



Aidan van Niekerk  
Quantitative Analyst  
April 2023

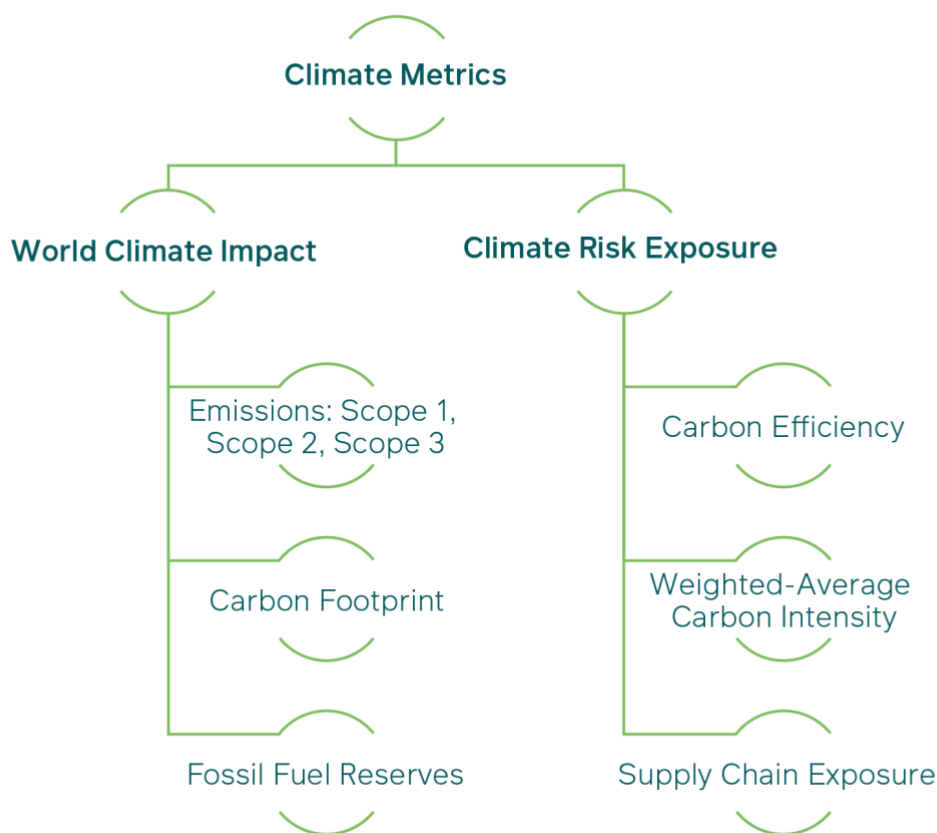
## A hot topic: Understanding climate metrics and avoiding carbon confusion

### Key take-aways

- There are several key metrics that are crucial for investors concerned about climate change that can be applied to single companies and individual assets, as well as to portfolios and financial indices.
- We explain these measures and how they are used with the aim of helping investors use them more widely, and reducing confusion among them.

Climate change has become an undeniable reality. In fact, there is in excess of 99% consensus among peer-reviewed publications that it is human-caused (according to Lynas et al., 2021). It is a non-trivial fact that builds a strong case is the mitigation of emissions of greenhouse gasses (GHG) and measuring them appropriately. The world of finance does not operate in isolation but rather is interwoven into the fabric of society and the globe's economic system. Likewise, investors are savvy and do not make decisions in isolation. The rise of responsible and sustainable investing is evidence that more investors are wary about the world's and their investments' exposure to the risks borne by climate change. Fortunately, there is an entire class of metrics that allow investors to quantitatively measure these risks and are explored, explained, and examined in this article.

Before one delves into the nitty-gritty of numbers and formulae, it's important to understand that there are two topics metrics fall under: *world climate impact* and *climate risk exposure*. World climate impact relates to a company's carbon emissions and its impact on global temperatures. Climate risk exposure quantifies a company's revenue and business exposure to adverse consequences of climate change. Pictures speak more than words, but flowcharts are handy too:



## World Climate Impact

### Emissions: Scope 1, Scope 2, Scope 3

A company's emissions are measured in terms tonnes of GHG emitted per year (tCO<sub>2</sub>) and classified as scope 1, 2, or 3. Scope 1 refers to emissions directly emitted by the company from its vehicles, processing equipment, generators, furnaces, etc. Scope 2 is the indirect emissions such as electricity consumption. Scope 3 refers to emissions over which the company does not have control but has influence – such as the use of its products, transportation of materials, or business travel.

## **Carbon Footprint**

Larger companies tend to have more emissions by virtue of their larger scale operations. To account for the emissions discrepancy caused by company size and allow one to compare different sized companies, the carbon footprint metric was introduced. Carbon footprint is calculated as the [sum of scope 1 and 2 emissions] divided by [enterprise value including cash (EVIC) in US\$ millions] and measured as tonnes of GHG per US\$1million invested (tCO<sub>2</sub>/\$1m invested). In a sense, carbon footprint gives an indication of GHG emissions ownership for every \$1m invested.

## **Fossil Fuel Reserves**

This metric quantifies how many tonnes of GHG emissions will be released should a company burn proven and probable fossil fuels it holds – which includes sources such as fossil fuels from the ground for which extraction is economically feasible. This method helps an investor to get a sense of relative levels of stranded asset risk. It's calculated as [fossil fuel reserve embedded emissions (FFREE)] divided by [enterprise value including cash (EVIC)]. Like carbon footprint, dividing by EVIC allows for fair comparison across companies of different sizes.

## **Climate Risk Exposure**

### **Carbon Efficiency**

Carbon efficiency aims to capture the relationship between a company's emissions and its revenue. This is based on the assumption that companies that have high emissions relative to their revenue have a higher exposure to risks arising from climate change – directly from negative climate outcomes but also costs arising from new regulatory or tax measures. Carbon efficiency is simply the [sum of scope 1 and scope 2 emissions] divided by [revenue in US\$ millions] and measured as tonnes of GHG per US\$1m of revenue.

### **Weighted Average Carbon Intensity (WACI)**

WACI is a measure that is not considered on a company level, but rather on a portfolio or index level. WACI, as the name suggests, is a weighted average of the carbon efficiency metrics of a portfolio – i.e., each portfolio constituent's carbon efficiency is multiplied by its portfolio weight and then all constituent values are summed together. On an index and portfolio level, it is useful to calculate the portfolio's or index's exposure to carbon-intensive

companies. It is also expressed as tonnes of GHG per US\$1m of revenue (tCO<sub>2</sub>/US\$1m revenue).

## Supply Chain Climate Exposure (SCCE)

SCCE is perhaps best illustrated by means of example: an IT company would typically have a very green score in terms of its carbon footprint and carbon intensity measures since the nature of its business is not carbon intensive at all. However, suppose an IT company primarily generates revenue from software for oil extractors and coal miners. Traditional metrics fail to capture the climate risk exposure this IT company would have due to its customer base (or supply chain). In their paper, Hall et al. (2022) propose the supply chain climate exposure calculation. To arrive at the exposure metric, one simply multiplies a customer's carbon efficiency with the percentage of revenue they are responsible for.

Customer	Revenue %	Carbon efficiency
A	20%	480
B	50%	120
C	30%	200

Repeat it for every customer and sum them all to get the supply chain climate exposure expressed as tCO<sub>2</sub>/US\$1m revenue. For example:

$$SCCE = (20\% \times 480) + (50\% \times 120) + (30\% \times 200) = 216$$

Climate metrics are by their nature technical, and it takes some time to become familiar with them, but in the words of Polonius: "Though this be madness, yet there is method in 't". To that end, it may be useful to keep a little cheat-sheet on hand to mitigate the madness.

	Metric	Calculation	Unit	Use
World Climate Impact	Emissions – Scope 1, 2, 3	<u>Sourced from</u> company reports	tCO <sub>2</sub> per year	Gauge the absolute impact of a company's emissions on the climate.
	Carbon Footprint	$\frac{\text{Scope 1} + \text{Scope 2}}{\text{EVIC } (\$1\text{m})}$	tCO <sub>2</sub> /\$1m invested	Compare the emissions of companies with one another.
	Fossil Fuel Reserves	$\frac{\text{FFREE}}{\text{EVIC } (\$1\text{m})}$	tCO <sub>2</sub> /\$1m invested	Compare relative levels of stranded asset risk and future additional GHG emissions.
Climate Risk Exposure	Carbon Efficiency	$\frac{\text{Scope 1} + \text{Scope 2}}{\text{Revenue } (\$1\text{m})}$	tCO <sub>2</sub> /\$1m revenue	Understand the link between a company's emissions and revenue and compare across companies.
	Weighted-Average Carbon Intensity (WACI)	$\sum_{i=1}^n \left( \frac{\text{Scope 1} + \text{Scope 2}}{\text{Revenue } (\$1\text{m})} * w_i \right)$	tCO <sub>2</sub> /\$1m revenue	Estimate an index or portfolio's exposure to carbon intensive companies.
	Supply Chain Climate Exposure (SCCE)	$\sum_{i=1}^n (\text{Efficiency}) * \text{Revenue}_i$	tCO <sub>2</sub> /\$1m revenue	Calculate a company's revenue and supply chain exposure to carbon intensive companies.

An article of this nature does limit the depths to which one can go to explain the calculations; however, both data providers and index providers typically present the calculated metrics on a company and index level. Arguably, it's of more importance to understand the metrics and what they may tell an investor rather than technical details of formulae. Papers explaining climate metrics in more detail are provided in the accompanying reference list for a reader who is fussed by formulae.

Understanding a company's contribution to climate change, as well as its exposure to associated risks, will only become more important as climate change progresses. It's a textbook example of the intersection of the financial industry and global society. Climate metrics are but our first ports of call for examining and understanding this intersection.

<https://www.mandg.co.za/insights/articlesreleases/a-hot-topic-understanding-climate-metrics-and-avoiding-carbon-confusion/>

## References

- Lynas, M., Houlton, B.Z., & Perry, S.L. (2021). Greater than 99% consensus on human caused climate change in the peer-reviewed scientific literature. *Environmental Research Letters*, 16.
- Hall, G., Liu, K., Pomorski, L., Serban, L. (2023) Supply Chain Climate Exposure, *Financial Analysts Journal*, 79:1, 58-76.

# Consider this



Carbon metrics - investment themes: S&P Dow Jones Indices (no date) S&P Global Homepage. Available at: <https://www.spglobal.com/spdji/en/landing/investment-themes/carbon-metrics/> (Accessed: 16 March 2023).