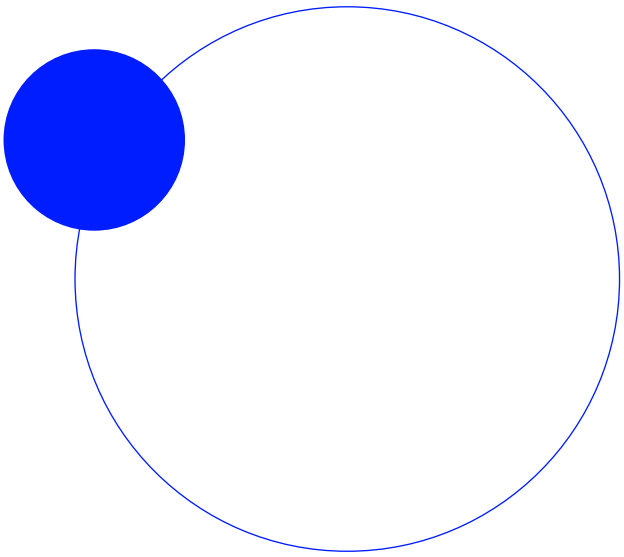

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Executive summary

Transitioning to a green net-zero economy requires climate solutions that enable the economy to decarbonize, such as renewable energy, electric vehicles, and recycling technologies. This also creates significant investment opportunities—companies providing climate and environmental solutions have been growing[1] and outperforming the market over the last decade. The economics of climate solutions are making fossil-fuel-dependent assets less attractive from a financial point of view. These companies are likely to grow even more as economies progress toward their net-zero goals.

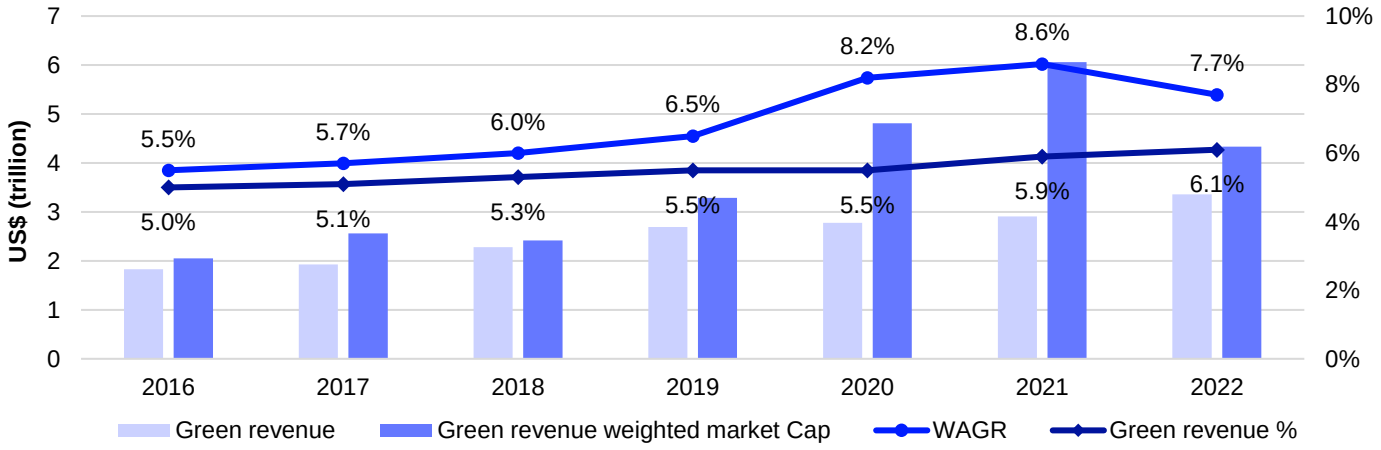
There is an emerging toolbox for systematically identifying and managing portfolio exposure to climate-related investment opportunities. Different metrics are typically employed across investors and asset classes, such as dollar amount invested in green bonds for fixed income, and renewable energy generation for infrastructure. These metrics, while helpful for measuring specific sectors or asset classes, are challenging for investors to use due to their lack of comparability.

To address challenges in measuring climate solutions exposure, this paper examines four metrics: green revenue, green capex, green patents and avoided emissions that are broadly applicable in a portfolio management context. Each metric has its pros and cons but, altogether, they provide a comprehensive view of the available metrics to assess companies' exposure to climate solutions. This paper focuses on green revenue based on its benefits. Green revenue is easier to interpret, directly links to companies' cash flows and real-world impact, and the data is more readily available and comparable.

We find Weighted Average Green Revenue (WAGR) to be the most promising metric currently for integrating climate solutions measurements into portfolio construction. It builds on the portfolio weighting methodology used in carbon metrics such as Weighted Average Carbon Intensity (WACI) that is widely adopted by investors. WAGR calculates the green revenue percentage (GR%) of a portfolio by applying company GR% to the portfolio weight of each company. Investors can set portfolio-level targets of climate solutions using WAGR, such as a minimum level, an improvement relative to the benchmark, or to track specific WAGR pathways such as decarbonisation trajectories.

Using WAGR, this paper analyzes portfolio exposure to climate solutions, including size, growth, industries, green sectors, regions, and the level of 'greenness' (shown by the tiering structure under the FTSE Russell Green Revenues Classification System), with the FTSE All-World Index as the reference portfolio. Figure 1 shows that FTSE All-World's WAGR grew from 5.5% to 8.6% between 2016 and 2021 and fell during the down market of 2022. In comparison, FTSE All-World's unweighted green revenues record steadier year-on-year growth, which reflects the 'value impact' of market capitalization.

Figure 1: WAGR of the FTSE All-World



Source: FTSE Russell, April 2023

[1] As shown by green revenue in Figure 1.

Akin to WACI, potential investor applications of WAGR include climate reporting against frameworks, such as the Task Force on Climate-related Financial Disclosures (TCFD), target setting, thematic investing, and corporate engagement. Investors should acknowledge the constraints and trade-offs when building portfolios with a significantly greater WAGR, such as sector and country concentration, volatility, and the size of the universe.

Disclosures based on green revenues are still nascent and would likely improve over time with the adoption of reporting based on different green taxonomies. In addition, climate-related disclosures in private markets, including green revenue data, continue to be in short supply, and limits access to comparable data across different asset classes for investors. This paper aims to raise greater awareness of the value of WAGR to assess and integrate green opportunities into portfolio construction, which in turn will encourage greater disclosures. In conjunction with other sustainability metrics, WAGR can be a useful tool to calibrate and measure exposure to climate solutions in a portfolio management context.

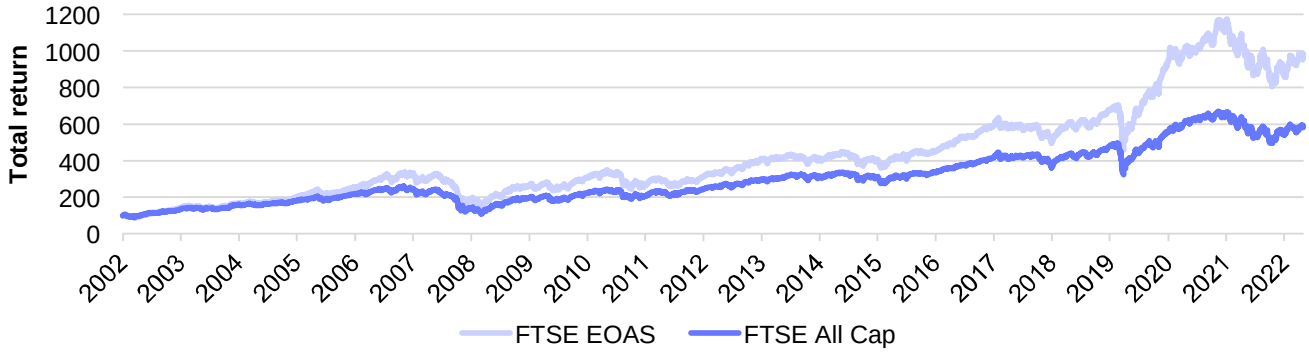
Section 1: Seizing investment opportunities from climate solutions

Investors are increasingly attempting to measure and manage climate-related risks in their portfolios, driven by a combination of client demand and regulatory pressures as well as concerns over impacts on asset values, cash flow, and revenues.[2] A suite of data and analytical tools for portfolio management and target setting, such as carbon footprinting and temperature alignment-tracking,[3] have been developed to monitor portfolio carbon performance.

However, achieving net-zero goals also requires investment in climate solutions that enable the economy to decarbonize, creating significant investment opportunities. Today, the green economy already grows faster than broader equity markets, with a compound annual growth rate of around 13% over the last decade.[4] Companies providing climate and environmental solutions have been outperforming the market since the early 2000s (figure 2).

Recent studies estimate that to achieve net-zero emissions by 2050, this growth needs to accelerate further, with between US$109 and US$275 trillion in both public and private investment needing to flow to a wide range of climate solutions, from renewable energy and electric vehicles to industrial energy efficiency and recycling technologies. If we were to limit global average temperature rise to 1.5°C, revenues generated by these green activities would likely grow from around 6% of total revenues of the FTSE All-World companies today, to 25% by 2050.[5]

Figure 2. The FTSE Environmental Opportunities All-Share (EOAS) with companies with at least 20% green revenues outperformed the market since 2003



Notes: Index represents total US$ return, based to 01/01/2003, running until 28/04/2023; Companies included in the Environmental Opportunities All Share Index have at least 20% green revenue. Past performance is not a guarantee of future performance.

Source: FTSE Russell, April 2023

Investor tools to systematically identify and manage exposure to such climate-related investment opportunities in addition to managing climate risks are still fairly limited. For example, financial markets lack consensus metrics for measuring portfolios' exposure to climate solutions that are comparable to widely used carbon intensity metrics, such as Weighted Average Carbon Intensity (WACI).[6] To tackle the challenge, this paper first examines available metrics for gauging company contribution to climate solutions before looking at metrics for measuring climate solutions exposure at the portfolio level. It then concludes with potential investor applications.

[2] Transition risks are associated with efforts to decarbonize sectors and the economy, and physical risks arise from global warming and shifting climate patterns. The most recent FTSE Russell Asset Owners Survey found that 84% of surveyed asset owners were considering or evaluating sustainable investment considerations, up from 53% in 2018, with climate/carbon the leading priority focus area; see FTSE Russell (2022), *Asset owners are buying into sustainable investment: How risk management enables widespread adoption*.

[3] Such as the Transition Pathway Initiative, a global asset-owner led initiative, which assesses companies' preparedness for the low-carbon transition.

[4] This is calculated based on green revenue weighted market capitalization of FTSE All World from 2016 to 2022.

[5] FTSE Russell (2022), *Green equity exposure in a 1.5oC: Applying climate investment trajectories with green revenues*.

[6] FTSE Russell (2022). *Decarbonization in equity benchmarks: Smoke still rising*.

Section 2: Asset owner needs for measuring exposure to climate solutions

Asset owners measuring portfolio 'greenness', such as their exposure to climate and environmental solutions, is heterogenous. Across North America, Europe, the Middle East and Asia Pacific, metrics employed differ across investors and asset classes, and typically cover only a sub-set of the overall portfolio.

Table 1. Metrics on portfolio exposure to climate solutions[7]

Asset class	Metrics
Public equity	Dollar amount or percentage of portfolio invested in green assets
Fixed income	Dollar amount or percentage of portfolio invested in green products (e.g., green/sustainability/sustainability-linked bonds)
Infrastructure	Dollar amount or percentage of portfolio invested in green assets/renewables/sustainable energy infrastructure
	Renewable energy generated (GWh) or capacity installed (GW)
	Avoided emissions (mtCO2) from sustainable energy investments
Private equity	Dollar amount or percentage of portfolio invested in green assets
Real estate	Dollar amount or percentage of portfolio invested in green assets
	Floor area or size of assets with a sustainability or green building certification
	Number or portfolio percentage of assets with a sustainability or green building certification

These metrics, while helpful for measuring specific sectors or asset classes, are challenging for investors to use due to their lack of comparability. Focusing on specific themes, such as renewable energy or sustainable energy infrastructure, is narrow and risks overlooking other critical segments of the green economy, such as long-range transportation, technology and resources. Comparability is further limited by varying definitions and methodologies for what constitutes a 'green asset'. It needs an overarching metric applied consistently across asset classes, to compare the performance among asset classes and aggregate the results up to the portfolio level.

Additionally, the way asset owners currently disclose green investment exposure is often binary—a company or investment is tagged as *green* or *not*. This approach focuses on pure plays and does not consider the nuanced nature of a company's business model, whereby some business lines are green, and others less so. It also fails to capture companies' progress in transition: For example, fossil fuel companies will be uniformly considered as not green even if some are developing climate-solution business lines that presently may be small.

To address these challenges in measuring climate-solution exposure systematically, we drill down into companies' fundamentals and consider four metrics: green revenue, green capex, green patents,[8] and avoided emissions. The subsequent section outlines the pros and cons of each metric, which offer an improvement to investors' existing disclosure practices. They are largely applicable across different sectors and asset classes, enabling cross-asset class comparisons and aggregation. At the individual company level, these metrics provide a more granular picture of a company's exposure to the green economy.

[7] Source: GIC analysis of annual reports of 48 asset owners, including pension funds, sovereign wealth funds, endowment funds, across North America, Europe, Middle East, and the Asia Pacific. The table provides an overview of the green metrics used by the asset owners surveyed but is by no means an exhaustive list.

[8] https://www.oecd.org/env/indicators-modelling-outlooks/green-patents.htm OECD. *Green patents*.

Available climate solutions metrics for investors

Several metrics have emerged in recent years that aim to capture the exposure of companies to climate solutions. Principally, these include green revenue, green capex, green patents, and avoided emissions measures. Both green revenue and green capex are used by the EU Taxonomy Regulation, which requires corporate reporting on sustainable economic activities.[9] Table 2 provides a more detailed comparison of each metric in terms of data availability and comparability, financial materiality to business, current exposure to climate solutions, and future commitment. It showcases the merits and drawbacks of each metric.

***Green revenue* offers a consistent metric across companies, which typically report revenues based on business lines, products, or services following accounting standards.** As a financial metric, green revenue can reflect the financial materiality of a green product or service to the business. However, green revenue focuses on climate solutions or innovative environmental technologies that are commercially successful today. These may lead to limited coverage of low-revenue, early-stage green activities.

***Green capex* can give a good sense of a company's direction of travel,[10] which demonstrates the financial materiality of, and a company's commitment to, developing climate solutions.** This forward-looking metric captures capital-intensive green activities better with long lead times at the early stage, such as offshore wind farm developments that can take years to generate revenue. However, it provides limited information on the size of the companies' existing climate solutions business and is constrained by companies rarely providing granular breakdowns of their capex.

***Green patents* are a good indicator of companies' innovation activities related to environmental technologies, signalling their strategies to develop climate solutions in the long term.** But they only reflect a subset of companies providing climate solutions in the market. Not all climate solutions require innovation, not all climate inventions are necessarily patented,[11] and not all patented climate technologies are implemented. The number of patents alone provides little information on the environmental impact or financial materiality of the underlying technologies.

***Avoided emissions*[12] are more easily integrated with existing climate measures like carbon footprint.** They demonstrate the existence and environmental impact of climate solutions and implicitly indicate the scale of their value proposition to customers in terms of reducing their emission cost liabilities. The challenge is the lack of consensus on the methodology (such as baselines and boundaries) to attribute avoided emissions to a specific product or service,[13] making the data less comparable among companies and investors that report them.

All these metrics together enable a comprehensive view on climate solutions and how they impact a company's outlook in a carbon-constrained world. We focus the remainder of the analysis on green revenues, based on their benefits. They are easier to interpret, directly link to companies' cash flows and real-world impact, are more readily available, and can be more easily estimated. As data and calculation methodologies for other metrics evolve and mature, they can be included as part of a comprehensive suite of indicators to measure a portfolio's exposure to climate solutions.

[9] Delegated Act supplementing Article 8 of the Taxonomy Regulation.
[10] EU TEG on Sustainable Finance (2020). *Taxonomy: Final report of the Technical Expert Group on Sustainable Finance*.
[11] OECD (2015). *Measuring environmental innovation using patent data*. Kruse T, Mohnen M and Sato M (2020). *Are financial markets aligned with climate action? New evidence from the Paris Agreement*. Centre for Climate Change Economics and Policy Working Paper 364/Grantham Research Institute on Climate Change and the Environment Working Paper 333.
[12] GIC (2021). *A Framework for Avoided Emissions Analysis*.
[13] Russell, Stephen (2018.). *Estimating and Reporting the Comparative Emissions Impacts of Products Working Paper*. Washington, DC: World Resources Institute.

Table 2: Comparing mainstream climate solutions metrics

Performance: Low Medium High

Metric	Description	Availability	Comparability	Financial materiality	Indication of current exposure	Indication of future direction
Green revenue	Revenue derived from selling existing green products and services Expressed as a ratio of overall company revenue	Companies disclose revenue data to investors regularly but with varying degrees of granularity. Dedicated green revenue disclosures are still less common but expanding rapidly	Revenue data is usually published in a structured format—segment by segment—making it easier to attribute revenue to products and services	Financial metric to indicate the materiality and commercial value of green products and services to business	Directly indicates the selling of existing commercialized green products and services in markets	Allows inferring current growth rates but does not directly indicate future strategy or cash flows. To some extent reflects green capex and patents that are commercially successful
Green capex	Capital expenditure in new green products and services Expressed as a ratio of overall capex	Corporate capex disclosures tend to be limited and highly aggregated. Dedicated green capex disclosures are still rare and very heterogenous	Reporting on capex data is less standardized, making it challenging to attribute capex to products and services	Financial metric to indicate the materiality of green products and services to future business	Provides limited insight on the role of climate solutions in the current commercial model	Signals investments in climate solutions and commitment with respect to future business strategy
Green patents	Patent on innovative environmental technologies Expressed as the number of granted patents	Limited corporate disclosure but available through databases of patent filings such as PATSTAT	Number varies greatly with divergent patenting behavior across firms, sectors and geographies, making it difficult to compare companies in a large universe	Not a financial metric and doesn't necessarily reflect the materiality of R&D to the business, i.e., number of patents alone provide little information on patent value and potential future impact	Provides limited insight on the significance of granted green patents to a company's commercial model Reflects a subset of existing climate solutions as not all of them are innovations with patents	Demonstrates where a firm invests in innovation, signalling long-term commitment to developing green technologies Reflects a subset of innovative climate solutions as not all of them are patented
Avoided emissions	Carbon emissions reduction from using green products and services to replace a more carbon-intensive incumbent Expressed as tCO2e	Low corporate disclosures with no guidelines for assumptions on carbon emissions baselines, boundaries and attribution, which are not yet available from credible standard-setting bodies	Complementary to existing metrics on carbon emissions, but the lack of consensus or globally accepted standards on baselines and boundaries means limited comparability	Implicitly measures the value proposition of the company's green products and services, i.e., the more emissions (and emission costs) they help customers to avoid, the more valuable their products and services	Demonstrates the existence and environmental impact of climate solutions, and implicitly indicates the scale of their value proposition to customers	Reflects the existing scale of green products and services that are commercially viable but does not directly provide an indication of how they would grow in the future

Section 3: WAGR calculation and trends

To measure portfolio exposure to climate solutions, investors need ways of aggregating company-level green revenues for a portfolio. We propose using Weighted Average Green Revenue (WAGR), defined as:

Weighted Average Green Revenue (WAGR)

$$\text{WAGR} = \sum_{i=1}^{n} GR\%_i * \text{W}_i$$

Where:

– $GR\%_i$ is company-level green revenue percentage for company i

– W_i is company i's given weight in a portfolio

WAGR builds on the portfolio weighting methodology used in carbon metrics such as WACI. It calculates the green revenue percentage (GR%) of a portfolio by applying company GR% to the market capitalization of each company. For example, if a company has a GR% of 20%, we consider 20% of the company's market capitalization as green. Then it aggregates the 'green' part of the market capitalization of all stocks in the portfolio, divides it by total market capitalization—providing the 'green' and 'non-green' parts of the portfolio—and leads to a portfolio GR%, or WAGR.

The calculation of WAGR is straightforward and easy to implement. It is also highly comparable across equity portfolios and indices given most of them use market capitalization to determine stock weight. This makes it easier to compare portfolio performance against benchmarks. In addition, it echoes the method recommended by the Technical Expert Group (TEG) on Sustainable Finance for measuring alignment of equity investment with the EU Taxonomy.[14]

The modular nature of the underlying green revenues data allows investors to measure portfolio exposures to individual climate solutions. WAGR can be broken down into different technologies across 10 sectors, 64 subsectors and 133 micro sectors under the FTSE Russell Green Revenues Classification System (GRCS), providing flexibility for investors seeking investment opportunities in specific sectors. For example, the BlackRock iShares Environmental Infrastructure and Industrials ETF selects companies providing solutions related to energy efficiency and emissions mitigation, pollution reduction, or land and resource optimization. It uses FTSE Russell Green Revenues data.[15] The granular level of the data also enables investors to measure portfolio alignment with other taxonomies and classification systems such as the EU Taxonomy.[16]

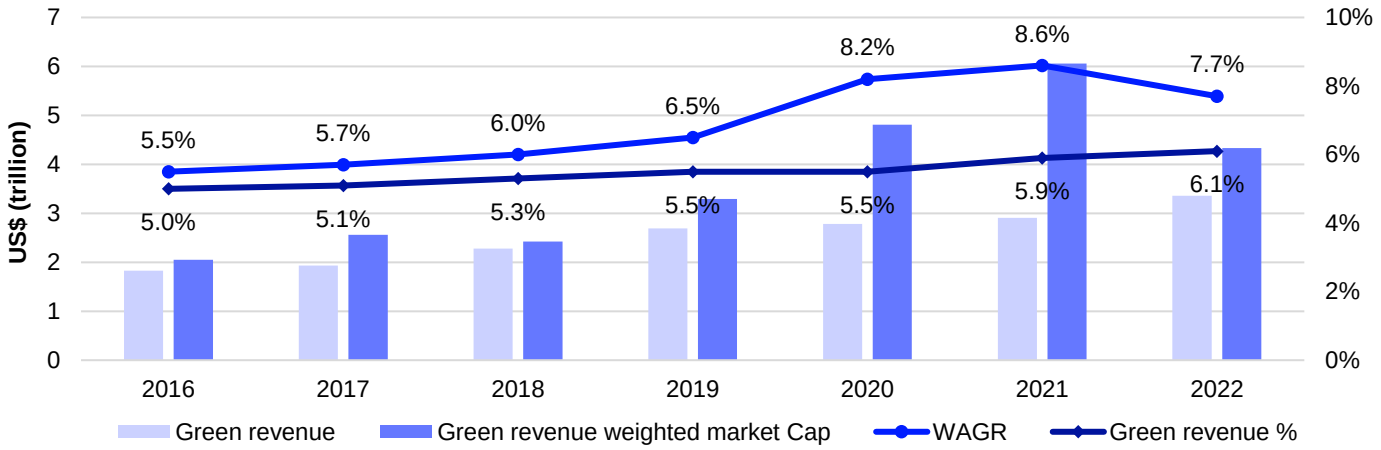
Disclosures based on green revenues are still nascent and would likely improve over time with the adoption of reporting based on different green taxonomies. In addition, climate-related disclosures in private markets, including green revenue data, continue to be in short supply. This limits access to comparable data across different asset classes for investors—one of the constraints of applying WAGR to a multi-asset portfolio.

Trends in WAGR

Between 2016 and 2021, the FTSE All-World's WAGR grew from 5.5% to 8.6%. It fell during the down market of 2022, but proved resilient over the whole period, recording a compound annual growth rate of 5.8% over the last six years. In comparison, FTSE All-World's unweighted green revenues record a steady year-on-year growth, increasing from 5% in 2016 to 6.1% in 2022. This reflects the 'value impact' of market capitalization as a metric, which is influenced by trends in the wider equity market.[17]

[14] The TEG on Sustainable Finance recommend measuring equity portfolio alignment with the EU Taxonomy a similar calculation to WAGR; see page 40, EU TEG on Sustainable Finance (2020), *Taxonomy: Final report of the Technical Expert Group on Sustainable Finance*.
[15] *iShares Environmental Infrastructure and Industrials ETF | EFRA*.
[16] FTSE Russell (2020). *Sizing the green economy: Green Revenues and the EU taxonomy*.
[17] FTSE Russell (2022), *Investing in the green economy 2022: Tracking growth and performance in green equities*.

Figure 3: WAGR of the FTSE All-World



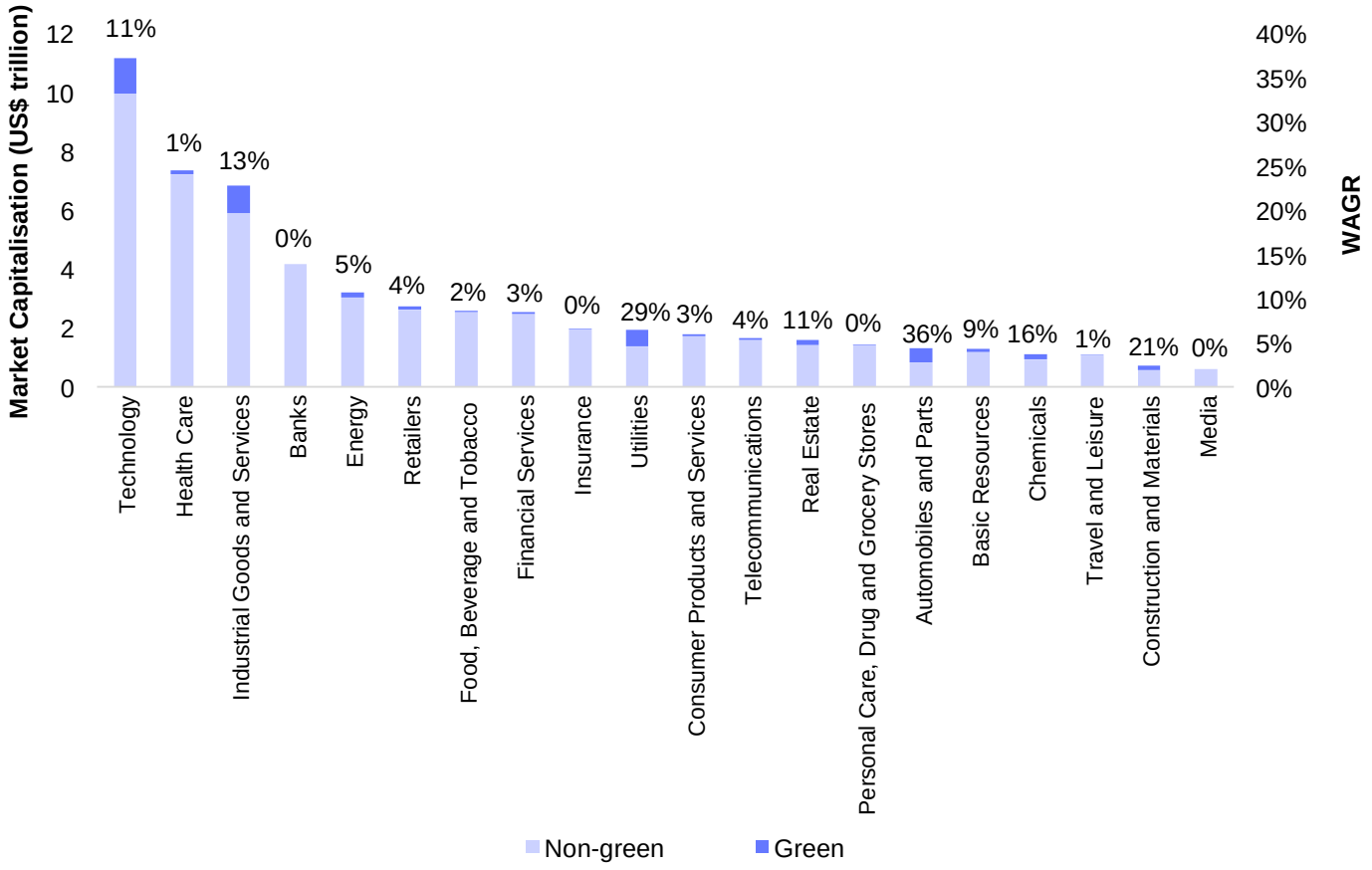
Source: FTSE Russell, April 2023.

Sectoral and regional diversity

Green revenue companies by market capitalization are diverse across industries, although they tend to be clustered in certain large sectors, such as technology and industrial goods and services. Several industries have higher WAGR (figure 4), particularly the automotive sector (36%) and utilities (29%), driven by demand for electric vehicles and renewable energy generation. Growth in the auto industry's green revenue weighted market cap is a more recent trend, having increased by over 350% between 2019 and 2020.

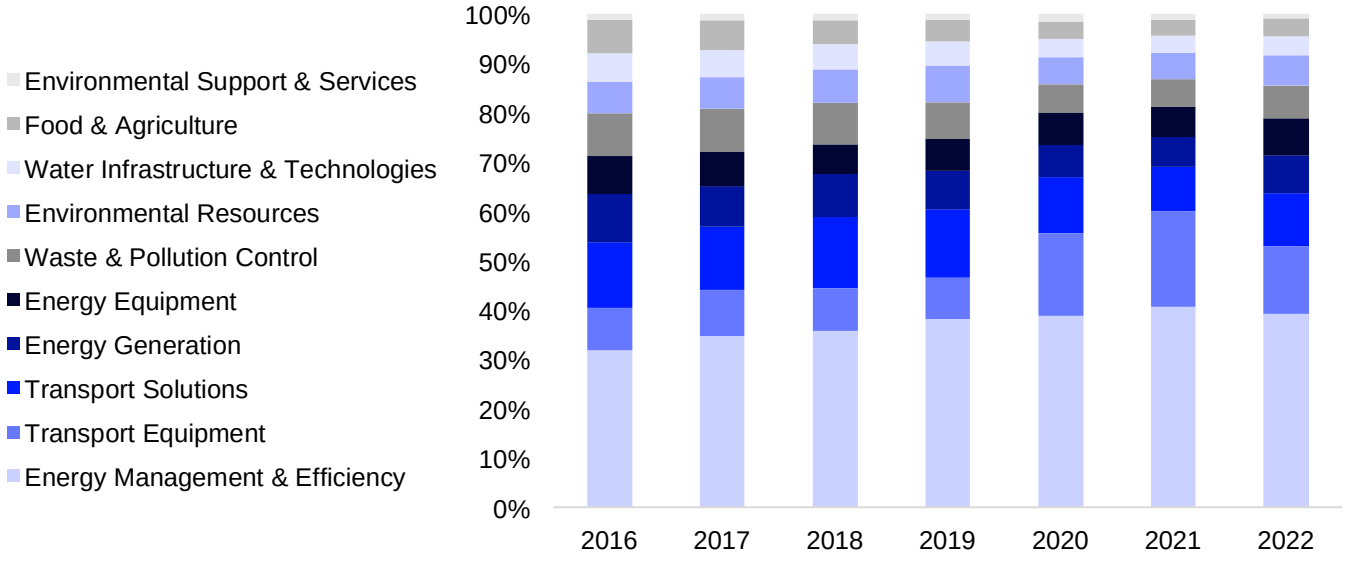
While climate solutions are often thought of as solely focused on renewable energy and electric vehicles, in reality, they represent a diverse set of activities spanning multiple points up and down value chains. For instance, energy management and efficiency have constituted at least a third of the green economy since 2016, driven by building and industry energy efficiency measures (figure 5).

Figure 4. Green revenue weighted market cap and WAGR across industries



Source: FTSE Russell, April 2023.

Figure 5. Green revenue weighted market cap by green sector (2016–2022)



Source: FTSE Russell, April 2023.

A look at green revenue weighted market cap by region shows a globally diverse distribution. North America and developed Europe dominate, together accounting for over three quarters of its size. Japan and Asia Pacific have a smaller green economy by size. Their WAGR is higher compared to other regions—largely due to Japan's large auto industry and the Asia Pacific semiconductor industry.

Figure 6. Green revenue weighted market cap by region

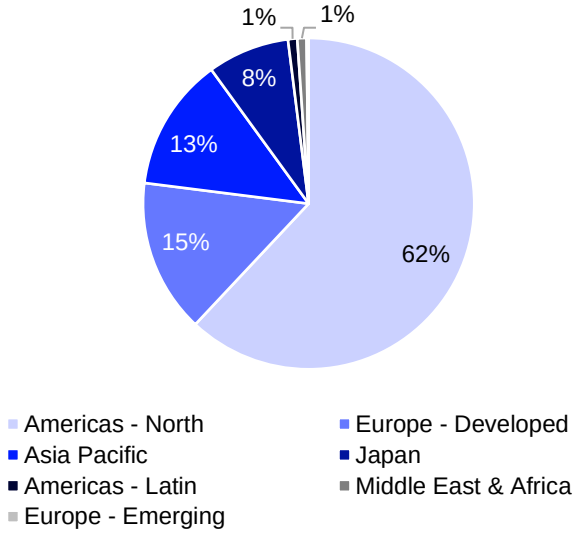
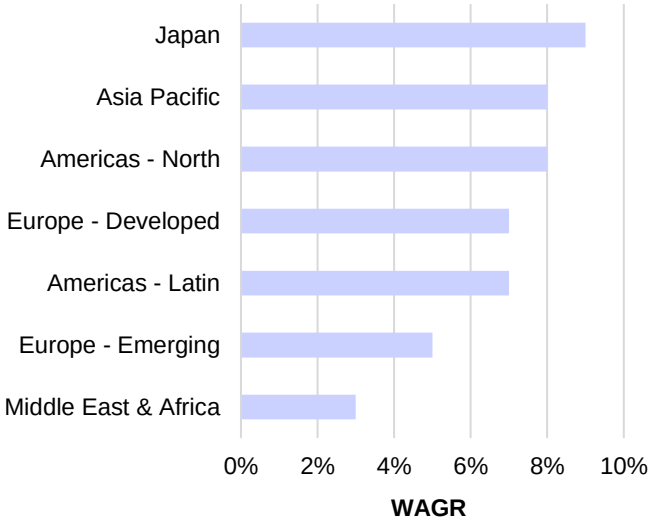


Figure 7. WAGR by region



Source: FTSE Russell, April 2023.

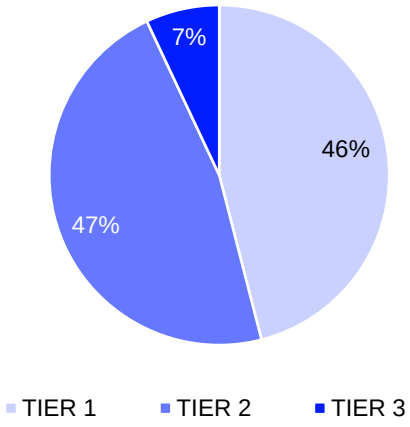
To recognize activities with both positive and negative environmental impacts, the FTSE Russell GRCS adopts a tiering approach:

– **Tier 1** covers activities with significant and clear environmental benefits (for example, solar energy generation);

– **Tier 2** covers activities with more limited but net positive environmental benefits (for example, water utilities);

– **Tier 3** covers activities that have some environmental benefits but are overall net neutral or negative. Within this schema, nuclear is classed as a tier 3 activity. Figure 8 shows that tier 3 activities only account for 7% of the green economy.

Figure 8. Green revenue weighted market cap by tier



Source: FTSE Russell, April 2023.

Section 4: WAGR in action

Highly customizable, WAGR provides investors with a wide range of options for applications. It can be used for climate reporting against frameworks such as TCFD, target setting, thematic investing or corporate engagement.

Reporting

WAGR is complementary to emissions metrics such as WACI, a recommended measure by the TCFD. Where WACI assesses a portfolio's exposure to transition risks, WAGR presents a picture of a portfolio's exposure to transition opportunities. 'Revenues from products or services that support the transition to a low-carbon economy'[18] is an example metric recommended by the TCFD to report climate-related opportunities. WAGR can be used to aggregate these in a portfolio.

By providing a more comprehensive and nuanced lens to measure a portfolio's exposure to the opportunities presented by climate solutions, WAGR offers an improvement to existing asset owner practices of green exposure disclosures. A portfolio's WAGR could be decomposed to examine the green opportunities to which it is most exposed and provide a more representative picture than standard sector classifications. For example, in the TCFD-based analysis for the financial year 2021, GPIF used WAGR to measure its portfolio companies' contributions to the green economy transition—including climate action—and decomposed them by country, tiers and green technologies.[19]

Target exposure

A portfolio can use WAGR to target an increase in its exposure to climate solutions and the broader green economy. For example, the FTSE EU Climate Benchmarks Index Series uses the target exposure framework[20] and sets the target of increased WAGR compared to the benchmark.[21]

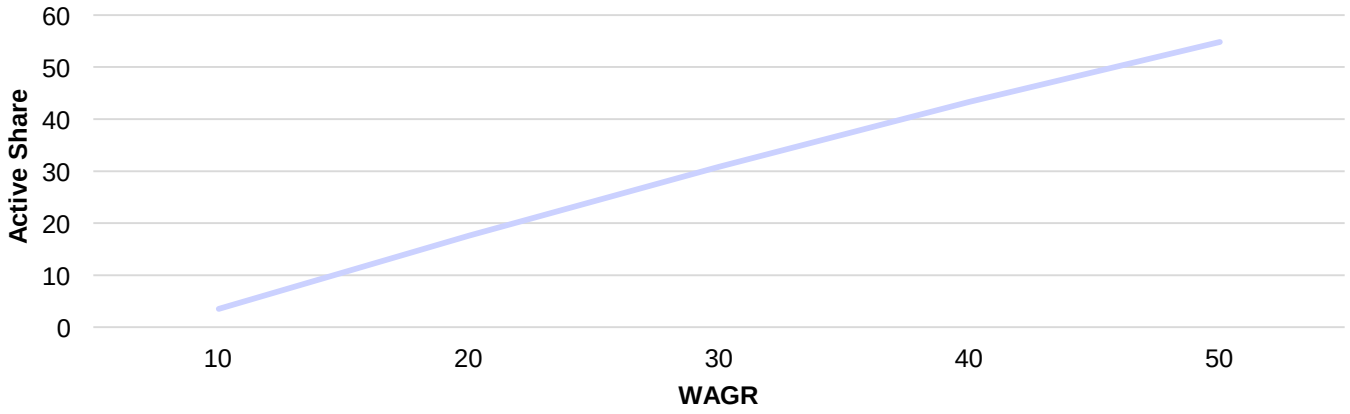
GMO, a global investment manager known in part for its early thinking about the investment implications of climate change, manages a dedicated Climate Change Strategy, which uses an active, value-based approach to climate investing. Since its inception in 2017, the strategy has achieved an average annual return of 13.6% net of fees,[22] compared to its benchmark return of 8.3%, underscoring the profitability associated with efforts to mitigate and adapt to climate change, which is largely independent of the global economy.[23] Using FTSE Russell data, the strategy provided an average WAGR of 39.3% between 2017 and 2022.

In 2022, GMO began to explore the creation of a systematic, lower-cost, higher-capacity approach to investing in climate solutions using the FTSE Russell Green Revenues data.

The transition to a green economy is still in its early stages, resulting in relatively low WAGR for market capitalization-based indices. In 2022, the WAGR of the FTSE All-World Index was less than 8%. To achieve portfolios that resemble an index but have a significantly greater WAGR, large positioning deviations are necessary. To investigate this point, GMO examined long-only, fully-invested portfolios with a minimum value of WAGR that are closest to the index.[24] Figure 9 shows the active share relative to the FTSE All-World Index of such portfolios with varying minimum levels of WAGR—the higher the WAGR requirement, the greater the active share needed to reach that requirement.

[18] TCFD (2021). *Guidance on Metrics, Targets, and Transition Plans*.
[19] GPIF (2022). *FY2021 Analysis of Climate Change-Related Risks and Opportunities in the GPIF Portfolio*.
[20] FTSE Russell (2020). *Target Exposure: Investment applications and solutions*.
[21] FTSE Russell. *EU Climate Benchmarks*.
[22] Performance data quoted represents past performance and is not predictive of future performance. Please click here for more recent performance.
[23] As of 31st January 2023.
[24] Here, distance between two portfolios is measured by taking the Euclidean norm of the difference between their respective weight vectors.

Figure 9. Active share required rises with higher WAGR needs



Source: GMO, April 2023.

We also find these portfolios have concentrated exposures to certain countries and industries (figures 10 and 11). For example, a portfolio with 50% WAGR has a 14% overweight on China and an 18% underweight on the United States. The next largest country over/underweight is a mere 1%. At the industry level, this portfolio has a 13% overweight on utilities, and a 10% underweight on financials. The next largest industry over/underweight is 6%, which is not as extreme a decline compared to the country allocations. However, some investors may still prefer greater diversification at the industry level.

One approach to mitigating the issues of concentrated country and sector exposures is to constrain the maximum allowed over/underweights on these factors. With a WAGR of 50% and additional constraints limiting the country and industry over/underweights to ±5%, the resulting allocations are more manageable.

Figure 10. Country over/underweights for 50% WAGR portfolios

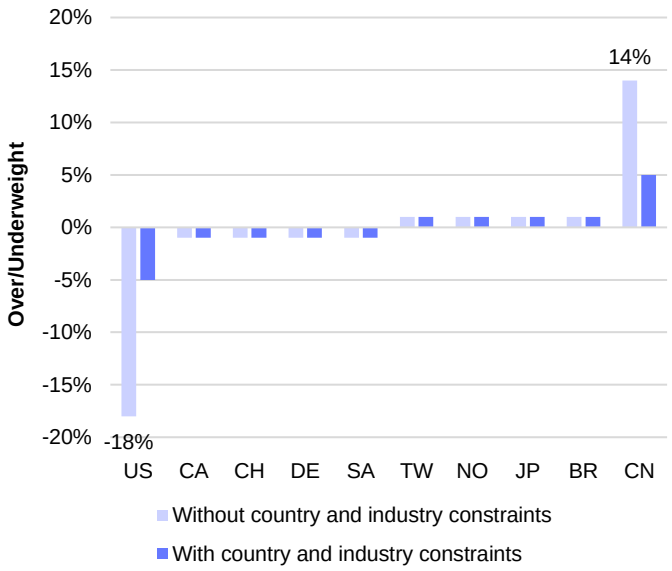
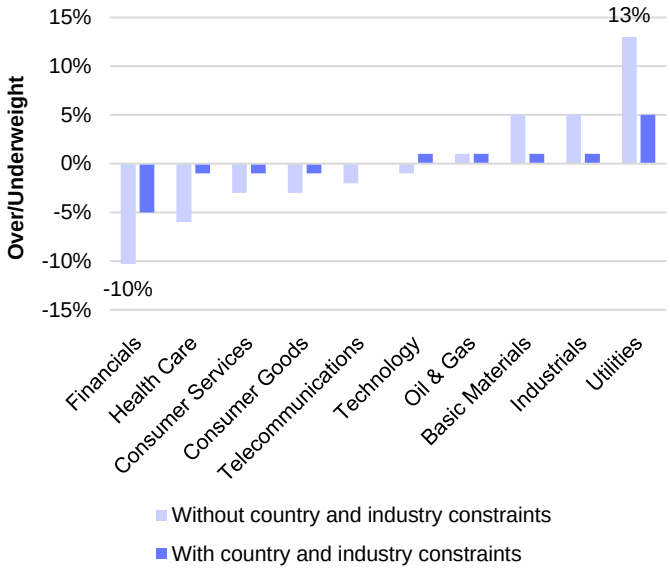


Figure 11. Industry over/underweights for 50% WAGR portfolios

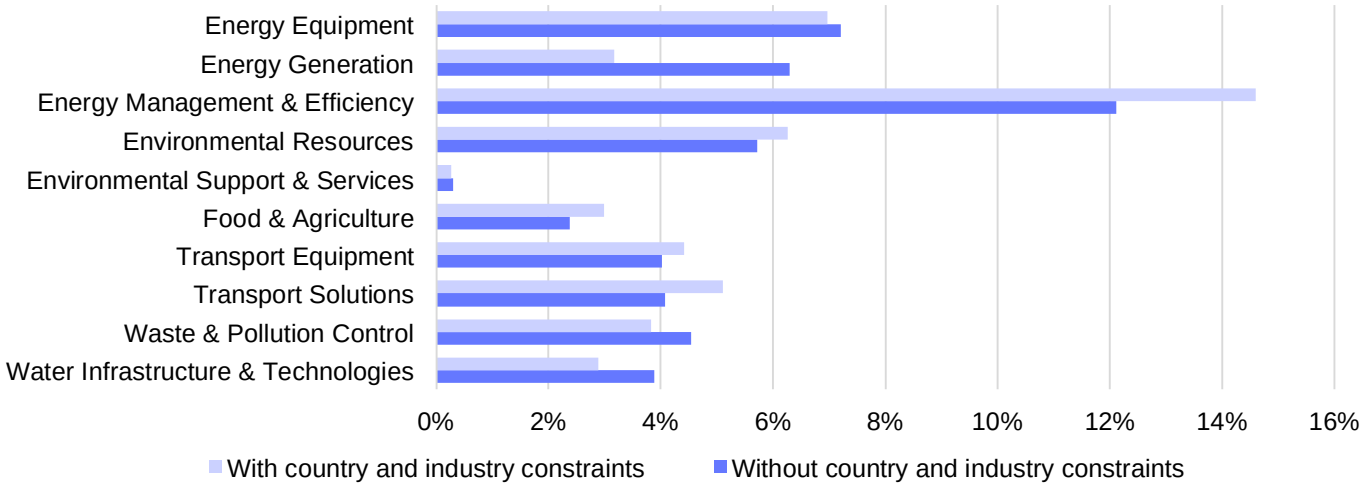


Source: GMO, April 2023.

A natural question that may arise is how these additional constraints affect portfolio exposure to climate opportunities. While both portfolios have a WAGR of 50%, they may attain this value in different ways. Although the extreme country and industry allocations have been significantly muted, it is good to note that some green characteristics of the portfolio have not been drastically altered (figure 12).

For example, when WAGR is decomposed into contributions from different green sectors, aside from a 3% reduction in energy generation, the overall distribution has retained its general shape. Moreover, 17 companies appear in the top 25 holdings in both portfolios.

Figure 12. Contributions of green sectors to WAGR



Source: GMO, April 2023.

This simple example reveals how to achieve high levels of WAGR and maintain the characteristics of the index at the country and industry level.

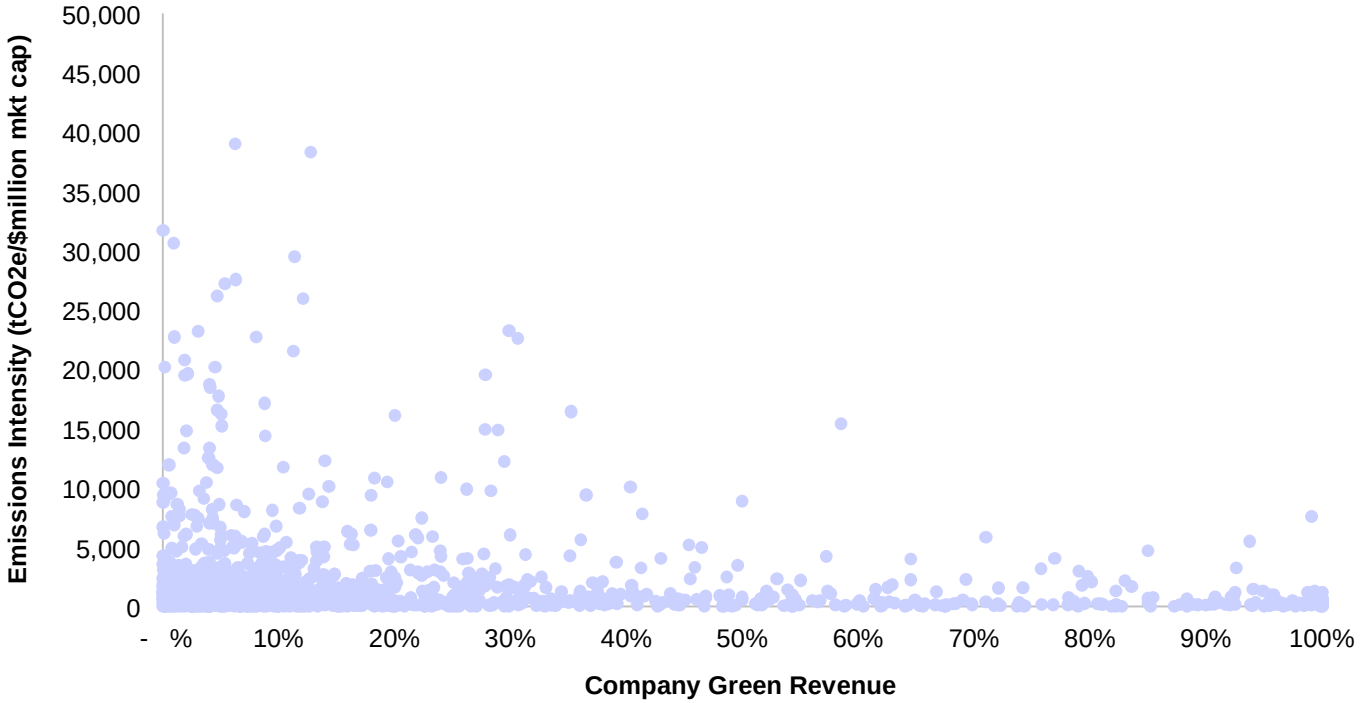
In designing its own systematic "Green Horizons" portfolio, GMO seeks to ensure that the pursuit of green revenues does not come at the expense of other environmental and societal needs. In particular, GMO believes that consideration of emissions is an essential part of sustainable investing. GMO uses scope 1 to measure direct emissions and the GMO Indirect Emissions Model[25] to measure upstream and downstream indirect emissions[26] across end-to-end company value chains. This provides a more complete picture of emissions generated throughout each firm's value chain that is comparable across firms, unlike the scope 2 and scope 3 measures outlined by the Greenhouse Gas Protocol[27].

Looking at the scatter plot of emissions intensities vs. green revenue percentages in figure 13, GMO finds that, in general, companies with lower green revenues have higher emissions intensities. However, there are times when high green revenues are accompanied by high emissions intensities. Therefore, it is essential to consider how emissions should play a role in the portfolio construction process.

While the primary objective of the GMO Green Horizons portfolio is to gain exposure to green revenues that contribute to mitigating or adapting to climate change, we also want to manage the emissions produced to generate green revenue but do so in a way that does not filter out companies that have both strong contributions to green revenue and higher emissions. Consider the case of a wind turbine manufacturer. Almost all the emissions are incurred upfront by the manufacturer, while the emissions avoided over the average 30-year life span of the turbine far exceed the initial emission cost.[28]

[25] Christopher Heelan, Kenneth Hsu, Timothy J. Wheeler, Deborah Ng (2023). Estimating Value Chain Emissions for Portfolio Construction: The GMO Indirect Emissions Model [Unpublished manuscript]. GMO Research Library, GMO LLC.
[26] GMO includes Scope 2 and Scope 3 emissions together in its Indirect Emissions Model.
[27] GHG Protocol establishes comprehensive global standardized frameworks to measure and manage greenhouse gas (GHG) emissions from private and public sector operations, value chains and mitigation actions. See https://ghgprotocol.org/.
[28] National Renewable Energy Laboratory (NREL) (2021). *Life Cycle Greenhouse Gas Emissions from Electricity Generation: Update*.

Figure 13. Companies with lower percentages of green revenues often have higher emissions intensities



Source: GMO, April 2023.

To manage significant ESG risk exposures in the Green Horizons portfolio, GMO applies the following strategies. First, it requires the portfolio to have a higher ESG score than the index,[29] ensuring the portfolio prefers companies that have effective ESG practices. Second, GMO seeks to avoid the companies that may be in breach of global norms and internationally accepted standards, such as the UN Global Compact Principles, the UN Guiding Principles on Business and Human Rights, and the OECD Guidelines for Multinational Entities.

Eliminating controversial companies and optimising the emissions intensity of the portfolio may lead to a concentration of either portfolio positions or green revenue contributions. While this is mitigated by the relative country and sector constraints mentioned above, GMO's Green Horizons portfolio seeks further diversification by managing the number of securities held in the portfolio, as well as the number of firms that contribute to the overall WAGR of the portfolio.

Taking all these considerations into account, the resulting portfolio can provide substantially more green revenue, lower emissions intensity, and minimal exposure to egregious corporate conduct. Table 3 shows the average green revenue financed by a US$1 million investment in the GMO Climate Change Strategy, the FTSE All-World Index and the hypothetical GMO Green Horizons portfolio.

[29] GMO developed a proprietary ESG Score in 2021 that weighs input from three external ESG data sources using a combination of fundamental and statistical processes.

Table 3. Substantially more green revenue financed per US$1 million investment in the GMO Green Horizon portfolio's climate-oriented and sustainable strategies than the standard market cap benchmark index

	GMO Climate Change Strategy	FTSE All-World Index	Hypothetical GMO Green Horizons portfolio
Energy Equipment	US$172,240	US$3,539	US$15,439
Energy Generation	29,405	3,707	3,831
Energy Management & Efficiency	58,466	12,104	51,812
Environmental Resources	45,583	4,262	33,729
Environmental Support & Services	5,608	360	820
Food & Agriculture	25,640	1,891	15,428
Transport Equipment	47,303	7,071	14,974
Transport Solutions	2,549	2,313	9,423
Waste & Pollution Control	32,840	3,399	13,004
Water Infrastructure & Technologies	35,870	1,870	11,714
Total	**US$456,504**	**US$40,517**	**US$170,173**

Source: GMO, February 2023

This example outlines some of the issues that were considered in building the GMO Green Horizons portfolio. At the core, the FTSE Green Revenues data provides a meaningful metric to target climate investment opportunities and quantifies the contribution of each firm to a more sustainable future. However, building a portfolio that provides an attractive risk-reward profile and meaningful exposure to green revenues is not as simple as tilting one's portfolio. Given the current low level of green revenues in public equity markets, one must apply additional techniques to reach the approximate 39% exposure GMO has achieved through its Climate Change Strategy. At the same time, investors need to be thoughtful about how they manage potential negative impacts, such as direct and indirect emissions, controversial corporate behaviours and poor ESG practices.

Thematic investing

While the tilting approach can maintain the broad universe without missing companies with low green revenues, a thematic investing approach can increase environmental impact and boost financial return of a portfolio by focusing on companies with a high degree of green revenues.

For example, the FTSE Environmental Opportunities Index Series selects companies with at least 20% green revenues, resulting in a WAGR of 46% and US$8.2 trillion market capitalization (compared to 8.4% WAGR and US$68.6 trillion market capitalization of the benchmark FTSE Global All Cap). Being growth-focused and less defensive, the index has outperformed the market over the long run, and it tends to underperform in downturns and trade at a valuation premium (figures 14 and 15).

Figure 14. Historic downturns in green equity market

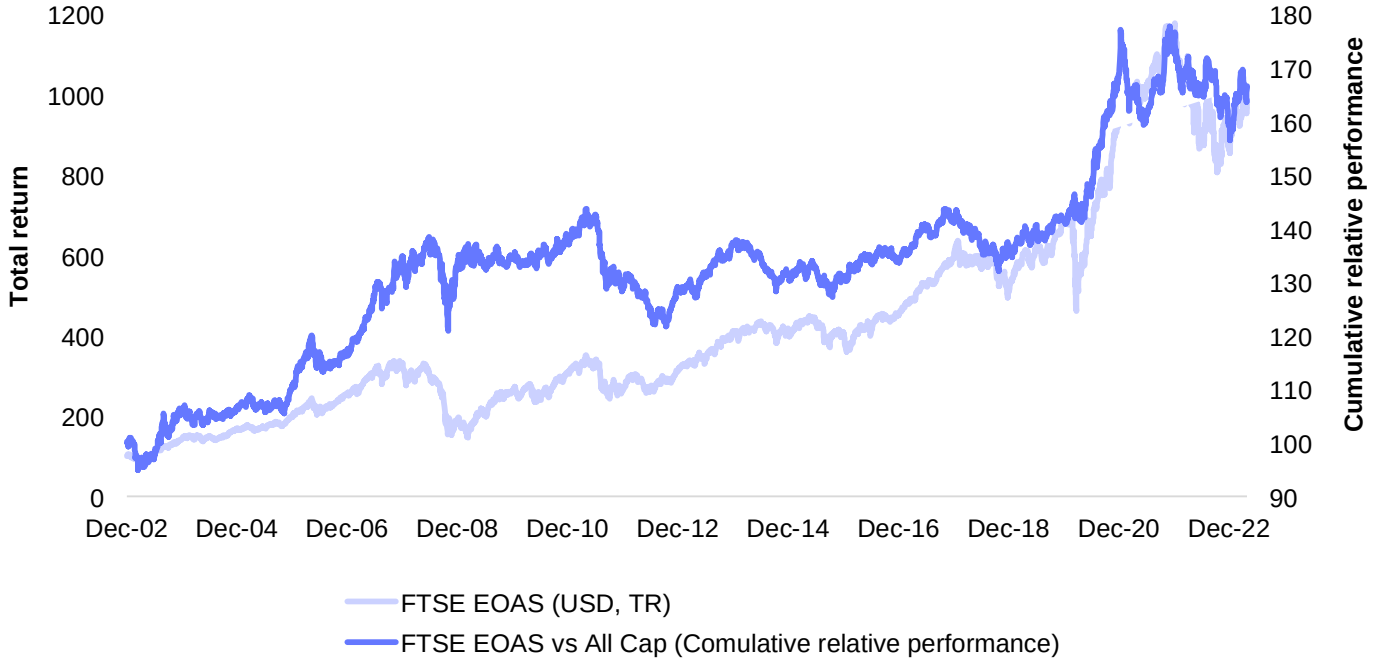


Figure 15. Fwd PE ratio: EOAS vs other indices

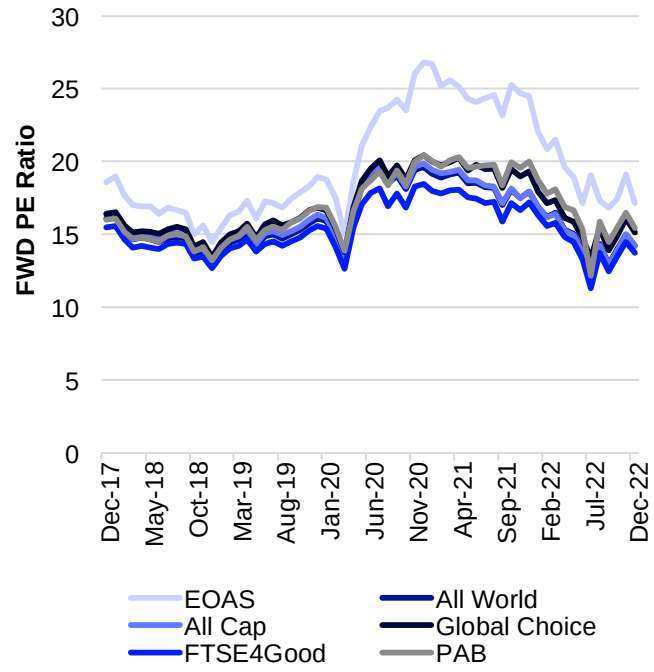
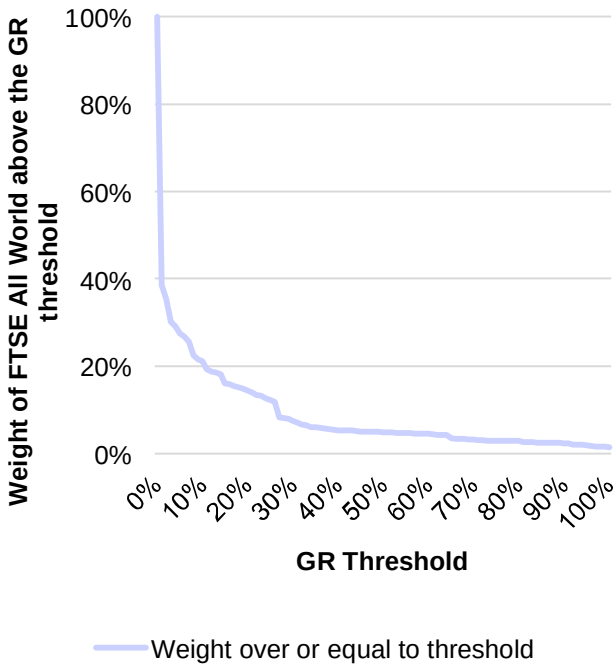


Figure 16. FTSE All World with GR threshold



Source: FTSE Russell, April 2023.

There will be trade-offs in the size of the universe and active share against green revenue thresholds. Figure 16 shows that increasing the green revenue threshold will significantly reduce the universe. In addition, compared to the tilting approach, achieving the same level of WAGR will require more active share with the selection approach.

Corporate engagement

Further to reporting and portfolio construction, investors may use green revenues as a tool to engage with corporates on decarbonization strategy—not the carbon emissions reductions by corporates themselves, but their contribution to climate solutions that enable the economy to decarbonize.

For example, the Climate Action 100+ Net Zero Company Benchmark requires companies to disclose the share of revenue from, or production of, climate solutions; and any target to increase that share, under indicator 5—Decarbonisation Strategy. Assessments against the benchmark are communicated to companies for comments, which can encourage further corporate disclosure and inform investor actions such as voting during engagement cycles.[30]

Conclusion

Transitioning to a green economy requires innovative climate solutions that enable and accelerate the decarbonization of the real economy. To systematically identify and measure these solutions, this paper examines four metrics, including green revenue, green capex, green patents, and avoided emissions in a portfolio management context. The analysis focuses on green revenue and WAGR as metrics to integrate climate solutions into portfolio construction, as they are more readily available, easier to interpret and directly linked to companies' cash flows.

While the availability of climate disclosures—especially for private assets—continues to be limited, WAGR offers a valuable tool to integrate the assessment of green opportunities into portfolio construction. Investors can apply WAGR in different ways including climate reporting, target setting, thematic investing and corporate engagement. As data and calculation methodologies for WAGR and other green metrics evolve and mature, together they can provide a comprehensive suite of indicators to measure a portfolio's exposure to climate solutions.

[30] Climate Action 100+. *Net Zero Company Benchmark: Frequently Asked Questions*.

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