RBC Global Asset Management

A guide to portfolio carbon emissions

Key takeaways:

- Carbon emissions metrics serve as a foundation for investors to assess the climate-related risks and opportunities associated with their portfolio, evaluate their contribution to climate change, and identify companies to engage with.
- To truly understand the impact of climate change on their portfolio, investors must combine portfolio carbon emissions data with forward-looking metrics – such as issuers' climate targets, temperature alignment, and scenario analysis.

At RBC Global Asset Management (RBC GAM), we believe that integrating environmental, social, and governance (ESG) factors into our investment approach supports our fiduciary duty and empowers us to enhance the long-term, risk-adjusted performance of our portfolios. Climate change is one such factor.

Climate change is caused by rising greenhouse gas (GHG) emissions – as GHG emissions accumulate in the atmosphere and trap heat, global average temperatures increase. To avoid the worst impacts of climate change, the world needs to limit global warming to well below 2°C, and preferably to no more than 1.5°C by the end of the century. According to some of the most reputable science studies, in order to meet this goal, GHG emissions must decline by approximately 45% by 2030 (relative to 2010 levels), and reach net-zero emissions by 2050 or sooner.[1] In order for the world to achieve this level of emissions reduction, decarbonization will need to take place across the entire value chain for all sectors, industries, and geographies.

Understanding the carbon emissions profile of an issuer and portfolio is the starting point for assessing if or how climate change may pose a material investment risk. It helps investors identify current or potential risks due to asset stranding, cost increases from climate policies such as carbon pricing, or revenue impacts due to shifts in consumer demand. Depending on the metrics used to assess carbon emissions, this type of analysis can also provide a view on the carbon efficiency of investments as well as the portfolio's contribution to global GHG emissions.

While carbon emissions analysis is necessary and important, it is also essential to recognize and understand some of the limitations and challenges of this analysis. Most notably, carbon emissions offer a static, backwards-looking viewpoint. They tell you where a portfolio has been, but not necessarily where it is going, or how well positioned investee companies are for the transition to a net-zero economy. For active investors, carbon emissions analysis provides a foundation for further investigation into how issuers are managing carbon risks – whether they have robust climate targets and action plans, and the quality of governance oversight they have in place to manage any strategic and financial impacts from the transition to a net-zero economy. At RBC GAM, we actively engage with issuers for whom climate change is a material financial risk if they do not have a net-zero target and action plan or are lagging their peers.

In this article we provide a guide to portfolio carbon emissions. We explain how companies measure carbon emissions, what metrics are used to aggregate carbon emissions at a portfolio level, and what these different metrics do and don't tell us.

[1] Intergovernmental Panel on Climate Change (2019), Link

What is carbon accounting?

Carbon accounting refers to measuring the amount of GHGs that are emitted into the atmosphere. It's a process that takes place at the individual company or issuer level, but can also be applied to an investment portfolio that is invested in a basket of issuers.

While carbon dioxide is the most abundant and commonly referenced greenhouse gas, it's important to note that carbon accounting goes beyond carbon. There are in fact seven GHGs that are commonly measured. This list includes methane (the main ingredient in natural gas – which you may use to heat the water in your house) and nitrous oxide (also known as laughing gas – which you may have encountered the last time you visited the dentist).[2]

Molecule for molecule, these other gases contribute more to global warming than carbon dioxide – this is called their global warming potential. However, in an effort to simplify matters, greenhouse gases are typically converted and expressed in a single measurement – referred to as carbon dioxide equivalents (CO_2e). Other GHGs are converted to CO_2e based on their global warming potential, as described in Figure 1.[3]

Figure 1: Global warming potential of GHGs

Greenhouse gas	Global warming potential (GWP)
Carbon Dioxide (CO_2)	1
Methane (CH_4)	25
Nitrous Oxide (N_2O)	298
Hydrofluorocarbons (HFCs)	124 – 14,800
Perfluorocarbons (PFCs)	7,390 – 12,200
Sulfur hexafluoride (SF_6)	22,800
Nitrogen trifluoride (NF_3)	17,200

How do you decide what emissions a portfolio is responsible for?

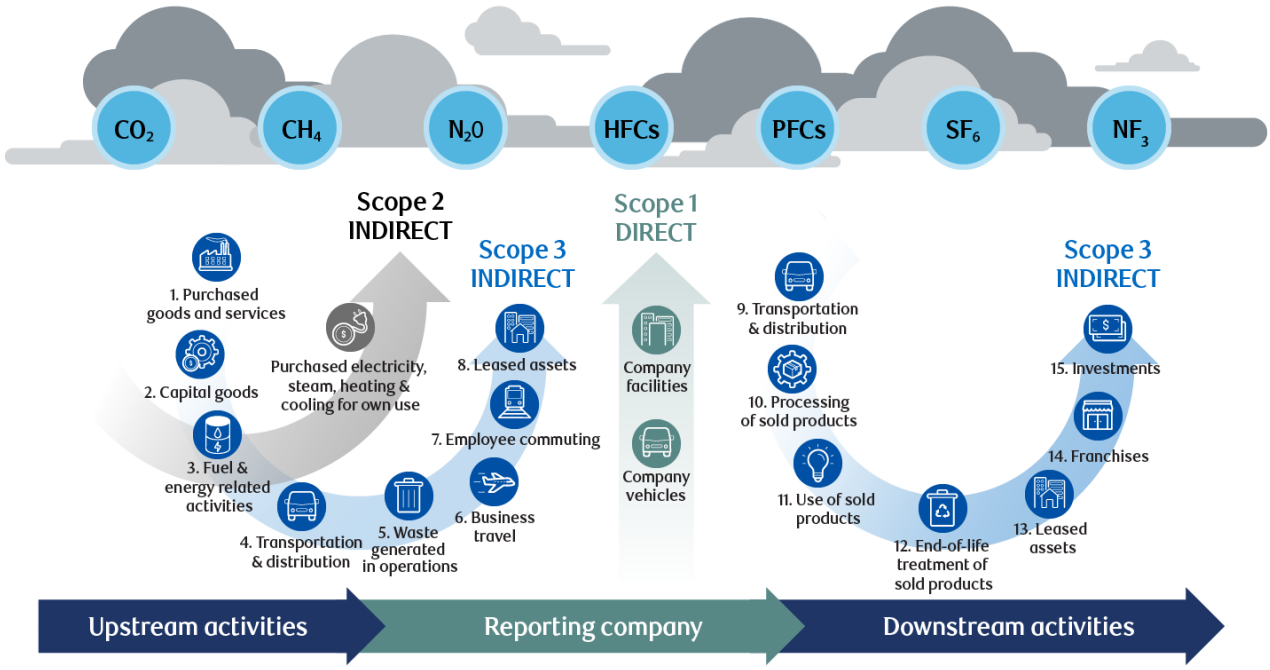
To be able to measure a portfolio's carbon emissions, we need to be able to identify and quantify the emissions associated with the underlying issuers within that portfolio. This in turn requires the identification of who owns or has responsibility for each molecule of emissions released by that issuer, which is a complex task. To make this easier, emissions are categorized into three categories, or "scopes" (see Figure 2 on the next page), and measured based on an international standard called the GHG Protocol. This allows a consistent and comparable way of determining who owns emissions across different entities, which in turn enables investors to calculate the emissions associated with an investment portfolio.

- **Scope 1** emissions occur directly from sources owned or controlled by the reporting company. This may include company-owned manufacturing facilities or vehicles.
- **Scope 2** emissions are not tied directly to a company's operations. Rather, they result from the generation of electricity, steam, heating, and cooling that's purchased and consumed by the reporting company.
- **Scope 3** emissions result from sources that are not owned or directly controlled by the company. Rather, they occur throughout their value chain. This includes emissions stemming from both upstream activities (e.g., within a company's supply chain) and downstream activities (e.g., through the use of an organization's products or services). In total, there are 15 categories of Scope 3 emissions – which vary in materiality from industry to industry.

[2] The emissions measured are the seven greenhouse gases mandated under the Kyoto Protocol, and include: Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). They are converted to carbon dioxide equivalents using the 100-year time horizon global warming potentials published by the IPCC.

[3] Source: IPCC. Based on Global Warming Potential for 100-year time horizon, Link

Figure 2: Accounting for GHG emissions across the value chain



Source: RBC GAM, GHG Protocol – Corporate Value Chain (Scope 3) Accounting and Reporting Standard.

The concept is best explained through an example. Let's take an auto manufacturer – they are directly responsible for any emissions released as part of their manufacturing process and the company's operations (Scope 1). They are also responsible for emissions produced to generate the electricity used to power their operations (Scope 2), for emissions produced by companies supplying the materials used in the production of their cars (upstream Scope 3 emissions), and for the emissions released when customers drive their cars (downstream Scope 3 emissions).[4] An investor that holds an equity share in that auto manufacturer is also considered to "own" or be responsible for a portion of the company's emissions, as an owner in the company.

One of the challenges that arises in carbon accounting however is the overlap or double-counting of emissions; one company's Scope 1 and 2 emissions are another company's Scope 3 emissions. For example, a portion of the Scope 1 and 2 emissions from the aluminum producer that supplies the auto manufacturer are included in the upstream Scope 3 emissions of the auto manufacturer. This is why, when aggregating emissions at a portfolio level, it is more accurate to only include the Scope 1 and 2 emissions of the underlying issuers. Another option is to provide the Scope 3 emissions of issuers separately from Scope 1 and 2 emissions. If a portfolio's emissions are calculated to include Scope 1, 2 and 3 emissions, this could result in a significant over-count of actual emissions released into the atmosphere.

[4] The distinction between upstream and downstream emissions is based on the financial transaction of the reporting company. Upstream emissions are related to purchased or acquired goods and services (e.g. emissions that have occurred up to the point of receipt by the reporting company). Meanwhile, downstream emissions are related to sold goods and services – occurring after the reporting company has transferred control to another entity (e.g. a customer). Source: GHG Protocol – Corporate Value Chain (Scope 3) Accounting and Reporting Standard

What does carbon emissions analysis mean for investors?

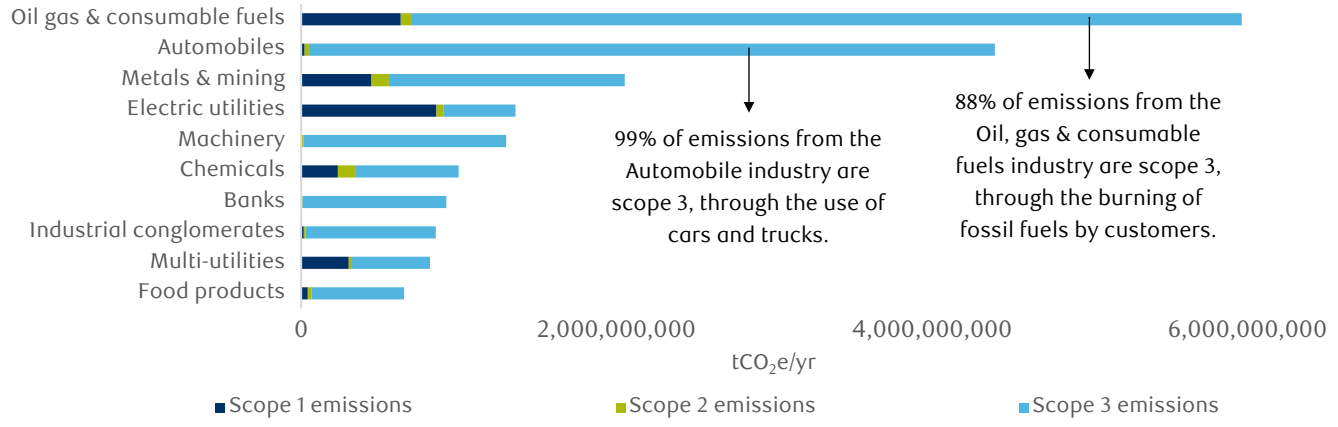
Carbon emissions analysis provides a view on the relative exposure of portfolios, sectors, and issuers to climate-related transition risks. These include policy, market, and technology risks. It also provides a view on the absolute and relative contribution of a portfolio, sector, or issuer to global emissions, and by extension to climate change.

RBC GAM conducts portfolio carbon emissions analysis on a quarterly basis for over 100 core equity and fixed income portfolios, which is then reviewed by the investment teams managing those portfolios. This internal assessment of carbon emissions considers all emissions scopes (Scope 1, 2, and 3), where data is available. We believe this is important as each scope tells a unique part of the story.

- **Scope 1** emissions are largely driven by the industry of an issuer, as the activities and outputs of some industries produce more emissions than others (see Figure 3). We must remain mindful of this when comparing Scope 1 emissions across portfolio companies; it is often more informative to compare across industry peers. This also means that a portfolio's sector and industry weights can have a significant impact on its overall emissions profile.
- **Scope 2** emissions are largely driven by the carbon intensity of the electricity grid in the region(s) where a company operates as well as by the company's industry. For instance, a company operating in a region whose power generation is largely coal- based will have higher Scope 2 emissions than a company operating in a region with more low-carbon power generation (e.g., renewables, hydro-power, nuclear etc.). In addition, a steel manufacturer will produce more Scope 2 emissions than a consumer staples company through its energy intensive smelting process.
- **Scope 3** emissions are driven by both the upstream and downstream value chain of the company. This makes these indirect emissions more challenging to measure, and to reduce. Assessing an issuer's Scope 3 emissions is useful for understanding where in the value chain the company may be exposed to risks due to increased costs from carbon pricing or shifts in consumer preferences towards low-carbon alternatives. Scope 3 emissions can therefore provide a signal of shifting market supply and demand dynamics, and identify both risks and opportunities for low-carbon innovation.

Figure 3: Emissions breakdown by scope

Top 10 emitting industries



Source: RBC GAM, MSCI ESG Climate Change Metrics, December 2021, MSCI®. Data represents the Scope 1, 2, and 3 emissions as of December 31, 2021 for the top-10 emitting GICs industries of the MSCI World Index.

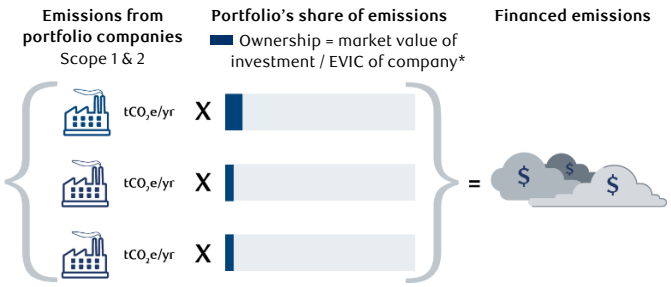
How do investors measure portfolio carbon emissions?

There are a number of different metrics or ways of measuring portfolio carbon emissions. The following section describes each of the key metrics investors use, what they do (and do not) measure, as well as the pros and cons of each.

Financed emissions

Let's begin by looking at financed emissions – the most straightforward metric. It's rooted in the logic that a portfolio's share of a company's emissions is proportionate to its ownership stake in the business. For instance, if a portfolio owns 5% of a company, it's responsible for 5% of the company's emissions. This is considered an absolute emissions metric.

Financed emissions



Source: RBC GAM. For illustrative purposes only. *EVIC = Enterprise Value Including Cash. It is computed as the sum of a company's market cap (ordinary and preferred shares), debt, and cash.[5]

- **Pros**
  A simple metric that offers the most direct measurement of a portfolio's absolute contribution to climate change. For investors, financed emissions represent their own Scope 3 (category 15 – see Figure 2 above) emissions.

- **Cons**
  Link to portfolio size makes it an inappropriate metric to use when drawing comparisons across portfolios and benchmarks. For instance, if two portfolios have identical securities and weights, but one portfolio has twice the assets under management, the larger portfolio will have twice the level of financed emissions. This issue is even more pronounced when making comparisons to benchmarks.

To illustrate the limitations of financed emissions, we've drawn up a hypothetical example in the table below. Here we consider a simplified investment universe consisting of three common stocks. We've calculated the financed emissions of two portfolios of varying sizes ($5 million and $10 million) that have the same weight (%) allocated to each company, along with the financed emissions of the market-cap benchmark.

Financed emissions of two portfolios and the market-cap benchmark

				Portfolio 1: $5 million			Portfolio 2: $10 million			Market-cap benchmark		
Company	Market cap	EVIC	Emissions	Position (weight)	Ownership	Financed emissions	Position (weight)	Ownership	Financed emissions	Position (weight)	Ownership	Financed emissions
Energy 123 Inc.	$25M	$35M	3,000	$2.5M (50%)	7%	214	$5M (50%)	14%	429	$25M (12.5%)	71%	2,143
Technology 789 Inc.	$100M	$105M	500	$1M (20%)	1%	5	$2M (20%)	2%	10	$100M (50%)	95%	476
Materials ABC Inc.	$75M	$100M	2,000	$1.5M (30%)	2%	30	$3M (30%)	3%	60	$75M (37.5%)	75%	1,500
				Portfolio 1 financed emissions: 249 tCO_2e/yr			Portfolio 2 financed emissions: 498 tCO_2e/yr			Benchmark financed emissions: 4,119 tCO_2e/yr		

Source: RBC GAM. For illustrative purposes only.

[5] Financed emissions can also be calculated using the market capitalization of the company in place of EVIC in the ownership percentage calculation. However, recent efforts to standardize and harmonize GHG accounting has seen a clear preference for using EVIC. We've seen evidence of this trend from the Partnership for Carbon Accounting, within the EU Technical Expert Group on Sustainable Finance, as well as updated Task Force on Climate-related Financial Disclosures recommendations. EVIC is also the preferential denominator when comparing portfolios comprised of both equity and fixed income holdings.

From this analysis, we can draw a few important observations:

- Portfolio 1 and Portfolio 2 have the same weight (%) allocated to each of the three securities, but
- Portfolio 2 has double the financed emissions. This variance is solely due to the size of the two portfolios and, by extension, their respective ownership share of each company.
- Meanwhile, the benchmark, which by design reflects 100% of the market cap and a significant share of the enterprise value of each company, has a considerably higher level of financed emissions.[6]

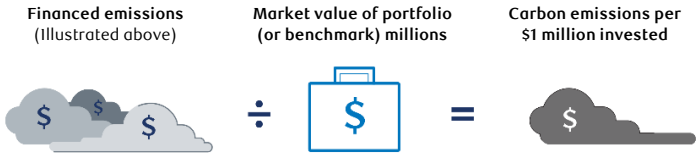
To overcome the limitations of the financed emissions metric, and facilitate comparisons across portfolios and benchmarks, it's helpful to consider measures of carbon intensity. These approaches normalize the level of emissions by different factors – including by dollars invested and revenue.

We'll explore each of these approaches below. To provide added clarity, we'll continue the hypothetical examples from above, first by outlining how each metric would be calculated for Portfolio 1, and then by bringing everything together and comparing the various metrics across both portfolios and the market-cap benchmark.

Carbon emissions per dollar invested

This metric offers insights into the carbon emissions generated by a portfolio for every $1 million invested. As illustrated below, this figure is arrived at by first calculating financed emissions, and then normalizing this by the market value of the portfolio and/or benchmark.

Carbon emissions per dollar invested



Source: RBC GAM. For illustrative purposes only.

Portfolio 1				
Financed emissions		Market value of portfolio		Carbon emissions per dollar invested (millions)
249	÷	$5M	=	50 tCO_2e / $M

- **Pros**
  This metric can be used to compare portfolios of any size, and also offers context with a simplified measure that's easy for investors to grasp.
- **Cons**
  Given that the market value of the portfolio is used in the equation, this metric can be sensitive to fluctuations in financial markets. For instance, a sharp and sudden decline in markets may reduce the value of a portfolio. With no impact on the level of financed emissions, this would result in a higher level of carbon emissions per dollar invested.

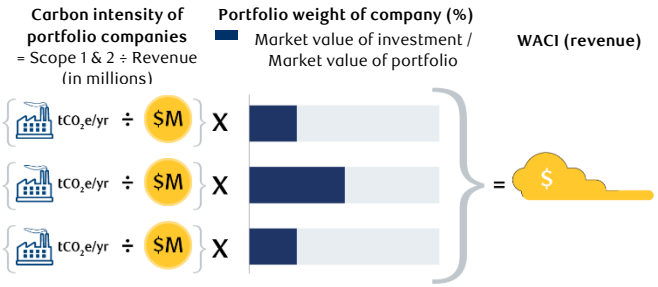
The two metrics we've reviewed thus far both allocate emissions based on an investor's ownership stake in a company (position size ÷ enterprise value). To provide a representative measure of a portfolio's exposure to carbon-intensive companies, we'll now switch to the weighted average carbon intensity metric, which as the name implies, apportions carbon emissions based on portfolio weights and exposure.

[6] Note: the market cap benchmark does not reflect 100% ownership of the company for purposes of assigning ownership of emissions. Utilizing EVIC in the financed emissions calculation ensures emissions are also assigned to investors holding securities comprising of other aspects of the company's capital structure – e.g. preferred shares and debt.

Weighted average carbon intensity (WACI) by revenue

This metric indicates the level of carbon emissions a portfolio generates per dollar of revenue from the underlying portfolio companies – offering a gauge of carbon efficiency in terms of output. It's arrived at by calculating the carbon intensity of each portfolio company, and then computing the weighted average based on portfolio weights.

Weighted average carbon intensity (revenue)



Source: RBC GAM. For illustrative purposes only.

Portfolio 1

Company	Emissions		Revenue		Carbon intensity		Portfolio weight		WACI
Energy 123 Inc.	3,000	÷	$15M	=	200	×	50%	=	100
Technology 789 Inc.	500	÷	$25M	=	20	×	20%	=	4
Materials ABC Inc.	2,000	÷	$30M	=	67	×	30%	=	20
							Portfolio 1 WACI (revenue)		124

- **Pros**
  This metric can be applied across asset classes, and is helpful in identifying exposure to carbon-intensive companies relative to other portfolios and/or a benchmark.

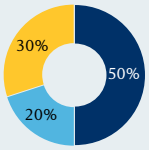
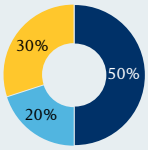
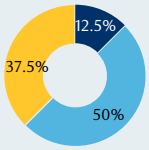
- **Cons**
  The metric doesn't take into account inventories produced during the year but not yet sold, it may be influenced by non-climate factors (such as the business cycle's impact on revenue), it may mischaracterize companies as carbon efficient if they have higher pricing levels than their peers, it is sensitive to outlier values, and intensity based on revenue may not be perfectly comparable across sectors.

Comparing metrics for calculating portfolio carbon emissions

A direct comparison of the three carbon emissions metrics for the hypothetical portfolios (see table on next page) illustrates the importance of normalizing emissions, and the implications of each approach.

- **Financed emissions:** The benchmark has a much higher level of financed emissions. This is intuitive as, by definition, the benchmark reflects 100% of the market cap, which in turn reflects a significant ownership percentage of the enterprise value of each company.

- **Carbon intensity metrics:** In comparison, for each carbon intensity measurement, the results are identical for Portfolio 1 and Portfolio 2. This is intuitive given that both portfolios hold the same securities and the same weights (%). The most meaningful takeaway comes from comparing the hypothetical portfolios to the benchmark. Here we can see that the benchmark is more carbon efficient, largely due to both portfolios holding a higher percentage weight in the more carbon-intensive company (Energy 123 Inc.) and underweight positions in the more carbon-efficient company (Technology 789 Inc.) relative to the benchmark. This demonstrates how differences in over/under-weight decisions can impact overall portfolio carbon intensity.

		Portfolio 1	Portfolio 2	Market-cap benchmark
Portfolio weights	Energy 123 Inc. Technology 789 Inc. Materials ABC Inc.			
Market value		$5M	$10M	$200M
Financed emissions (tCO_2e)		249	498	4,119
Carbon intensity metrics	Carbon emissions per dollar invested (tCO_2e/$M)	50	50	21
	WACI (revenue)	124	124	60

Carbon accounting as a foundation for broader climate analysis at RBC GAM

RBC GAM supports the global goal of achieving net-zero emissions by 2050 or sooner. Our Net-Zero Ambition articulates how we are supporting this goal by integrating climate change into our investment process, measuring and reporting on the carbon emissions and net-zero alignment of our investments, and by engaging with issuers for whom climate change is material if they have not yet set net-zero targets and robust action plans.

Carbon emissions analysis is a starting point for how we measure and assess climate-related risks as it provides a view of the relative exposure and concentration of climate-related risk, and can drive deeper investigation into a company's management and mitigation of those risks. While essential, carbon emissions analysis only tells part of the story. It is a static and backwards-looking metric that does not provide a view on progress companies are making to reduce emissions, their investments in low-carbon technologies, or an indication of their performance or valuation under a net-zero transition or other climate scenario.

It is for this reason that RBC GAM investment teams have access to a range of climate data at both issuer and portfolio levels. This includes over 900 data points that allow each team to assess how a security, issuer, portfolio, or sector may be affected by key climate impact drivers – policy risk, technology opportunities, and both physical risks and opportunities.

We use climate data that is directly reported by companies as well as data collected from external datasets (e.g., global patents), third-party research, and/or estimated and modelled data. Where possible, independently verified and reported data is used, and supplemented by direct research collected through due diligence and engagements. Some examples of climate data used by investment teams include:

- **Carbon emissions data for Scope 1, 2, and 3**, which includes reported and estimated data, time series data, and both economic activity and physical activity based data.
- **Transition risks and opportunities**, which includes the identification of issuers at risk of asset stranding, and those with poor-quality transition risk management, as well as those that earn revenue from climate solutions (e.g., energy efficiency, sustainable water, etc.) and/or are investing in low-carbon technologies.
- **Climate targets**, which includes the scope, type, and timeline of company-level emission reductions targets, and whether the target is science-based or net-zero aligned.
- **Governance oversight** of climate targets and strategies.

- **Implied temperature rise**, which provides an indication of what temperature pathway an issuer or portfolio aligns with. This indicates what the global temperature rise would be in 2100 if the global economy looked like that issuer or portfolio.
- **Climate value at risk**, which provides the potential change in valuation of an issuer or portfolio under a range of climate scenarios.

Climate change is a widespread and systemic risk. Its impact on the economy, markets, and society is complex and varied. Understanding and responding to the effects of climate change requires investors to use advanced data and analytics to assess financial risks and opportunities. It also requires us to measure ongoing impacts so that we can monitor and adjust our investment approach, when necessary.

At RBC GAM, we recognize the metrics used to measure climate risks and opportunities are constantly evolving. We're committed to staying well informed and aligned with best practices as they emerge over time. Through this evolution, maintaining a detailed understanding of the carbon emissions of our portfolios is expected to remain a foundational element.

Review more climate analysis tools in Our Approach to Climate Change and RBC GAM TCFD Report 2021.

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