



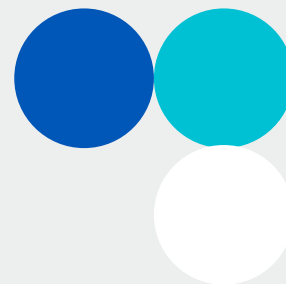
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Why the Choice of Carbon Metric Matters

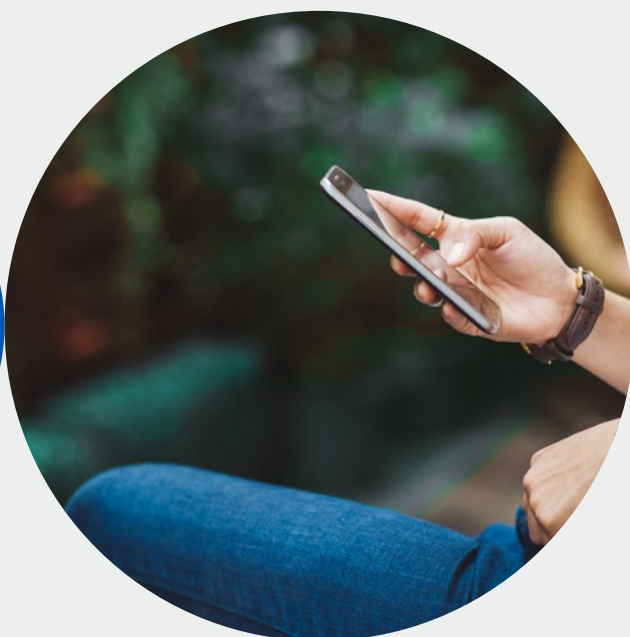
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Executive Summary

The issue

Investors have a range of carbon metrics at their disposal for carbon risk management, reporting and investment decision making. As industry frameworks continue to evolve, investors are increasingly encouraged to move from revenue based carbon intensity metrics (Weighted Average carbon intensity) towards metrics that are based on enterprise value including cash (EVIC) such as Financed Emissions and Economic Emission intensity. But the shift has implications: These metrics tell a different story and can indeed move in opposite directions under identical scenarios. Swings in carbon metrics can also be driven by factors beyond carbon emissions alone.

Core Portfolio-Level Metrics	Unit	Absolute or Intensity
Financed Emissions	tCO2e	Absolute (EVIC based)
Economic Emissions Intensity	tCO2e/\$m Invested	Intensity (EVIC based)
Weightd Average Carbon Intensity (WACI)	tCO2e/\$m Revenue	Intensity (revenue based)

- If an investor solely uses **Financed Emissions** to measure carbon, the investors ownership share of EVIC will be a core driver of the result, this can be altered by market movements that are unrelated to changes in carbon.
- If an investor solely uses **Economic Emissions Intensity** to measure carbon, the investors portfolio weight of the company and changes in the company's EVIC will be a core driver of the result, this can also move due to market movements that are unrelated to carbon.
- If an investor solely uses **WACI** to measure carbon, the investors portfolio weight of the company and changes in the company's revenue will be a core driver of the result, this can move due to market movements and revenue shocks that are unrelated to carbon.

Why is this Important?

Understanding the different carbon metrics is important for investors that use these metrics to identify carbon risk exposure and manage carbon targets, because:



Investors could over or underestimate the climate impact of their investment decisions if the drivers of change are not well understood.



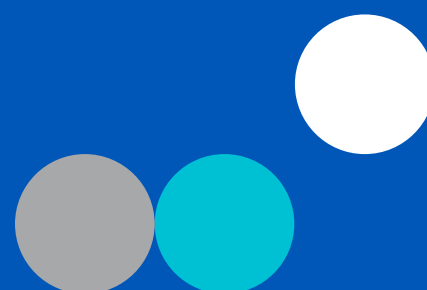
They may misinterpret changes in carbon metrics for real-world impact.



They may fail to manage their carbon targets effectively if market volatility leads to major fluctuations in carbon metrics, particularly EVIC based metrics.

Implications for Investors

- Firstly, we believe that using multiple carbon metrics is pragmatic and disaggregating the underlying drivers of each metric is necessary.
- Secondly, investors should focus on real-world climate impacts, requiring additional forward-looking climate data to compliment backward-looking carbon metrics.
- Finally, to achieve real-world decarbonisation carbon metrics are only one lever, to achieve net-zero investors should utilise a wider toolkit, including active ownership.



The Three Core Carbon Metrics

The table below shows three core portfolio-level carbon metrics. These three metrics are used widely and align to leading industry and regulatory standards. The Taskforce on Climate-Related Financial Disclosure (TCFD) encouraged WACI as the core metric to disclose in 2017. Then in 2020, the Partnership for Carbon Accounting Financials (PCAF) set EVIC based Financed Emissions as the new, consistent carbon disclosure standard for investors.

Table 1

Core portfolio-level metrics	Unit	Absolute or Intensity
Financed Emissions	tCO ₂ e	Absolute
Economic Emissions Intensity	tCO ₂ e/\$m Invested	Intensity
Weighted Average Carbon Intensity	tCO ₂ e/\$m Revenue	Intensity

Financed Emissions

Financed emissions calculates the absolute tonnes of CO₂ that are financed or 'owned' by investors across both equity and credit. The metric attributes ownership of emissions based on the percentage of enterprise value including cash (EVIC) that is attributed to an investor.

$$\left(\frac{\text{Investment in the company}}{\text{Company EVIC}} \right) \times \text{Company Emissions}$$

One of the drawbacks in calculating Financed Emissions is that it does not normalise emissions for the size of a company. Nor does it normalise for the size of a fund. Typically, a larger company will have greater emissions relative to a smaller company in its peer group. Similarly, a larger fund will typically have more financed emissions relative to a smaller fund in its peer group.

To make carbon emissions comparable across companies of differing size, emissions are normalised, this produces a carbon intensity metric.

Economic Emissions Intensity

Calculates the weighted average emissions of a portfolio normalised by EVIC.

Common Expression found in Standards:

$$\frac{\left(\frac{\text{Investment in the Company}}{\text{Company EVIC}} \right) \times \text{Company Emissions}}{\text{Portfolio Value}}$$

Simplified Expression:

$$\left(\frac{\text{Investment in the Company}}{\text{Portfolio Value}} \right) \times \left(\frac{\text{Company Emissions}}{\text{Company EVIC}} \right)$$

Economic Emissions Intensity uses EVIC to normalise emissions. In contrast, Weighted Average Carbon Intensity (WACI) uses revenue to normalise emissions. The normalised emissions are then multiplied by the company weighting in a portfolio.

In regulations and standards it is common to see Economic Emissions Intensity written as Financed Emissions normalised by the total size of the portfolio. This is mathematically equivalent to normalising emissions by EVIC and using portfolio weights - in the same way we see Weighted Average Carbon Intensity expressed. We simply substitute the revenue denominator with EVIC.

Weighted Average Carbon Intensity

Calculates the weighted average emissions of a portfolio normalised by revenue.

$$\left(\frac{\text{Investment in the company}}{\text{Portfolio value}} \right) \times \left(\frac{\text{Company emissions}}{\text{Company revenue}} \right)$$



Why EVIC Volatility Matters

EVIC is the sum of market capitalisation plus total debt.

Market capitalisation is driven by fundamentals (earnings) and market valuations (P/E ratios). Similarly, total debt will change with a company's debt financing decisions. For example, if share prices fall due to a contraction in P/E ratios, EVIC will fall as the equity component of EVIC shrinks. In this scenario, equity investors own a smaller slice of EVIC and fixed income investors will own a greater slice of EVIC. Assuming emissions stay constant, fixed income investors will see a rise in Financed Emissions and equity investors will see a fall in Financed Emissions.

Crucially, changes in any of the components of EVIC will impact multiple elements of EVIC-based carbon metrics (Financed Emissions and Economic Emissions Intensity) and are often unrelated to changes in emissions in the longer-term. The components of the Financed Emissions and Economic Emissions Intensity metrics that are impacted by EVIC volatility are shown in Table 2 below.

Table 2: Impact from a change in EVIC

Metric component	Impact on Financed Emissions?	Absolute or Intensity
Company EVIC	✓	✓
Investment in company	✓	✓
Portfolio value	✗	✓

Impact on Financed Emissions

A simple rule of thumb is that if an investor owns a greater share of EVIC they will own a greater share of Financed Emissions.

Investors must be aware that market swings can change EVIC ownership. For example, if stock prices decline¹, equity investors will own a smaller share of EVIC and fixed income investors will own a larger share of EVIC. Consequently, Financed Emissions will fall for equity investors and rise for fixed income investors.

Worked Example 1: Financed Emissions

In the below table we show a company with two investors, an equity and debt investor. Both investors have the same absolute investment in the company, \$100. Therefore, they own the same proportion of EVIC and therefore the same proportion of the company's emissions.

Table 3

Company Investors	Company EVIC structure (\$)	EVIC owned (%)	Financed Emissions (tCO ₂)
Equity	100	50	500
Debt	100	50	500
EVIC & emissions	200	100	1,000



¹ This can be driven by a fall in earnings and/or a fall in price to earnings valuations.

If we assume the company's share price increases by 10% and recalculate financed emissions of investors, we see that the equity investor now owns a larger share of the company's EVIC and therefore a larger share of Financed Emissions. While the fixed income investor owns less of the company's EVIC and therefore a smaller share of Financed Emissions.

Table 4

Company Investors	Company EVIC Structure (\$)	EVIC Owned (%)	Financed Emissions (tCO2)
Equity	110	52.4	524
Debt	100	47.6	476
EVIC & Emissions	210	100	1,000

This occurs because the rise in share prices has changed two things: It has increased EVIC since the equity portion of EVIC has risen and the equity investors size of investment in the company has increased.

Whether this increases Financed Emissions depends on the following rule (as long as emissions stay constant):

%ΔInvestment in the company > %ΔCompany EVIC = Financed Emissions ↑

%ΔInvestment in the company < %ΔCompany EVIC = Financed Emissions ↓

We can see the rule holds when applying it to the worked example:

Investor	%ΔInvestment in the company	< or >	%ΔCompany EVIC	Δ in Financed Emissions
Equity	+10%	>	+5	↑
Fixed income	0%	<	+5	↓



Impact on Economic Emissions Intensity

Economic Emissions Intensity is slightly more complex. Just because an investor's Financed Emissions increases it does not mean intensities will increase, in fact intensity can decline. This is because the investments holding weight is a key driver of the final result and is also impacted by changes in EVIC.

Worked Example 2: Economic Emissions Intensity

We take the same company from the Financed Emissions worked example. We show that Financed Emissions and Economic Emissions Intensity can move in opposite directions under the same conditions.

Table 5: Company A Intensity

Company	Equity Investment	Weight %	Company Equity	Company Debt	Company EVIC	Company tCO2	tCO2/\$ invested
A	100	100	100	100	200	500	2.50

$$\left(\frac{\text{Investment in the Company}}{\text{Portfolio Value}}\right) \times \left(\frac{\text{Company Emissions}}{\text{Company EVIC}}\right)$$

$$\left(\frac{100}{100}\right) \times \left(\frac{500}{200}\right) = 2.50$$

Following worked example 1 for Financed Emissions, the company share price increases by 10%

Table 6: Company A after share price increase

Company	Equity Investment	Weight %	Company Equity	Company Debt	Company EVIC	Company tCO2	tCO2/\$ invested
A	110	100	110	100	210	500	2.38

$$\left(\frac{110}{110}\right) \times \left(\frac{500}{210}\right) = 2.38$$

We see the equity investment in Company A has decarbonised based on Economic Emissions Intensity from 2.50 to 2.38 tCO2/\$ invested, despite its Financed Emissions increasing in worked example 1.

Worked Example 3: Economic Emissions Intensity

Worked example 2 is a single stock portfolio. This time, if we add a company to the portfolio, we show that the Economic Emissions Intensity of Company A can move in the opposite direction, this is due to changes in holding weights in the portfolio context.

Table 7: Portfolio example

Company	Investment	Weight %	Company equity	Company debt	Company EVIC	Company tCO2	tCO2/\$ invested
A	100	50	100	100	200	500	1.25
B	100	50	100	100	200	500	1.25
Total	200	100	-	-	-	-	2.5

We use the same share price increase for Company A as in the previous worked examples 1 and 2 but now apply a 10% share price fall for Company B in this worked example 3.

Table 8 & 9: Changes in Share Prices Impacting Portfolios

Company A equity change	+10%
Company B equity change	-10%

Company	Investment	Weight %	Company equity	Company debt	Company EVIC	Company tCO2	tCO2/\$ invested
A	110	55	110	100	210	500	1.31
B	90	45	90	100	190	500	1.18
Total	200	100	-	-	-	-	2.49

In this worked example, Company A sees a rise in Economic Emissions Intensity. This is opposite to the previous worked example 2 but is in line with the Financed Emissions worked example 1 – all of which applied the same change to Company A’s share price. The reason for this is the change in the holding weight of Company A.

We can show the drivers by applying this rule (as long as emissions stay constant):

%ΔInvestment holding weight > %ΔCompany EVIC = Economic Emissions Intensity ↑

%ΔInvestment holding weight < %ΔCompany EVIC = Economic Emissions Intensity ↓

We can see the rule holds across all the Economic Emissions Intensity worked examples:

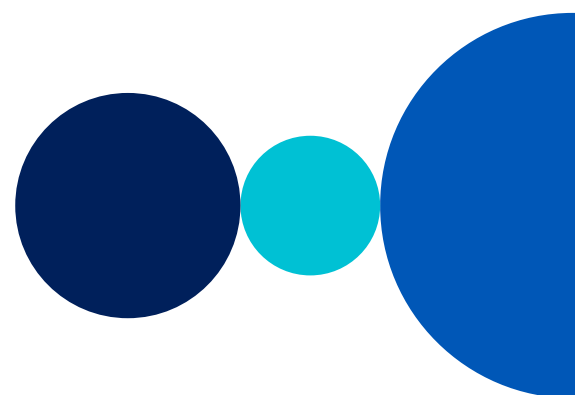
Company examples	%ΔInvestment holding weight	< or >	%ΔCompany EVIC	Δ in Intensity
A (worked example 2)	0	<	+5	↓
A (worked example 3)	+10	>	+5	↑
B (worked example 3)	-10	<	-5	↓

What about WACI?

The same logic applies to Weighted Average Carbon Intensity as it does to Economic Emissions Intensity. All we need to do is substitute Company EVIC for Company Revenue in our rule of thumb, as such we can use the following rule of thumb (as long as emissions stay constant):

%ΔInvestment holding weight > %ΔCompany revenue = WACI ↑

%ΔInvestment holding weight < %ΔCompany revenue = WACI ↓

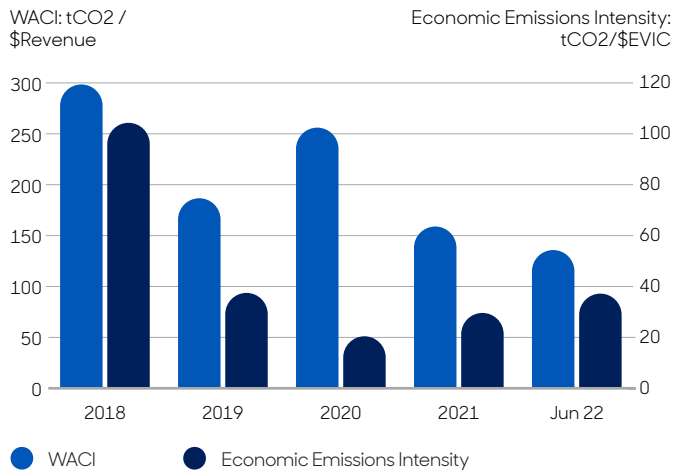


A Real-World Example: Carbon Metrics Moving in Opposite Directions

EVIC and revenue can move in the opposite direction. Therefore, WACI and Economic Emissions Intensity can move in opposite directions given their sensitivity to changes in their denominator. We show this using a real-world company example. Previously an oil & gas company, Orsted has gone through a transformation to become one of the largest offshore wind energy producers.

In Chart 1, we have calculated WACI and Economic Emission Intensity metrics for Orsted for the period 2018-2022. We have taken historical carbon data for the period 2018 - 2020. To calculate 2021 and 2022 metrics we have taken 2021 and 2022 financial data with the most up to date emissions data (from 2020). We can see a complete divergence in WACI and Economic Emissions Intensity in 2020, 2021 and 2022.

Chart 1: Orsted carbon metric confusion



Source: Trucost, Bloomberg, abrdn.

It is important to understand how the components underlying these metrics have changed which is shown in Table 10 below, using annual percentage changes. We also consider total emissions of Orsted as a company, which shows the company has been successful in decarbonising operations.

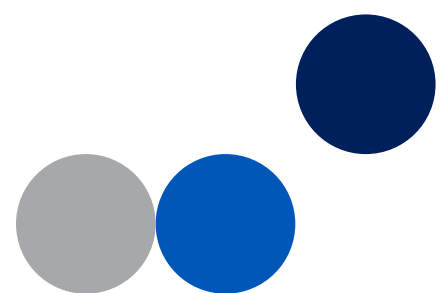
Table 10: Orsted carbon metrics (%)

Year	2019	2020	2021	Jun 22
WACI % change YoY	-37	37	-38	-15
Economic Emissions Intensity % change YoY	-64	-45	45	25
Orsted Total Emissions % change YoY	-46	-0.4	0	0
Revenue % change YoY	-13	-27	61	17
EVIC % change YoY	50	82	-31	-20

Source: Trucost, Bloomberg, abrdn.

We see divergence is being driven by changes in revenue and EVIC. For example, in 2020 a fall in revenues has led to an increase in WACI, while an increase in EVIC has led to a decrease in Economic Emissions Intensity. Moreover, even where the intensity metrics move in the same direction we can see their magnitude in change is highly variable. In 2019, Economic Emissions Intensity decarbonises by nearly double that of WACI.

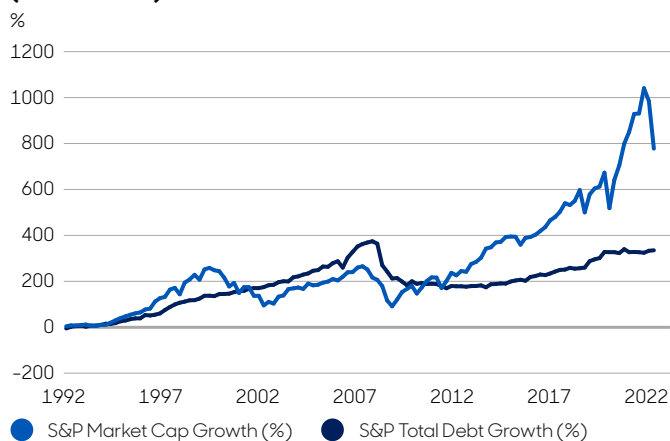
Company shown for illustrative purposes only.
Past performance is no guarantee of future returns.



How will Different Asset Classes be Impacted?

How EVIC-based carbon metrics impact equity and credit depends on the Debt to Equity ratio of investee companies. We can see in Chart 2 that the growth of debt vs equity has been cyclical.

Chart 2: S&P Market cap and debt growth rates (1992 – 2022)



Source: Bloomberg.

In the S&P 500, over the last decade equity has grown at a faster rate than debt, this implies that Financed Emissions have been transferred from debt investors to equity investors. However, between 2000–2010 debt grew at a faster rate than equity, implying a faster growth in Financed Emissions for fixed income investors versus equity investors during this period.

Debt Growth > Equity Growth = Debt Financed Emissions ↑

Debt Growth < Equity Growth = Equity Financed Emissions ↓

What this means for Economic Emissions Intensity will depend on the rule we applied in the worked example 2 & 3 – whether or not holding weights change more than changes in EVIC.

Following the PCAF standard, EVIC is calculated using market value of equity and book value of debt. The Investment in the Company (numerator) should be consistent with how EVIC (denominator) is calculated.

$$\left(\frac{\text{Investment in the company}}{\text{Portfolio value}} \right) \times \left(\frac{\text{Company emissions}}{\text{Company EVIC}} \right)$$

Investor	Investment in the company	Company EVIC ²
Equity	Market Value	Market Value of Equity
Fixed Income	Book Value	Book Value of Debt

²Based on PCAF recommendation.

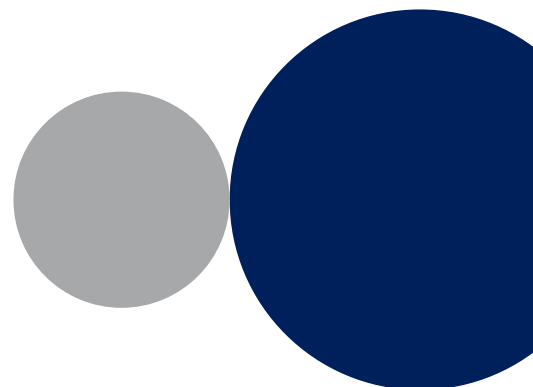
Because equity investors are tied to the changes in market value of equity, the left-hand side of the intensity formula will closely reflect changes in Company EVIC on the right-hand side.

Because fixed income investors are tied to book value of debt, the left-hand side of the intensity formula will not reflect changes in Company EVIC on the right-hand side. For example, a company may increase debt by bank borrowing or new bonds that the investor does not purchase, Company EVIC will increase but the Investment in the Company remains static. This can happen in reverse, for example, a company may repay outstanding bonds that the investor does not own.

The Bottom-Line for Asset Classes

The differences between equity and fixed income means EVIC-based metrics do not treat equity and fixed income investors equally. Under market conditions where share prices rise and equity portfolios see larger growth than fixed income portfolios, EVIC-based metrics favour fixed income. Ultimately final results are a consequence of numerous variables that should be disaggregated.

Equity & Fixed Income	Both exposed to changes in Debt to Equity ratios which can dilute or concentrate EVIC ownership & therefore impact Financed Emissions.
Equity Investors	Changes in market value of equity will be reflected in the equity investors value of Investment in the Company.
Fixed Income Investors	Changes in book value of debt will not be reflected in the fixed income investors value of Investment in the Company.



Choosing the Suitable Metric

When investors are selecting a carbon metric, it is important to understand the carbon question being asked by the investor. No single metric will be a comprehensive to answer all questions without having to make broad assumptions.

We use the outline in Table 11 to better understand which carbon metric should be used when seeking an answer to various carbon-related questions.

Table 11: Choosing The Suitable Metric to Answer the Right Carbon Question

Carbon question	Carbon metric	Rationale
1. What is the real-world climate impact of the company?	Company Total Emissions	Increasing global temperature is a function of cumulative absolute emissions. This is the only metric to assess overall warming impact of a company on the climate without exogenous impacts from revenue or EVIC. Weakness: fails to capture changes in the size of the company, Physical Emissions Intensity solves for this but cannot be aggregated at a portfolio-level. Total emissions also fails to apportion emissions across investors, this is solved by Financed Emissions
	Physical Emissions Intensity	This metric takes the company total emissions normalised by actual economic output (e.g. tons of steel). Weakness: data availability is low and not suitable for portfolio-level aggregation or for large conglomerates, WACI and Economic Emissions Intensity solves for this weakness.
2. How many emissions have I financed as an investor in the company?	Financed Emissions	This metric will capture total emissions owned by an investor across both equity and debt. Weakness: larger investors will own more Financed Emissions due to simply managing more AUM & ownership of emissions change over time due to market moves will impact changes in EVIC ownership.
3. What is the carbon efficiency of the company?	WACI	Accounts for company size and indicates carbon efficiency per \$ of revenue earned. Weakness: metric volatility will occur due to revenue shocks & changes in portfolio weighting will also impact results.
4. How to calculate the emissions I own as an intensity, to normalise by the size of my portfolio	Economic Emissions Intensity	Allows for Financed Emissions to account for the size of an investors total AUM. Weakness: changes in EVIC will impact several components of the metric.
5. How to measure if a company is climate positive?	Forward-Looking Metrics	Green CAPEX & Green Revenues Weakness: relies on a taxonomy, does not account for avoided emissions magnitude and data availability is currently sparse.

So What – Implications for investors

1. All three carbon metrics should ideally be disclosed and disaggregated where possible

The choice of carbon metric matters – All metrics provide investors with a different, sometimes opposing view on carbon and should be disclosed.

Disaggregating the metrics is necessary to examine the underlying drivers of change, particularly in cases where changes in carbon metrics are unrelated to carbon fundamentals. For example, when changes in EVIC due to market volatility or when revenue shocks impact final results.

It can be beneficial to also consider total company absolute emissions to compliment the carbon metrics. However, it must be understood that normalising emissions is important and needed for comparability purposes, for investors to compare companies of different size and funds of different sizes. abrdn calls this 'Fiduciary Carbon Risk Management'.

2. More importantly, we need a forward looking view on carbon and credible targets

Backward looking carbon metrics should be complemented with a forward looking view using scenario analysis, corporate emissions targets and an assessment of their credibility, green revenues and green capex data. This supports the development of a forward looking view on carbon. It is important to consider that data availability can be sparse and forward-looking methodologies are relatively nascent. Nevertheless, investors should attempt to incorporate this data as best as possible, using an approach that transparently accounts for data gaps.

3. Focus on carbon metrics alone is not sufficient for real-world decarbonisation

Using carbon metrics alone will leave investors at risk of making decisions that are mis-aligned with climate goals. Carbon is crucial to measure, report and benchmark. But this is only one component of abrdn's **Net-Zero Directed Investing toolkit** – We believe that supporting real world decarbonisation also requires strong active ownership and net zero focused investment solutions.



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