MSCI

RESEARCH INSIGHT

Carbon Footprinting Demystified

Navigating carbon metrics in a rapidly changing landscape

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Executive summary

Assessing the carbon footprint of a portfolio is the first step in addressing the investment implications of climate change.[1] Carbon footprinting sets a baseline to inform future actions, which can range from reporting and engagement to decarbonization and integrated risk management.

Since our initial publication of "Carbon Footprinting 101" in 2015, different metrics and names have been developed in the market. Investors can thus find it challenging to navigate the complex and fast-evolving landscape and to decide which metrics and underlying inputs to use.

This guide provides a clear and intuitive structure that leads investors through the evaluation and application process, including:

1. **Selecting the appropriate carbon-footprint metrics** based on measurement objectives and varied use cases.
2. **Choosing calculation inputs** based on the underlying portfolio constituents and adjusting as necessary.
3. **Expanding the measurements to asset classes beyond corporates and sovereigns** in the portfolio, if applicable.
4. **Tracking the portfolio's carbon-emissions profile over time** by conducting an attribution analysis.

As a first step, this guide provides two decision trees which outline the key criteria investors could consider when selecting carbon-footprint metrics for their portfolios.

- For investors required to, or who wish to, **follow a specific reporting standard**, the first decision tree lists metrics recommended by each of the seven widely adopted initiatives and regulations.[2]
- If several carbon metrics are recommended by a standard, or if investors wish to **select metrics based on their sustainable-investment objective**, the second decision tree may be useful. It classifies metrics via potential suitability to measure climate impact or emissions-based risks.

The next section contains a summary table that provides a more **granular comparison of each carbon metric**. When multiple metrics are in scope, investors may choose based on certain pros and cons and corresponding use cases. We also include detailed calculation methods, examples and variations of inputs in calculations.

For portfolios that consist of asset classes other than corporates and sovereigns, investors may wish to refer to the approaches proposed by the **MSCI Total Portfolio Footprinting**[3] solution for computing the carbon footprint of each asset class.

Lastly, an **attribution framework** created by MSCI ESG Research is provided to demonstrate how investors can identify the drivers of changes in portfolio emissions and track emissions profiles over time.

[1] In this report, the use of "carbon" refers to total greenhouse gas (GHG) emissions (CO2 equivalent (CO2e)).

[2] The seven initiatives and regulations include PCAF, TCFD/ISSB, GFANZ, IIGCC-PAII, SFDR, EU PAB, and CSRD/ESRS.

[3] The MSCI Total Portfolio Footprinting methodology is based on the Partnership for Carbon Accounting Financial's (PCAF) "Global GHG Accounting and Reporting Standard for the Financial Industry," and extends its approach to additional asset classes for which PCAF does not yet provide an official guide.

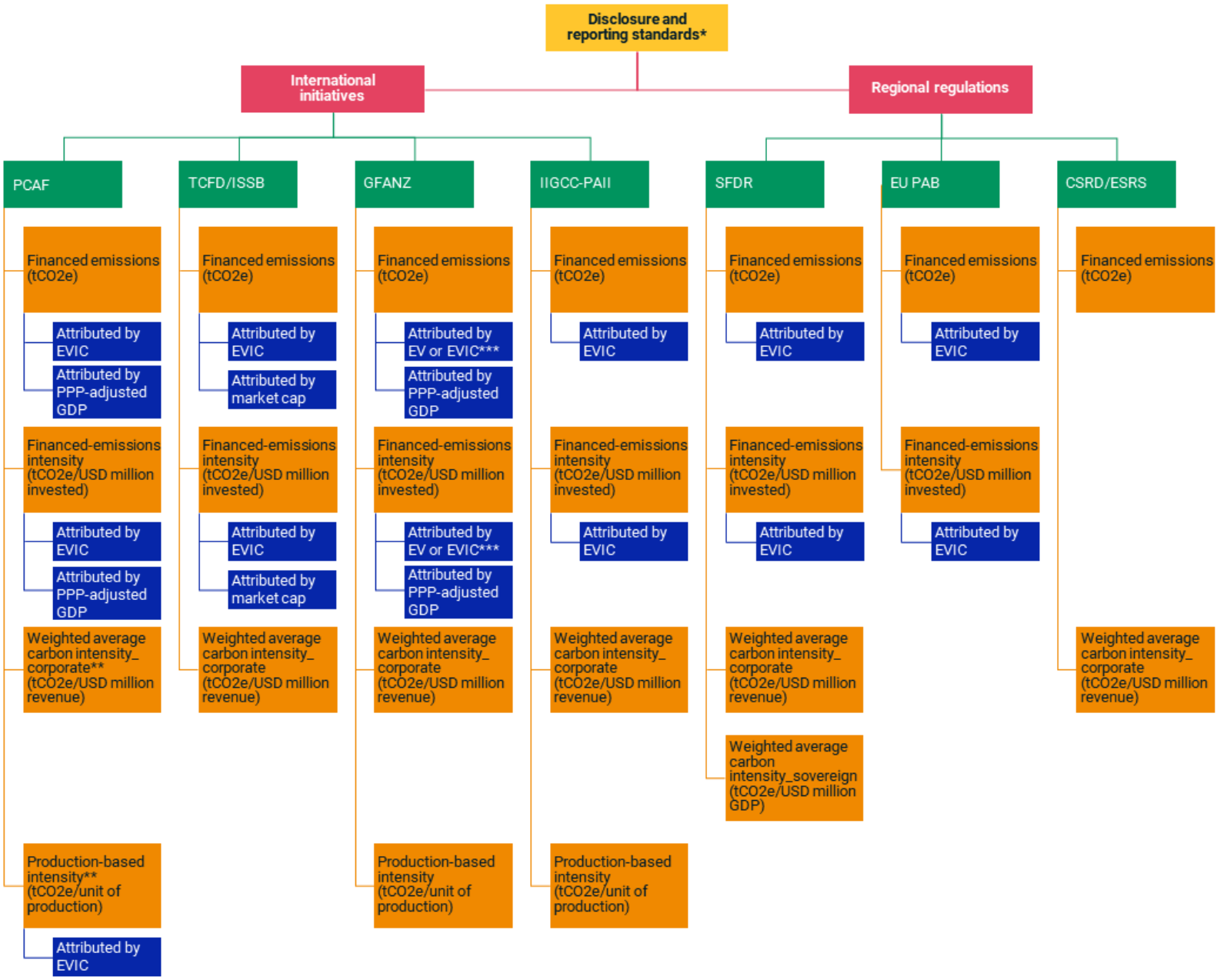
Selecting carbon-footprint metrics

This section outlines two sets of criteria investors may consider when selecting carbon-footprint metrics: alignment with reporting standards and investment objective. Investors can choose to follow either, or both decision trees, based on their needs. In addition to metric selection, the second decision tree (Exhibit 2) outlines options for potential denominator adjustments for each metric. Both trees were created with a focus on corporate and sovereign constituents. Treatment of other asset classes can be found in the "Carbon footprinting beyond corporates and sovereigns" section on page 18 of this guide.

Alignment with reporting standards

The decision tree in Exhibit 1 includes four globally recognized voluntary initiatives and three pervasive regulatory schemes (which are all in the European Union) in force as of April 2024 — these are detailed under the exhibit. All of these reporting standards ask investors to measure the total absolute financed emissions of their portfolio along with select intensity metrics. The recommended attribution factors (defined as the share of total annual greenhouse gas (GHG) emissions of the borrower or investee that is allocated to the loan(s) or investment(s), according to the PCAF standard) and preferred intensity metrics may, however, vary among standards.

Exhibit 1: Decision tree based on reporting standards



**The list is non-exhaustive, and the information is provided "as is" and does not constitute legal advice or binding interpretations of the said climate and net-zero initiatives. Regions that have adopted local financed-emissions disclosure rules outside of the EU (such as Canada, New Zealand and Malaysia) tend to follow PCAF or TCFD/ISSB standards and are therefore not listed separately.*

***PCAF listed weighted average carbon intensity and production-based intensity as optional metrics that can be reported in addition to financed emissions and financed-emissions intensity.*

****GFANZ listed market cap as an alternative attribution factor base, but recommended using EV or EVIC as most members are also invested in corporate bonds. It also had a slight preference for EV- or EVIC-based intensity metrics compared to weighted average carbon intensity.*

EV = Enterprise value
EVIC = Enterprise value including cash (For financing to private companies or project finance, EVIC is defined as the total equity plus debt of the respective company or project)
PPP = Purchasing power parity
PCAF = Partnership for Carbon Accounting Financials
TCFD = Taskforce on the Climate-related Financial Disclosures
ISSB = International Sustainability Standards Board
GFANZ = Glasgow Financial Alliance for Net Zero
IIGCC-PAII = The Institutional Investors Group on Climate Change's Paris Aligned Investment Initiative
SFDR = Sustainable Finance Disclosure Regulation
EU PAB = EU Paris-aligned Benchmarks
CSRD = Corporate Sustainability Reporting Directive
ESRS = European Sustainability Reporting Standards
GFANZ and IIGCC-PAII did not specify an attribution factor base for production-based intensity.

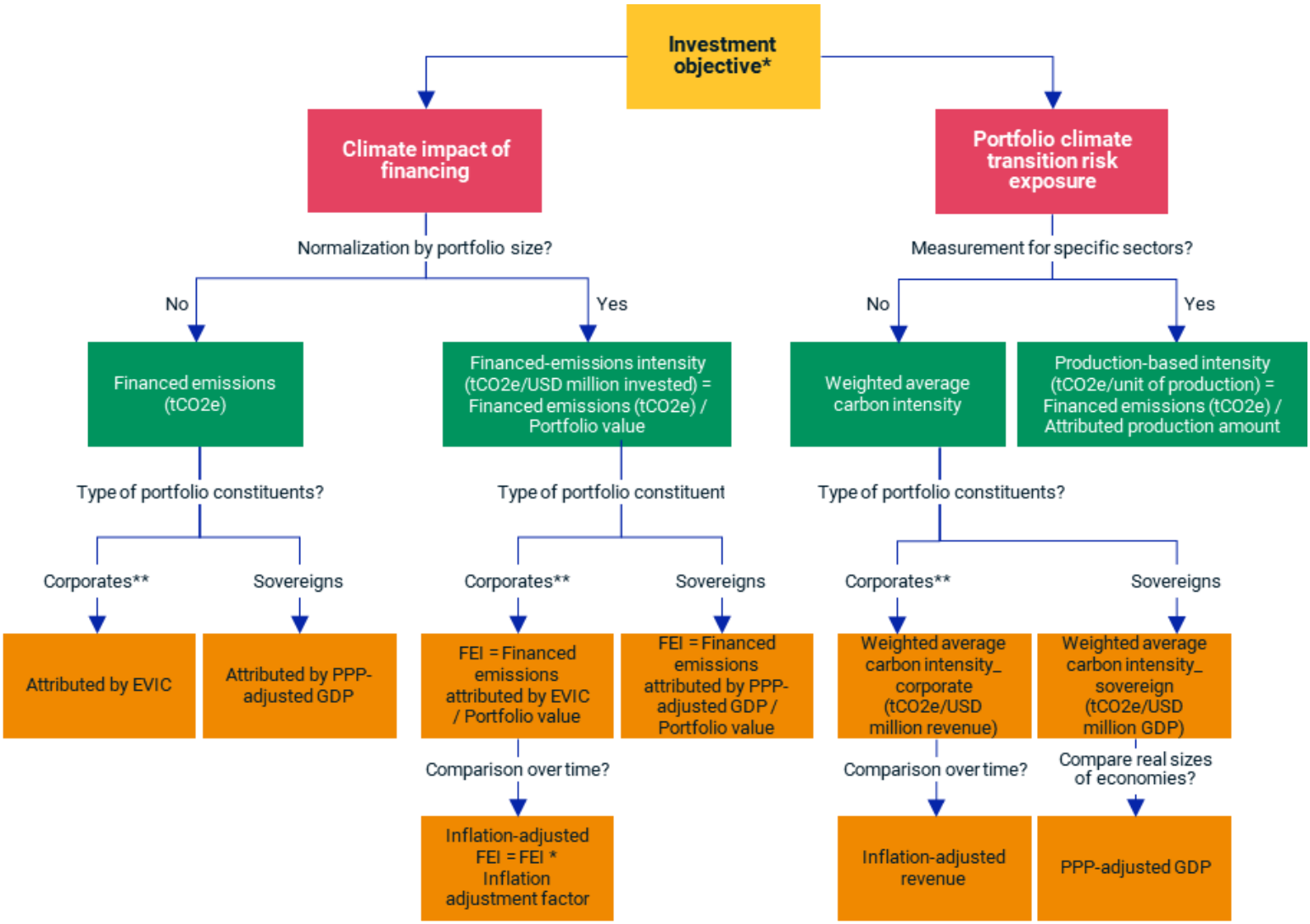
Sources:
MSCI ESG Research, as of April 2024.
"The Global GHG Accounting and Reporting Standard Part A: Financed Emissions," (Second edition) PCAF, December 2022.
"Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures," TCFD, October 2021.
"UNEPFI Guidelines for Climate Target Setting," Net-Zero Banking Alliance (NZBA), August 2022
"UN-convened Net-Zero Asset Owner Alliance Target Setting Protocol," (Third edition) Net Zero Asset Owner Alliance (NZAOA), January 2023.
"Net Zero Investment Framework (1.5°C): Implementation Guide," IIGCC, March 2021.
"Net Zero Investment Framework: IIGCC's Supplementary Guidance on Target Setting," IIGCC, December 2021.
"From asset to portfolio alignment: Assessing climate target alignment with cumulative benchmark divergence," IIGCC, February 2024.
"Commission Delegated Regulation (EU) 2022/1288 of 6 April 2022 containing technical standards to be used by financial market participants when disclosing sustainability-related information under the Sustainable Finance Disclosures Regulation (SFDR)," SFDR, July 25, 2022.
"Commission Delegated Regulation (EU) 2020/1818," EU PAB, July 17, 2020.
"Commission Delegated Regulation (EU) 2023/2772," CSRD/ESRS, July 31, 2023.
The Net Zero Asset Managers initiative (NZAM) endorses IIGCC, SBTi and NZAOA methodologies.

Following sustainable-investment objectives

Depending on their sustainable-investment objective, investors may be interested in understanding either the potential impact of their portfolio assets on the climate (i.e., contribution to global warming), the potential impact of climate change on their portfolios (i.e., risk to the value of portfolio assets from climate change), or both. Financed emissions and financed-emissions intensity provide a measure for the emissions that an investor is responsible for through financing, while weighted average carbon intensity and production-based intensity provide a measure of how carbon-intensive portfolio constituents' business models are, and therefore a measure of the portfolio's exposure to transition risk.

After a metric is chosen, investors can also use this decision tree to select the proper attribution factor for the metric based on the types of portfolio constituents, as well as for the further adjustments that could be made to the attribution factors under specific use cases.

Exhibit 2: Decision tree based on sustainable-investment objective



**Impact and risk can sometimes correlate and certain metrics can serve both purposes, yet our classification is based on each metric's best fit.*
***Equity-only investors can also use market cap as an attribution factor base. A growing number of regulatory and non-regulatory initiatives are, however, recommending using EVIC where possible.*

EVIC = Enterprise value including cash (For financing to private companies or project finance, EVIC is defined as the total equity plus debt of the respective company or project)
PPP = Purchasing power parity

Source: MSCI ESG Research, as of April 2024.

Calculating carbon-footprint metrics

In this section, we take an in-depth look at the four key carbon-footprint metrics in terms of what they measure, their pros and cons, how they are calculated and variations of inputs in calculation.

Exhibit 3: Comparison of carbon-footprint metrics

	Financed emissions (tCO2e)	Financed-emissions intensity (tCO2e/USD million invested)	Production-based intensity (tCO2e/unit of production)	Weighted average carbon intensity_corporate (tCO2e/USD million revenue*) *or* sovereign (tCO2e/USD million GDP)
Definition	Total amount of GHG emissions financed by a portfolio for a given year	Financed emissions normalized by portfolio value	Financed emissions normalized by attributed physical production amount	Portfolio-weighted GHG emissions per company revenue (or per sovereign GDP)
Formula**	$\sum_i^n \left(\frac{position\ value_i}{issuer's\ value_i} \times issuer's\ GHG\ emissions_i\right)$	$\frac{\sum_i^n \left(\frac{position\ value_i}{issuer's\ value_i} \times issuer's\ GHG\ emissions_i\right)}{USD\ million\ portfolio\ value}$	$\frac{\sum_i^n \left(\frac{position\ value_i}{issuer's\ value_i} \times issuer's\ GHG\ emissions_i\right)}{\sum_i^n \left(\frac{position\ value_i}{issuer's\ value_i} \times issuer's\ production\ amount_i\right)}$	$\sum_i^n \left(\frac{position\ value_i}{portfolio\ value} \times \frac{issuer's\ GHG\ emissions_i}{issuer's\ USD\ million\ revenue_i\ or\ GDP_i}\right)$
Normalization factor	N/A	Portfolio value	Attributed production amount	Company revenue or sovereign GDP
Investor question addressed	What is the portfolio's total carbon footprint?	What is the portfolio's normalized carbon footprint per million dollars invested?	What is the portfolio's (or parts of the portfolio) normalized carbon footprint per unit of physical production?	What is the portfolio's exposure to carbon-intensive companies (or economies)?
Main use cases	To set baseline and targets, and track emission changes over time	To compare carbon footprint between portfolios	To evaluate sector-specific carbon efficiency and set sector-specific targets	To evaluate a portfolio's relative exposure to carbon-intensive companies (or economies)
Pros	Most literal carbon footprint from GHG accounting perspective	Allows comparison to benchmark indexes and to other portfolios of different sizes	Clear view of carbon efficiency of underlying physical production	Allows aggregation across different sectors and asset classes
	Allows portfolio decomposition and attribution analysis	Allows portfolio decomposition and attribution analysis	Independent of product-price fluctuations	Allows portfolio decomposition and attribution analysis
	Can be used for carbon offsetting			Does not require company value data
Cons	Does not allow comparison between portfolios of different sizes	Can fluctuate with market movements	Does not allow aggregation across different sectors	Does not measure investor responsibility
			Cannot be used for sectors with a wide product range	For corporates: sensitive to fluctuations in product price, inflation and foreign-exchange rates For sovereigns: GDP is an imperfect proxy for the value of sovereign issuers
Supporting initiatives	PCAF	PCAF	PCAF	PCAF
	TCFD/ISSB	TCFD/ISSB		TCFD/ISSB
	GFANZ	GFANZ	GFANZ	GFANZ
	IIGCC-PAII	IIGCC-PAII	IIGCC-PAII	IIGCC-PAII
	SFDR	SFDR		SFDR
	EU PAB	EU PAB		
	CSRD/ESRS			CSRD/ESRS

Supporting MSCI products	MSCI Carbon Footprint Calculator Report	MSCI Carbon Footprint Calculator Report		MSCI Carbon Footprint Calculator Report
	MSCI Climate Risk Report	MSCI Climate Risk Report		MSCI Climate Risk Report
	MSCI Total Portfolio Footprinting	MSCI Total Portfolio Footprinting	MSCI Total Portfolio Footprinting (for real estate only)	
	MSCI Financed Emissions Attribution Report	MSCI Financed Emissions Attribution Report		
		MSCI Swiss Climate Score Report		MSCI Swiss Climate Score Report
	Carbon Footprinting of Private Equity and Debt Funds	Carbon Footprinting of Private Equity and Debt Funds		Carbon Footprinting of Private Equity and Debt Funds
			MSCI Climate Change Metrics	
			Real Estate Climate Solutions	

**In some MSCI products (such as MSCI Carbon Footprint Calculator Report and MSCI Climate Risk Report) we use "sales" in the units. The two terms "sales" and "revenue" can be used interchangeably.*
***Formulas in this report are created by MSCI ESG Research.*

Source: MSCI ESG Research, as of April 2024.

Metrics explained

Financed emissions (tCO2e)

Financed emissions refers to the total amount of GHG emissions financed by a portfolio. It measures the emissions that an investor is responsible for by summing up the proportionate GHG emissions of portfolio companies (or economies) based on the investor's ownership share. The ownership share can be calculated based on either the share of all financing (EVIC[4] for listed issuers and total equity plus debt for private issuers) or equity ownership (market capitalization). For sovereign constituents, PCAF recommends using PPP-adjusted GDP as the attribution factor.

As an absolute figure, this metric is often used for emissions baseline setting and is recommended by almost all regulatory and non-regulatory initiatives. It has limited usefulness, however, for benchmarking and comparison to other portfolios due to its link to portfolio size.

Financed emissions (tCO2e) = $$\sum_{i}^{n}\left(\frac{position\ value_i}{issuer's\ value_i} \times issuer's\ GHG\ emissions_i\right)$$

Issuer's value (Corporates) = EVIC or *total equity + debt* or *market capitalization*

Issuer's value (Sovereigns) = PPP-adjusted GDP

[4] EVIC = Market capitalization + preferred stock + minority interest + total debt

Exhibit 4: Financed emissions calculation example

Holding	Weight (%)	Portfolio value (USD)	Position value (USD)	Issuer EVIC (USD)	Ownership share (%)	Issuer GHG emissions (tCO2e)	Financed emissions (tCO2e)
Security A	60%	1,000,000	600,000	6,000,000	10%	5,000	500
Security B	40%	1,000,000	400,000	8,000,000	5%	10,000	500
Total	**100%**						**1,000**

Source: MSCI ESG Research, as of April 2024.

Financed-emissions intensity (tCO2e/USD million invested)

Financed-emissions intensity is a normalized version of financed emissions, calculated as the ratio of financed emissions to the total value of the portfolio. It indicates the climate impact that an investor is responsible for per USD 1 million of financing.

As a normalized metric, financed-emissions intensity allows comparing the carbon footprint across portfolios of different sizes or against benchmark indexes. It is also a common metric recommended by regulatory and non-regulatory initiatives.

Financed-emissions intensity (tCO2e/USD million invested) = $\frac{Financed\ emissions\ (tCO2e)}{USD\ million\ portfolio\ value}$

$$= \frac{\sum_i^n \left(\frac{position\ value_i}{issuer's\ value_i} \times issuer's\ GHG\ emissions_i\right)}{USD\ million\ portfolio\ value}$$

Issuer's value (Corporates) = EVIC or *total equity + debt* or *market capitalization*

Issuer's value (Sovereigns) = PPP-adjusted GDP

If the position value and portfolio value are calculated as of the same date (the approach adopted in EU PAB standards), the financed-emissions intensity formula can be rearranged so that it can also be expressed as the weighted average position intensity:

Financed-emissions intensity (tCO2e/USD million invested) = $\sum_i^n \left(weight_i \times \frac{issuer's\ GHG\ emissions_i}{issuer's\ value_i}\right)$

$$weight_i = \frac{position\ value_i}{USD\ million\ portfolio\ value}$$

Exhibit 5: Financed-emissions intensity calculation example

Portfolio	Portfolio value (USD)	Financed emissions (tCO2e)	Financed emissions intensity (tCO2e/USD million invested)
Portfolio A	1,000,000	1,000	**1,000**
Portfolio B	4,000,000	2,000	**500**

Source: MSCI ESG Research, as of April 2024.

Production-based intensity (tCO2e/unit of production)

Production-based intensity is similar to financed-emissions intensity but normalizes financed emissions by the total physical production units attributed to the investor in a specific sector, such as megawatt-hour (MWh) for power generation, megajoule (MJ) for oil and gas, tons of steel produced for steel companies, etc.[5] It measures the efficiency of a portfolio (or parts of a portfolio) in terms of total GHG emissions per unit of a given product.

As the production unit is usually sector-specific, this metric does not allow comparison or aggregation across different sectors. It is widely used, however, in target setting for carbon-intensive sectors.

$$\textit{Production-based intensity (tCO2e/unit of production)} = \frac{Financed\ emissions\ (tCO2e)}{attributed\ production\ amount}$$

$$= \frac{\sum_i^n \left(\frac{position\ value_i}{issuer's\ value_i} \times issuer's\ GHG\ emissions_i\right)}{\sum_i^n \left(\frac{position\ value_i}{issuer's\ value_i} \times issuer's\ production\ amount_i\right)}$$

Issuer's value = EVIC or *total equity + debt* or *market capitalization*

Exhibit 6: Production-based intensity calculation example

Portfolio	Attributed production amount	Financed emissions (tCO2e)	Production-based intensity
Portfolio A – Power generation	2,000 MWh	1,000	**0.5 tCO2e/MWh**
Portfolio B – Power generation	10,000 MWh	2,000	**0.2 tCO2e/MWh**
Portfolio C – Oil and gas	100,000 MJ	50	**0.0005 tCO2e/MJ**

Source: MSCI ESG Research, as of April 2024.

[5] Calculation methodology for each sector can be found in "Production-based Greenhouse Gas Intensities," MSCI ESG Research, March 2024. (Client access only.)

Weighted average carbon intensity (tCO2e/USD million revenue or GDP)

Weighted average carbon intensity normalizes each portfolio constituent's GHG emissions by their revenue. It measures a portfolio's exposure to carbon-intensive companies. Since companies with higher GHG intensity are likely to be more affected by climate-related risks, this metric can serve as a starting point to measure a portfolio's potential exposure to transition risks relative to other portfolios or benchmarks.

As weighted average carbon intensity is calculated based on company revenues and portfolio weights (instead of ownership share of each company), it can be applied across different sectors and asset classes.

For sovereign constituents in a portfolio, their weighted average carbon intensity can be calculated by replacing company revenue with GDP. While nominal GDP and general government debt were both used before PCAF published its guidance on sovereign debt, PPP-adjusted GDP has gained popularity as per PCAF's recommendation. The PPP adjustment allows for comparing the real sizes of the economies and the output by subtracting the exchange-rate effect. Due to the difference in denominators and potential double counting (sovereign emissions include corporate emissions), investors may consider reporting the weighted average carbon intensity of corporate and sovereign constituents separately.

Weighted average carbon intensity_corporate (tCO2e/USD million revenue) =

$$\sum_i^n \left(\frac{position\ value_i}{portfolio\ value} \times \frac{issuer's\ GHG\ emissions_i}{issuer's\ USD\ million\ revenue_i} \right)$$

Weighted average carbon intensity_sovereign (tCO2e/USD million GDP) =

$$\sum_i^n \left(\frac{position\ value_i}{portfolio\ value} \times \frac{sovereign\ issuer's\ GHG\ emissions_i}{sovereign\ issuer's\ USD\ million\ GDP_i} \right)$$

Sovereign issuer's GDP = Nominal GDP or PPP-adjusted GDP

Exhibit 7: Weighted average carbon intensity (corporate) calculation example

Holding	Weight (%)	Portfolio value (USD)	Position value (USD)	Issuer revenue (USD)	Issuer GHG emissions (tCO2e)	Issuer GHG revenue intensity (tCO2e/USD million revenue)	Weighted average carbon intensity_corporate (tCO2e/USD million revenue)
Security A	60%	1,000,000	600,000	10,000,000	5,000	500	300
Security B	40%	1,000,000	400,000	4,000,000	10,000	2,500	1,000
Total	**100%**						**1,300**

Source: MSCI ESG Research, as of April 2024.

Variations of inputs in calculation

Do investors measure Scope 1, 2 and 3 together or separately (for all four metrics)?

Depending on the use cases, GHG emissions can be based on Scope 1, 2 or 3, individually or on a combined basis. As Scope 3 emissions encompass a broad spectrum of indirect emissions generated from various upstream and downstream activities, double counting can occur when multiple companies within a portfolio fall within the same value chain. Both PCAF and the IIGCC therefore recommend reporting the Scope 3 emissions of loans and investments separately from the other two scopes, for better transparency.

For sovereign constituents, while production emissions (Scope 1) is usually the key metric to account for sovereign GHG emissions, PCAF also recommends that financial institutions report sovereign-consumption emissions (calculated as Scope 1 + 2 + 3 – exported emissions) to account for consumption patterns and trade effects. More details about sovereign bonds' financed emissions can be found in our research paper "Sovereign Bonds and Climate."

Do investors use EVIC or market capitalization to calculate ownership share (for financed emissions, financed-emissions intensity and production-based intensity)?

While early equity-focused carbon-footprinting methodologies tended to use market capitalization, the adoption of EVIC (or total equity plus debt for financing to private companies and project finance) has become more widespread, as it can be applied to multi-asset portfolios.

PCAF calls for the use of EVIC as the denominator in the attribution factor to harmonize GHG accounting across financial institutions. TCFD, in its latest implementing guidance as of October 2021, also recommends the same for banks, asset owners and asset managers to calculate their GHG emissions (these recommendations have been fully incorporated into the ISSB standards).[6] In the EU, the SFDR and PAB both require the use of EVIC.

[6] ISSB issued its inaugural standards for general sustainability reporting (IFRS S1) and climate-related disclosures (IFRS S2) in June 2023.

Which date is used for the calculation inputs (for financed emissions, financed-emissions intensity and production-based intensity)?

Due to different accounting standards and the availability and quality of data, it may not always be possible to both align the measurement date of the three key inputs in carbon footprint calculations (EVIC, position value and portfolio value) and make the calculations in a timely manner. Exhibit 8 summarizes the options investors may consider and their main use cases. More details can be found in "Practical Considerations for Calculating Portfolios' Carbon Footprint."

Exhibit 8: Variations in the timing of calculation inputs

Option	Approach	Pros/cons	Use case	Supporting MSCI products
• EVIC as of fiscal year-end • Position value and portfolio value as of analysis date	EU PAB	• Pro: Aligned position and portfolio value • Pro: Stable financed-emissions intensity • Con: Noisy attribution factor • Con: Financed emissions fluctuate with market movements	• Portfolio and risk management • Reporting and target monitoring using financed-emissions intensity	• MSCI Carbon Footprint Calculator Report • MSCI Climate Risk Report
• EVIC as of fiscal year-end • Position value as of fiscal year-end • Portfolio value as of analysis date	PCAF	• Pro: Stable attribution factor • Pro: Stable financed emissions • Con: Position and portfolio value not aligned • Con: Financed-emissions intensity fluctuates with market movements	• Reporting and target monitoring using financed emissions	• MSCI Total Portfolio Footprinting
• EVIC updated more often • Position value and portfolio value as of analysis date	Mixed approach	• Pro: Less noisy attribution factor • Pro: Aligned position and portfolio value • Pro: Most timely data • Con: Financed-emissions intensity and financed emissions fluctuate with market movements	• Portfolio and risk management	

Source: MSCI ESG Research, as of April 2024.

Do investors make inflation or foreign-exchange rate adjustments to the denominators (for financed-emissions intensity and weighted average carbon intensity)?

If an investor's aim is to compare a portfolio's carbon footprint against a benchmark at a specific point in time, then no re-baselining is required.

When investors aim to track the changes in their portfolio's carbon footprint or in their progress in achieving targets over time, however, the denominator of intensity metrics (EVIC, market cap or revenue) can be influenced by market volatility such as asset or consumer-price inflation and exchange-rate fluctuations, which undermines the utility of the metric to compare real-world emissions improvements from one time period to the next. In this case, corrections to those variables (re-baselining) are needed to isolate actual emissions changes.[7]

The EU regulation on benchmarks[8] first proposed applying an inflation-adjustment factor to the EVIC of each constituent in the portfolio. The factor is calculated by dividing the average EVIC of the benchmark constituents at the end of a calendar year by the average EVIC of the benchmark constituents at the end of the previous calendar year. Building on the EU inflation correction, PCAF has recommended calculating a market-cap-weighted adjustment factor[9] and applying it to the portfolio's financed-emissions intensity.

While PCAF's approach incorporates the consideration of different weights of benchmark constituents instead of taking the simple average, there are still limitations to this method. For example, weights calculated using market cap may not properly reflect the scale of emissions impact of each constituent, and the inflation adjustment was only tested by asset managers and asset owners, and may not be applicable to banks over total loan exposure. PCAF therefore requires investors to use the adjustment factor to report both the unadjusted and adjusted financed-emissions intensity separately. As carbon accounting methods continue to evolve, investors may wish to look out for further developments in re-baselining approaches.

Meanwhile, both the NZAOA and the IIGCC suggest that investors seek to understand the factors that are driving the changes in their portfolio carbon footprint through attribution analysis, a powerful tool that identifies the drivers of emissions reductions.[10]

[7] "Re-baselining for a net-zero commitment," Robeco, May 9, 2023. In this, the authors state: "*Re-baselining is the process of calculating what the baseline carbon footprint would have been at the start date, had the entity had the asset mix it does today, and had the financial valuation metrics of the portfolio companies been at today's levels.*"

[8] "Commission Delegated Regulation (EU) 2020/1818," EU Commission, July 2020.

[9] According to PCAF's financed emissions standard as of December 2022, the adjustment factor = sum of w_T * ($EVIC_b/EVIC_T$), where b = base year, T = current year and w_T = benchmarks weights at time T.

[10] "Understanding the Drivers of Investment Portfolio Decarbonisation," UNEPFI and PRI, December 2023.
"NZIF 2.0: The Net Zero Investment Framework," IIGCC, March 2024.

Carbon footprinting beyond corporates and sovereigns

Besides corporates and sovereigns, MSCI Total Portfolio Footprinting (TPF) provides footprinting solutions for other publicly-traded asset classes, as well as private assets in alignment with the PCAF standard. It also adds coverage for green bonds, municipal bonds and securitized products, on which PCAF has not yet released official guidance.

The focus of the TPF methodology is to calculate absolute financed emissions that are consistent and comparable over time, irrespective of market fluctuations. It allows investors to measure the total climate impact of their investment and lending activities and is geared toward annual reporting and target monitoring.

Below, we summarize the financed-emissions calculation methods of selected asset classes covered by TPF and link them to our past research, which demonstrated the application of those methods in analysis.[11] In addition, we have highlighted general approaches regarding the treatment of derivatives and short positions in portfolio carbon footprinting.

Selected asset classes covered by MSCI Total Portfolio Footprinting

Commercial real estate and mortgages

Operational emissions from buildings can be either computed using physical production-based intensities from energy consumption or estimated using the location and property type. The attribution factor is calculated as investment or outstanding loan amount divided by property value at origination. MSCI's Real Estate Climate Solutions also offers emissions data covering a wide range of property transactions.

Related research:

- Five Misconceptions About Climate-Change Risk in Real Estate

Green bonds

Each underlying project is assessed individually and categorized by the bond's use of proceeds according to seven environmental categories (alternative energy, energy efficiency, pollution prevention and control, sustainable water, green building, climate adaptation and other green).[12] The estimated emissions intensity for each category is then multiplied by the amount of proceeds allocated to this category to calculate the emissions of the green bond.

Related research:

- Total Portfolio Footprinting to Transform Green-Bond Emission Accounting
- Green Bonds and Climate — Towards a Quantitative Method

[11] The TPF methodology covered listed equity and corporate bonds, private equity and loans, project finance, commercial real-estate and mortgages, motor vehicle loans, municipal bonds, green bonds, sovereign debt, securitized products and cash as of October 2023.

[12] The "other green" category includes environmental activities and projects that are not included in the six use-of-proceeds categories.

Securitized products

Financed emissions are calculated using the emissions of the collateral or underlying assets, such as commercial real estate, mortgages, motor vehicle loans or business loans. The financed emissions of a position are calculated as the product of the outstanding amount of the position and financed-emissions intensity of the corresponding security.

Related research:

- Breaking Down Financed Emissions for Agency RMBS
- Carbon-Emissions Data to Inform the MBS Market

Cash

TPF adopts the approach that cash does not contribute to GHG emissions. This approach covers physical cash and spot foreign-exchange positions in any physical currency, and excludes any interest-rate derivatives, foreign-exchange derivatives, money-market positions, commodities and crypto currencies.

Treatment of derivatives and short positions

Derivatives

MSCI ESG Research proposes netting positions at the issuer level, accounting for physical and delta-adjusted market values of all instruments and calculating the carbon emissions of the net long positions.

Related research:

- ESG and Climate Reporting with Derivatives

Short positions

MSCI ESG Research proposes the offsetting of emissions between the long and short legs (netting approach), implying that the short position reduces real-world emissions “owned” through the long leg. To allow better transparency, we recommend long-short portfolios report carbon-footprint metrics separately for both the long and short legs, in addition to any preferred aggregation schemes.

Related research:

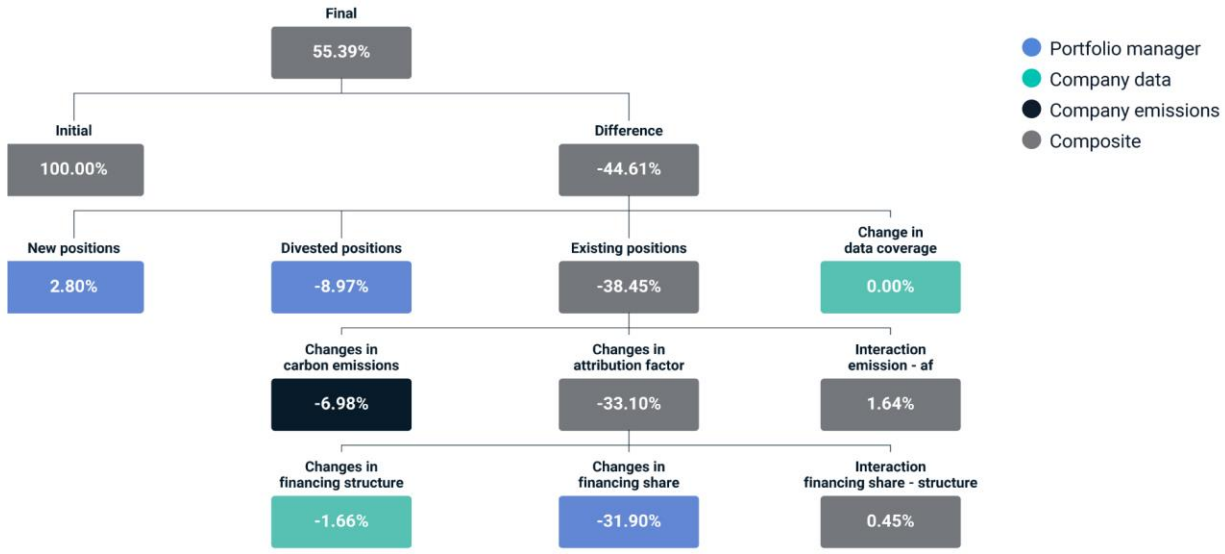
- ESG Reporting in Long-Short Portfolios

Tracking changes in portfolio carbon footprint

For any investment strategies that need to consider, monitor or report portfolio carbon footprint, tracking a portfolio's emissions profile over time is of high importance. Emissions attribution analysis helps investors discern the factors affecting portfolio carbon changes and interpret the progress toward any decarbonization targets. This added transparency allows investors to ascertain the magnitude of real-world emissions reduction, as well as the effects of portfolio allocations. The NZAOA, for example, therefore encourages every asset owner and asset manager with a net-zero commitment to endeavor to run its own emissions-attribution analysis.[13]

MSCI's framework for attributing changes in portfolio carbon footprint allows investors to understand to what extent changes in a portfolio's carbon footprint are due to companies' real-world decarbonization efforts, a portfolio manager's investment decisions or changes in companies' financing. An attribution tree (Exhibit 9) is used to demonstrate the drivers in portfolio-level emissions including changes in issuers' emissions, changes in the portfolio composition, as well as changes in ownership and financing structure. This framework was cited by the NZAOA in its discussion paper on emissions attribution analysis published in December 2023. For additional details about the methodology, please refer to our research paper, "A Framework for Attributing Changes in Portfolio Carbon Footprint."[14]

Exhibit 9: Drivers of financed emissions — a worked example



Source: MSCI ESG Research. Data for the period Dec. 31, 2019, to Dec. 31, 2021. The MSCI Financed Emissions Attribution Report can be accessed through on-demand reporting services on MSCI ONE (client-only).

[13] "Understanding the Drivers of Investment Portfolio Decarbonisation," UNEPFI and PRI, December 2023.

[14] We have also published a series of related blog posts demonstrating the attribution framework's application to different types of portfolios: "Tracking a Corporate-Bond Portfolio's Emissions Over Time," MSCI Research, May 30, 2023.
"Tracking Multi-Asset-Class Portfolios' Emissions," MSCI Research, Aug. 8, 2023.
"What's Been Driving the Carbon Footprint of MSCI's ESG Indexes?" MSCI Research, Sept. 22, 2023.

Conclusion

Measuring the carbon footprint of their portfolios allows investors to understand the climate risks and opportunities they are facing and make decarbonation decisions accordingly. We identified four main metrics that have been adopted by policy makers and industry bodies, where each of them has its own set of properties that may fit some objectives better than others. With the help of this guide, investors work out how to select the right metrics to use depending on their investment objective(s) and the adjustments they may wish to apply based on their individual climate objectives and the types of assets in their portfolios.

Given the development of GHG accounting standards and changing regulatory landscape, the approaches to quantify and report portfolio carbon footprints are likely to continue to evolve. In the meantime, data availability and applicability across different asset classes may also improve.

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