Understanding carbon exposure metrics

An evaluation of current standards in a rapidly evolving landscape

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The Task Force on Climate-Related Financial Disclosures (TCFD) recommends asset managers to disclose carbon metrics for assessing climate change risk. This document looks at the main types of greenhouse gases and their impact on the climate, reviews the current state of greenhouse gas emissions accounting and clarifies the main types of carbon exposure metrics.

Climate change risk and the role of greenhouse gases

Greenhouse gases are defined as atmospheric compounds that have the ability to absorb and re-emit the heat (infrared radiation) coming from the Earth's surface. As this atmospheric re-emission occurs in all directions, some of the energy is radiated back towards the Earth's surface, effectively slowing down the cooling rate of the planet. The amplitude of this phenomenon, called the greenhouse effect, is controlled by the concentration of greenhouse gases in the atmosphere.

Although this process is natural in itself, and critical to the emergence and support of life on the planet, greenhouse gas emissions as a result of human activity have amplified the phenomenon. The result of these man-made emissions, so far, is an increase in the global average surface temperature of over 1.1° Celsius (1.9°F) relative to the pre-industrial period.[1] This increase in temperature has induced significant changes to the climate system, including (but not limited to) a rapid melting of mountain glaciers and large ice sheets, a rise in sea levels (from this melting and from the thermal expansion of warming oceans) and emerging changes in the frequency and severity of extreme events. While attributing any specific event to climate change alone is extremely challenging, trends can be assessed, and clear climate change signals have already been observed for events such as temperature extremes (hot and cold), extreme precipitation, and drought. For example, it was found that the record Siberian heatwave of 2020 would have been extremely unlikely to happen without the contribution of human-induced climate change.[2]

[1] Defined as the 1850-1900 period by the Intergovernmental Panel on Climate Change (IPCC), in its latest series of reports (Fifth and Sixth Assessment Reports (AR5, AR6) and the Special Report on 1.5°C).

[2] Ciavarella, A., Cotterill, D., Stott , P. (Met Office UK); Kew, S., Philip, S., van Oldenborgh, G. J. (KNMI); Skålevåg, A., Lorenz, P. (DWD); Robin, Y. (Météo France); Otto, F. (University of Oxford); Hauser, M., Seneviratne, S. I., Lehner, F. (ETH Zurich); Zolina, O. (IGE/UGA, P.P. Shirshov Institute of Oceanology), "Prolonged Siberian Heat of 2020", World Weather Attribution (2020).

Economic impacts from such changes to the climate system are also starting to be felt. Over the past few decades, economic losses from weather-related natural catastrophes have been trending up. In 2020, the world experienced the second-highest number of billion-dollar natural disaster events in history,[3] with economic losses reaching USD 210 billion, of which only about 40% was insured.[4] Recent research suggests that expected global GDP losses could amount up to 18% by 2050 (compared to a world without climate change) if no mitigation action is taken, whereas meeting the Paris Agreement target to limit the global temperature rise to well below 2°C (3.6°F) would mean that global GDP would be just 4% lower than in a no climate change world.[5] Furthermore, meeting the Paris Agreement target results in a significant reduction in climate-related risks and therefore reduced impact on human and natural systems. By mid-century, estimates suggest avoided damages could total USD 8.1 trillion to USD 11.6 trillion, and could lead to human health co-benefits worth 0.5%-0.6% of world GDP due to a reduction in air pollution.[6]

A constant temperature can only be achieved when the rate of removal of greenhouse gases from the atmosphere is equal to the rate of their emission or, in other words, when there is a balance between the sources and sinks of each greenhouse gas.[7] Reaching this equilibrium, or "net zero emissions", does not result in an instantaneous stabilization of the global temperature. Furthermore, some impacts of climate change, such as sea-level rise, have a delayed response, meaning that the final impact will not be realized until decades after temperatures have stabilized. Reaching net-zero emissions by a certain date could also lead to different temperature outcomes, since the global temperature depends on the total "carbon budget", or the net cumulative emissions up to the point of stabilization. Thus, achieving a given temperature target requires both reaching net zero emissions and keeping within the carbon budget.

This twin objective is particularly important in the context of efforts to limit the temperature increase to well below 2°C (3.6°F).[8]

The most widely used standards for greenhouse gas emissions accounting come from the Greenhouse Gas Protocol.[9] This corporate standard for accounting and reporting on greenhouse gas emissions was developed to provide a framework for businesses to measure and manage emissions data in a complete, transparent and consistent manner. The protocol identifies seven main greenhouse gases significantly impacted by human activity: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and four types/families of fluorinated gases – nitrogen trifluoride (NF_3), sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).

The overall contribution of each gas to the energy balance of the climate system depends on its concentration, its ability to absorb/emit thermal energy and its lifetime in the atmosphere. To facilitate any comparison between emissions of those various gases, their overall warming impact is usually presented with respect to that of an equivalent mass of CO_2 over a specified time period (100 years), using a conversion factor called the Global Warming Potential (GWP). The IPCC GWP estimates for different greenhouse gases are given in **Exhibit 1** below. Using those conversion factors, total greenhouse gas emissions are combined and presented in terms of "CO_2 equivalent", or CO_2e. Although carbon dioxide has the lowest global warming potential among monitored greenhouse gases, it has the greatest impact on the radiative balance of the planet due to its long atmospheric lifetime and the large volumes emitted by human activity.

3 "Weather, Climate and Catastrophe Insight: 2020 Annual Report", Aon. There were 53 billion-dollar loss events in 2020, second only to 2010, which had 54.

4 "Record hurricane season and major wildfires – The natural disaster figures for 2020", Munich Re (7 January 2001).

5 Guo, J., Kubli, D., Saner, P., "The economics of climate change: No action not an option", Haegeli, Dr. J. J. and Ronke, P. (eds.), Swiss Re Institute (April 2021).

6 "Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C Above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty", Masson-Delmotte, V., Zhai, P., Pörtner, H. O., Roberts, D., Skea, J., Shukla, P. R., Pirani, A., Moufouma-Okia, W., Péan, C., Pidcock, R., Connors, S., Matthews, J. B. R., Chen, Y., Zhou, X., Gomis, M. I., Lonnoy, E., Maycock, T., Tignor, M. and Waterfield, T. (eds.), Intergovernmental Panel on Climate Change (2018, Cambridge University Press) pp. 616, https://doi.org/ 10.1017/9781009157940.

7 The Paris Agreement calls for a balance between sources and sinks of anthropogenic greenhouse gases "by the second half of this century" in order to limit the global temperature rise to "well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C" (Source: United Nations Framework Convention on Climate Change, https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement).

8 "Climate Change 2023: Synthesis Report of the Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change", IPPC (2023).

9 "A Corporate Accounting and Reporting Standard Revised Edition", Greenhouse Gas Protocol, World Resources Institute and World Business Council for Sustainable Development, https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf.

Exhibit 1: Global warming potential estimates and lifetime for the greenhouse gases covered by the Greenhouse Gas Protocol

Gas	Atmospheric concentration (2019)[10]	Global warming potential[11]	Lifetime (years)
Carbon dioxide (CO_2)	410 ppm	1	#[12]
Methane (CH_4)	1866 ppb	29.8	11.8
Nitrous oxide (N_2O)	332 ppb	273	109
Hydrofluorocarbons (HFCs)	237 ppt	5,920	>50[13]
Perfluorocarbons (PFCs)	109 ppt	7,850	2,600 – 50,000[14]
Nitrogen trifluoride (NF_3)	2 ppt	16,100	569
Sulphur hexafluoride (SF_6)	10 ppt	23,500	3200

Source: "Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change", IPCC (2021). ppm = parts per million; ppb = parts per billion; ppt = parts per trillion.

The complex role of short-lived gases is increasingly being recognized as a core component of efforts to establish credible emission reduction plans. Methane, for example, has a relatively short atmospheric lifetime (around 12 years), which means determining its overall impact based on a 100-year reference frame can underestimate its impacts on shorter timescales. The immediate gains obtainable from tackling emissions can thus be underestimated. However, understanding of the benefits of reducing methane emissions early has grown in recent years, resulting in a new focus on tackling methane emissions from gas flaring[15] as well as in the agriculture and waste sectors.[16] In September 2021, the US and the European Union announced the Global Methane Pledge, a non-binding initiative that aims to reduce global methane emissions by 30% by 2030 (from 2020 levels).[17]

Emission categories

The Greenhouse Gas Protocol divides emissions into three main categories:

- **Scope 1**: Direct emissions from owned and controlled assets, such as company facilities and vehicles, as well as fugitive emissions.[18]
- **Scope 2:** Indirect emissions from purchased electricity, steam, heat or cooling.
- **Scope 3**: Indirect emissions from the rest of a company's value chain, occurring either before (upstream) or after (downstream) its activities. The Greenhouse Gas Protocol separates those emissions into 15 separate sub-categories.

Exhibit 2 illustrates the GHG emissions categories in a company's value chain. The separation of emissions into these scopes avoids double counting emissions within a company, and facilitates the year-on-year tracking of emission evolution. Double counting will, however, be a feature of aggregated emissions (for example, the scope 1 emissions of a utility company will be the scope 2 or 3 emissions for another). For the purposes of portfolio carbon accounting, this is not necessarily of significant concern, as it simply extends the responsibility for a particular emission across multiple parties.

10 "Climate Change 2023: Synthesis Report of the Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change", IPPC (2023). HFC concentration given in HFC-134a equivalent, PFC concentration given in CF4 equivalent.

11 100-year global warming potential.

12 CO_2 has multiple lifetimes owing to the variety of removal processes. Around 25% of emitted CO_2 remains in the atmosphere for more than 1,000 years.

13 There are many types of HFCs. The most prominent, HFC-134a, has a lifetime of 14 years.

14 Range based on the most prominent types of PFCs: PFC-14, PFC-116 and PFC-218.

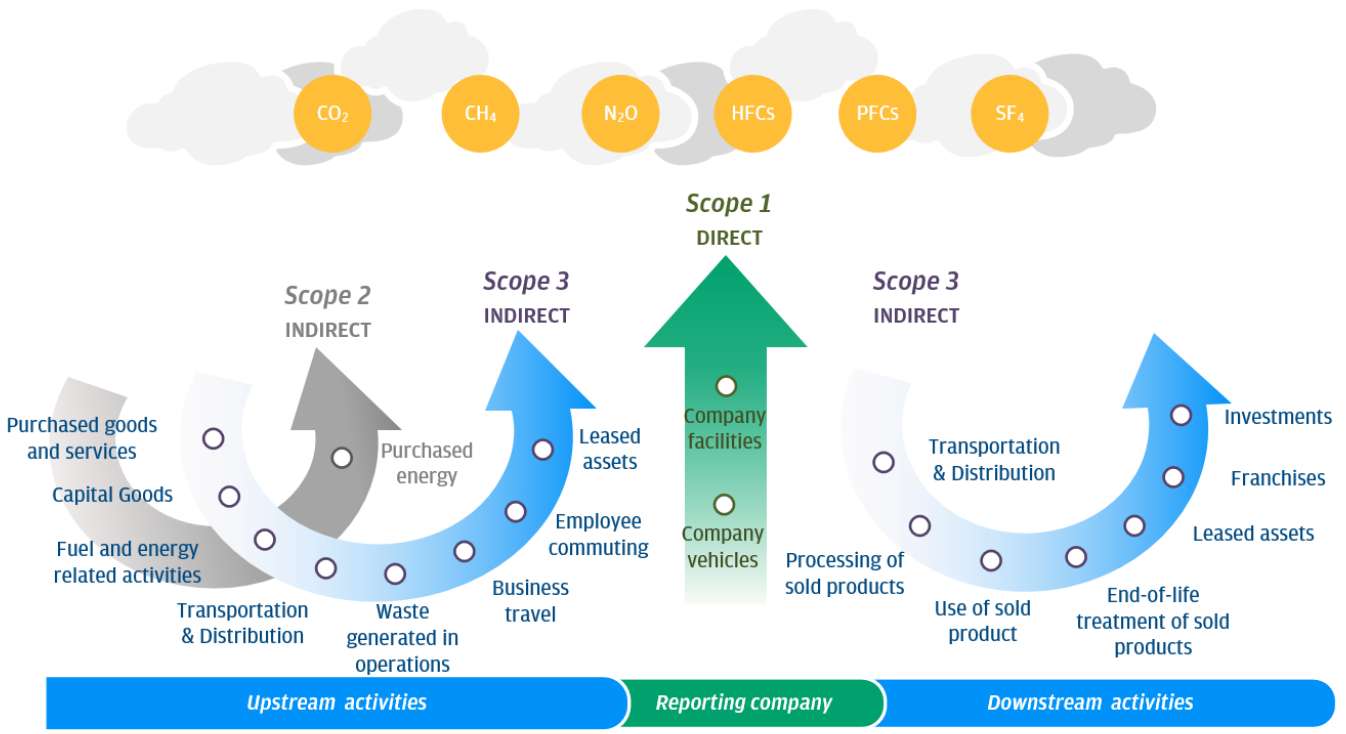
15 Stewart, J., "Tackling Flaring: Learnings from Leading Permian Operators", Gaffney Cline/Environmental Defense Fund (June 2022).

16 "Reducing Greenhouse Gas Emissions: Commission Adopts EU Methane Strategy as Part of European Green Deal", European Commission (Brussels, 14 October 2020). The European Commission noted an increased focus on reducing methane emissions as part of its 2030 Climate Target Plan.

17 "Joint EU-US Press Release on the Global Methane Pledge", European Commission (Brussels, 18 September 2021).

18 Fugitive emissions typically result from leaks – for example, from air conditioning or refrigeration equipment, gas transport, gas processing, coal mines, coal piles, waste and waste water.

Exhibit 2: Categories of greenhouse gas emissions



Source: J.P. Morgan Asset Management, Greenhouse Gas Protocol - Corporate Value Chain (Scope 3) Accounting and Reporting Standard.[19]

Most companies will have negligible scope 1 emissions, as these tend to be concentrated in the power, materials, heavy industry and transport sectors. Scope 2 emissions, however, are distributed across all sectors, with a particular concentration in the industry sector. Scope 3 emissions will often represent the majority of emissions of a given company, but with significant variance in the specific origin of those emissions. For example, the "use of sold products" is estimated to comprise up to 90% of emissions for oil and gas companies,[20] while emissions from "investments" are most material for financial institutions.[21]

Measuring and validating scope 3 emissions is particularly challenging. As emissions must be considered and apportioned across a wide range of economic activities, reported values and estimates are particularly sensitive to methodological assumptions and broader emission data availability. For those reasons, regulators are more flexible in their approach to scope 3 integration and have focused their immediate attention on scope 1 and 2 emissions. However, as the largest share of company emissions are typically scope 3, there is an increasing demand for the measurement and reporting of this data.[22] To address the computation challenges, scope 3 emissions can be split by category and considered in a hierarchical fashion, focusing first on categories that are both material and close in the economic chain. Sources of uncertainties and potential biases can then be addressed separately.

19 "Corporate Value Chain (Scope 3) Accounting and Reporting Standard: Supplement to the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard", World Resources Institute and World Business Council for Sustainable Development, Greenhouse Gas Protocol (2011). https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf

20 Climate Accountability Institute, Carbon Majors. https://climateaccountability.org/carbonmajors.html.

21 "Finance Sector's Funded Emissions Over 700 Times Greater Than Its Own", CDP (28 April 2021). https://www.cdp.net/en/articles/media/finance-sectors-funded-emissions-over-700-times-greater-than-its-own.

22 For example, the European Union Climate Transition and Paris-aligned benchmarks require scope 3 emissions to be phased in over a four-year timeframe from December 2020.

Carbon accounting metrics

The carbon accounting definitions in this section are based on the two leading standards on carbon accounting metrics: the Partnership for Carbon Accounting Financials (PCAF)[23] and the Task Force on Climate-related Financial Disclosures (TCFD). The PCAF standards, based on the Greenhouse Gas Protocol, are quickly becoming the reference for the calculation of scope 3 emissions of investments (category 15). The TCFD, on the other hand, provides a broader range of carbon footprinting and exposure metrics.[24]

Carbon emissions can be assessed based on financing or efficiency perspectives, with these two families of metrics providing complementary information on the emission characteristics of portfolios or individual issuers.

1. Total financed emissions

The total financed emissions metric is a measure of the total emissions (tonnes[25] of CO_2e) attributed to a portfolio, where in-scope[26] company emissions are apportioned based on a relevant ownership ratio (here, financing share):

$$\textit{Total financed emissions (tonnes } CO_2e) = \sum_{i=1}^{N}\left[\frac{Investment_i}{EVIC_i} \times Emissions_i\right],$$

where:

$Emissions_i$ greenhouse gas emissions of company *i*, in tonnes of CO_2 equivalent
$Investment_i$ is the total value invested in company *i*
$EVIC_i$ is the enterprise value (including cash) of company *i*, defined as the sum of the market capitalization of ordinary shares at fiscal year-end, the market capitalization of preferred shares at fiscal year-end, and the book values of total debt and minorities' interest (PCAF)

This simple metric is the starting point of any carbon analysis process. It can be used as a check that strategies based on other intensity-based or footprint-based metrics result in overall carbon emission reductions, all else equal. It is also additive, allowing portfolio decomposition and attribution analysis. However, as it is an absolute measure (scaling with portfolio size), portfolios cannot be compared on a like-for-like basis; differences in total financed emissions may simply reflect differences in portfolio size. Thus, great care should be taken in interpreting any observed trends, as the metric will respond to changes in emissions and portfolio size. It is also important to bear in mind that, since this metric aggregates the emissions of all portfolio companies, double counting of emissions is likely to occur. Double counting can be minimized by following the attribution methods provided by PCAF and, if a consistent methodology is followed and data transparently reported, should not be considered a significant issue, given that the overall aim of these calculations is to track progress against decarbonization targets.[27] As double counting spreads the responsibility for an emission across multiple companies, it simply increases the gain (or loss) resulting from an emission reduction (or rise).

A note on enterprise value

The apportioning metric for ownership ratio can be based on either equity ownership (market capitalization) or financing share (enterprise value). Whereas early equity-focused iterations tended to focus on market capitalization, the use of enterprise value has become more widespread, as it provides a harmonized way of attributing emissions across a broader range of financial actors and allows total financed emissions to be calculated for fixed income portfolios as well.

In 2019, the European Union Technical Expert Group (TEG) on Sustainable Finance recommended the exclusion of cash and cash equivalent deductions from the computation of enterprise value to avoid rare cases of negative enterprise values, leading to the concept of "enterprise value including cash" (EVIC).

EVIC has been recommended by PCAF as the apportioning metric of choice, and the TCFD has also recommended its use for listed equities, corporate bonds and business loans in its latest guidance on carbon metrics.

23 "The Global Greenhouse Gas Accounting and Reporting Standard Part A: Financed Emissions. Second Edition", Partnership for Carbon Accounting Financials (2022). https://carbonaccountingfinancials.com/files/downloads/PCAF-Global-GHG-Standard.pdf.

24 Table 2 (Greenhouse Gas Emissions for Banks, Asset Owners and Asset Managers) in "Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures", TCFD (October 2021). https://assets.bbhub.io/company/sites/60/2021/07/2021-TCFD-Implementing_Guidance.pdf.

25 According to the Greenhouse Gas Protocol, greenhouse gases should be measured in units of "tonnes" (metric ton, equivalent to 1000kg). The tonne or metric ton is often shortened to "ton" and is not to be confused with the "short ton" or "long ton", which are both imperial units.

26 Scope 1 and 2 emissions, with a progressive phase-in of scope 3 emissions (following the PCAF standard and TCFD recommendations).

27 PCAF defines attributions rules, which when correctly applied can minimize double counting of emissions between financial institutions.

2. Carbon footprint[28]

This version of the total financed emissions metric is normalized by the total value invested in a given portfolio and measures the emission impact of a portfolio per million invested. It allows for like-for-like comparisons across differently sized portfolios, and the contribution of individual issuers can be examined to identify large relative contributors to overall emissions. This carbon footprint metric can be applied across asset classes and can be directly linked to company ownership.

$$\textit{Carbon footprint}\ (\textit{tonnes}\ CO_2e/\textit{million invested}\ (USD)) = \frac{\sum_{i=1}^{N}\left[\frac{Investment_i}{EVIC_i} \times Emissions_i\right]}{AUM},$$

where:

$Emissions_i$ are the greenhouse gas emissions of company *i*, in tonnes of CO_2 equivalent
$Investment_i$ is the total value invested in company *i*
AUM is the total value of the portfolio for which emissions data is available
$EVIC_i$ is the enterprise value (including cash) of company *i*, in million USD, defined as "the sum of the market capitalization of ordinary shares at fiscal year-end, the market capitalization of preferred shares at fiscal year-end, and the book values of total debt and minorities' interest" (PCAF)

3. Intensity metrics

While carbon footprint is ownership-driven, carbon intensity metrics focus on the carbon efficiency of companies relative to the products they sell and can establish the exposure of a portfolio to carbon-intensive companies or sectors. This efficiency can be computed in economic terms (using revenues as a common economic denominator), or in physical terms (using sector-specific physical units of production).

3a. Weighted average carbon intensity

Weighted average carbon intensity (WACI) is a measure of carbon emissions normalized by revenues, which is a relevant comparison point across all issuers. This metric may be useful for portfolio decomposition and attribution analyses across sectors and asset classes. Companies with high emissions and low revenues are likely to be more vulnerable to regulatory carbon pricing mechanisms, the metric may be useful from a risk analysis perspective to indicate an issuer's potential exposure to transition risks. It also accounts for the fact that emitting one tonne of CO_2 to produce a high-value product may be more justifiable than emitting one tonne of CO_2 to produce a low value product. As such, it is useful to compare the carbon efficiency of companies across different industries. However, revenues cannot just be influenced by the long-term value of the products a company produces, but also by short-term price fluctuations and/or differences in the competitiveness of local markets. WACI can therefore be an imperfect way of comparing the carbon efficiency of different companies operating in the same industry.

$$WACI\ (\textit{tonnes}\ CO_2e/\textit{million revenues}\ (USD)) = \sum_{i=1}^{N}\left[\frac{Investment_i}{AUM} \times \frac{Emissions_i}{Revenues_i}\right],$$

where:

$Emissions_i$ are the greenhouse gas emissions of company *i*, in tonnes of CO_2 equivalent
$Investment_i$ is the total value invested in company *i*
AUM is the total size of the portfolio for which emissions data is available
$Revenues_i$ are the total revenues of company *i*, in million USD

3b. Physical intensity

Sector-specific intensity analyses can be performed using physical production units. This approach ties emissions to industrial output, independent of revenue, business strategy or market positioning. It replaces revenues in the above equation with a production metric relevant to the sector under study.[29] As such, this metric compares the carbon efficiency of companies producing a given product and removes the dependence on any fluctuations in the prices those products are sold for. **Exhibit 3** provides some examples of physical intensity metrics.

Comparisons among product types and across sectors are difficult and potentially misleading, limiting the scope of this approach for portfolio analysis. This approach is also best suited to sectors with a simple, relatively uniform product mix.

[28] This metric is also called "Financed Carbon Emissions" by certain data providers, such as MSCI.
[29] This method is used in sector specific analysis such as the Transition Pathway Initiative (TPI) (Source: TPI, https://www.transitionpathwayinitiative.org/publications/65.pdf?type=Publication).

Exhibit 3: Examples of physical intensity metrics

Sector	Physical intensity metric
Automotive	kg CO_2e/km driven
Energy	kg CO_2e/MJ (megajoule) of energy extracted
Manufacturing	kg CO_2e/unit of production output
Materials	kg CO_2e/tonne of production output
Mining	kg CO_2e/tonne of mineral extracted
Utilities	kg CO_2e/MWh (megawatt-hour) of electricity produced

Source: J.P. Morgan Asset Management, as of June 2023.

Application approach

TCFD describes the complementary nature of the insights that the carbon metrics may provide, given in **Exhibit 4** below.

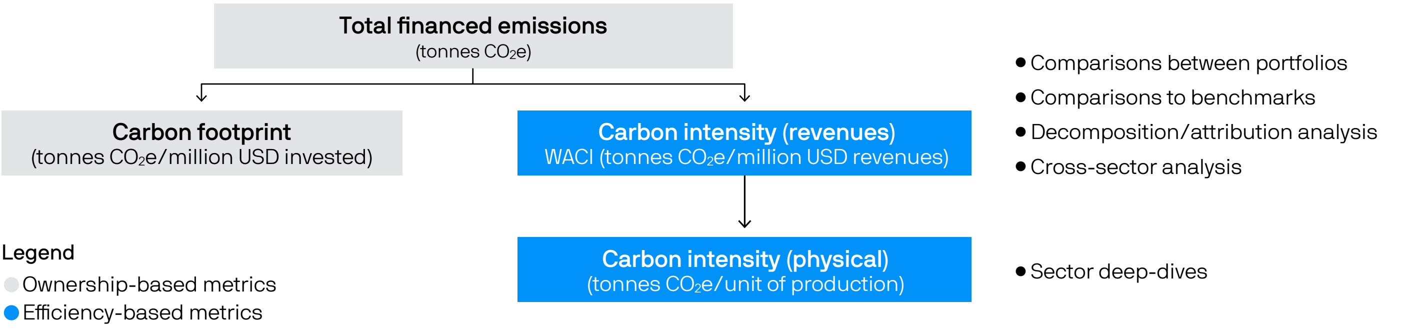
Exhibit 4: Comparison of carbon metrics

Metric	Use case(s)	Pros/cons
Total financed emissions (tonnes CO_2e)	To set baselines and to track emission evolution.	+ Easily applied to portfolio analysis (decomposition and attribution). + Tracks absolute emission changes of a portfolio over time. - Portfolio comparisons are difficult, since the data is not normalized by portfolio size. - Variations in enterprise value can impact emission trends.
Carbon footprint (tonnes CO_2e/million invested)	To compare portfolios and perform company attribution based on ownership.	+ Easily applied to portfolio analysis (decomposition and attribution). + Comparisons between portfolios can be easily performed. + Link between ownership and emission responsibility is intuitive. - Does not consider the carbon efficiency (relative to the products sold) of individual companies. - Variations in enterprise value can impact emission trends.
Weighted average carbon intensity (revenue (WACI)) (tonnes CO_2e/million revenues)	To evaluate exposure to carbon-intensive companies.	+ Easily applied to portfolio analysis (decomposition and attribution). + Reflects the size and carbon efficiency of individual companies. - Normalization using revenues can make this metric sensitive to short-term fluctuations in product prices. - Sensitive to outliers, as extreme values with large portfolio weights can skew the output.
Physical intensity (tonnes CO_2e/unit of production)	To perform sector-specific deep-dive analyses.	+ Direct, fundamental link to physical production. + Independent of pricing practices and market positioning. + Considers the size and carbon efficiency of individual companies. - Normalizing factors are sector-specific. - Does not allow for portfolio analysis (decomposition and attribution) across sectors. - Not suitable for sectors with a wide product mix.

Source: 2021 TCFD report: Implementing the Recommendations of the Task Force on Climate-Related Financial Disclosures.

In the context of portfolio analysis, carbon footprint analysis can be used to identify individual issuers/sectors contributing to the overall emissions of a portfolio and perform comparisons to relevant benchmarks. This information can be complemented with revenue-based weighted average carbon intensity (WACI), which may provide insight on carbon efficiency across and within sectors. For specific sectors where high emissions (absolute or with respect to a relevant benchmark) are identified, deep dives can be conducted based on physical units of production. **Exhibit 5** illustrates the different types and use cases of carbon metrics.

Exhibit 5: Application of carbon metrics



Source: J.P. Morgan Asset Management.

Emissions reporting

In order to calculate any of the available carbon metrics, investors must rely on accurate, comparable and timely company level emissions data. However, data quality is mixed and reporting rates vary across countries and sectors, resulting in a fragmented data landscape. Third-party data providers[30] supply estimates to fill these gaps, and even sometimes evaluate and replace potentially erroneous data. While these estimates allow for a more complete emissions calculation universe, estimation methodologies vary widely and therefore company or portfolio assessments will have a strong dependency on the data provider used. Differences between data providers can become especially acute when scope 3 emissions are considered.

Within individual portfolios, the proportion of estimated emissions will depend on several factors, including country, sector, size and whether the company is listed. Publicly-listed companies in high emitting sectors such as oil & gas, coal and heavy industry are required to report their scope 1 emissions under national regulations in many countries, and requirements are much more extensive in several jurisdictions.[31] In emerging markets, reporting levels are currently lower, and the degree of reliance on estimates tends to be higher. Similarly, as private companies do not typically fall under mandatory regulations, the majority of these emissions are estimated. It is also important to note that each data provider has a different coverage universe, so the proportion of estimated data within a portfolio will vary across data providers, both in terms of reporting companies covered and companies that have their emissions estimated.

[30] Such as CDP, S&P Global, MSCI, Sustainalytics, Bloomberg, ISS and Moody's.
[31] Emissions reporting is mandatory for publicly listed big emitters (at a minimum) in the UK, EU, Japan, US and Canada (Source: Carbone4, https://www.carbone4.com/wp-content/uploads/2016/09/CARBONE4-carbon-reporting-by-companies-around-the-world-EN.pdf).

Financial industry standards and practices

The use of carbon metrics in the regulatory landscape is evolving rapidly. Regulators across regions have started to require carbon metric disclosures, for example in Hong Kong, Singapore, the UK, the US and the European Union. **Exhibit 6** shows the carbon accounting metrics that are currently recommended or required by different standards and regulators. A shift occurred following the release of the PCAF Greenhouse Gas Accounting and Reporting Standards at the end of 2020, which led to updates in the TCFD guidance that underpins many of the regulatory standards. The TCFD now recommends reporting total financed emissions following the PCAF standard in addition to the intensity-based WACI metric it initially chose in 2017.

Exhibit 6: Overview of select carbon metric standards and reporting requirements

	Organisation	Total financed emissions	Carbon footprint	Weighted average carbon intensity (WACI)
Disclosure regulations	Sustainable Finance Disclosure Regulation (SFDR)[32]	✓	✓	✓
	EU Climate Transition and Paris-Aligned Benchmarks Disclosure Regulation[33]		✓	✓
	Securities and Exchange Commission (SEC) Climate-Related Disclosures[34]	✓		✓
Key supporting standards	Partnership for Carbon Accounting Financials (PCAF)[35]	✓		
	Task Force on Climate-Related Financial Disclosures (TCFD)[36]	✓	✓[37]	✓
	ISSB S2 Climate-related Disclosures[38]	✓		✓[39]
	EFRAG European Sustainability Reporting Standards (ESRS)[40]	✓		✓

Source: 2021 TCFD report: Implementing the Recommendations of the Task Force on Climate-Related Financial Disclosures.

32 "Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial services sector", Official Journal of the European Union L 317, Volume 62 p.1-16 (9 December 2019). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32019R2088.

33 TEG final report on European Union climate benchmarks and ESG disclosures, 30 September 2019. The regulation defines greenhouse gas intensity for the reporting use case as tCO_2e / enterprise value, i.e. Footprint or tCO_2e / revenue, i.e. WACI.

34 "The Enhancement and Standardization of Climate-Related Disclosures for Investors. Proposed Rule", Securities and Exchange Commission. https://www.sec.gov/rules/proposed/2022/33-11042.pdf. Draft rules are still under consultation and are expected to be published in 2023.

35 "The Global Greenhouse Gas Accounting and Reporting Standard Part A: Financed Emissions. Second Edition", Partnership for Carbon Accounting Financials (2022). https://carbonaccountingfinancials.com/files/downloads/PCAF-Global-GHG-Standard.pdf.

36 "Recommendations of the Task Force on Climate-Related Financial Disclosures: Final Report", TCFD (June 2017). https://assets.bbhub.io/company/sites/60/2021/10/FINAL-2017-TCFD-Report.pdf.

37 In its latest proposed guidance on carbon metrics, the TCFD now recommends following the PCAF framework (carbon footprint) for financed emissions. See: "Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures", TCFD (October 2021). https://assets.bbhub.io/company/sites/60/2021/07/2021-TCFD-Implementing_Guidance.pdf.

38 Draft standards. The International Sustainability Standards Board (ISSB) is finalising requirements for disclosure standards and expects to issue an IFRS (International Financial Reporting Standards) Sustainability Disclosure Standard around the end of the second quarter of 2023. See: "Exposure Draft, IFRS Sustainability Disclosure Standard: Basis for Conclusions on (Draft) Climate-Related Disclosures", IFRS Sustainability (March 2022). https://www.ifrs.org/content/dam/ifrs/project/climate-related-disclosures/issb-exposure-draft-2022-2-basis-for-conclusions-climate-related-disclosures.pdf.

39 Intensity expressed as metric tonnes of CO_2 equivalent per unit of physical or economic output.

40 Draft regulation submitted to European Commission for further consultation. Absolute emissions reporting is required for all firms in scope and revenue-based intensity is required if meaningful for a given company. Implemented by the European Union Corporate Sustainability Disclosure Standards (CSRD).

Summary

Investors are increasingly expected and required to measure and report the greenhouse gas emissions with respect to assets for which they are responsible. Under the TCFD guidelines and the PCAF standard, a suite of complementary carbon accounting metrics can be used by asset managers to report and analyze portfolio emissions, where applicable including:

1. Total financed emissions to set baselines and track emissions evolution
2. Carbon footprint to compare portfolios and perform attribution analyses
3. Weighted average carbon intensity (revenue based) to perform cross-sector comparisons and evaluate exposure to carbon-intensive companies
4. Physical carbon intensity to perform sector-specific deep dives

Approaches to carbon accounting are likely to continue evolving, especially given the changing regulatory landscape. In this context, it is important for asset managers to continue to assess the development of emissions standards and metrics as part of understanding risk and developing further insights on the emissions characteristics of investments.

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