Measuring Portfolio Alignment

Assessing the position of companies and portfolios on the path to net zero

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ABOUT THE PORTFOLIO ALIGNMENT TEAM

The Portfolio Alignment Team was formed to respond to growing investor and lender interest in measuring portfolios' relative alignment to the objectives of the Paris Agreement, and to advance industry efforts to promote widespread adoption of a consistent, robust and decision useful approach. This report would not have been possible without the generous contributions of the analysts who lent their expertise and their organizations who made them available to produce this report.

DISCLAIMER

Portfolio Alignment Team

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Foreword

As countries turn the Paris Agreement goals into nationally legislated objectives to achieve Net Zero, the financial sector will need to adapt and allocate capital according to their understanding of the opportunities and risks in the transition. Financial institutions will also increasingly be expected to disclose the alignment of their investments to net zero and show how clients' money is invested. Existing climate-related measures all serve an important purpose for this community, but aren't yet as forward-looking, robust, decision useful and comparable as they need to be to measure portfolio alignment.

This report is an excellent critical assessment of the strengths and trade-offs of the options available to measure the alignment of investments with climate goals and is an important contribution to the debate. I hope that it will serve as a basis for discussion in the industry on the approaches to measurement so that by COP 26, investors and creditors can robustly answer how their clients' money is invested for the transition.

Mark Carney
UN Special Envoy for Climate Action and Finance, and
Prime Minister Johnson's Finance Adviser for COP26

Executive summary

As an increasing number of countries legislate for net zero, all sectors of the economy will need to adapt.

For investors and lenders, this will mean identifying risks and opportunities in the transition to a net zero economy. It will also mean demonstrating to stakeholders the extent to which their investments are aligned to climate targets.

This will require common, comparable metrics that meet the following criteria:

- **Forward looking:** to communicate a direction of travel and give credit to credible efforts by companies to decarbonise
- **Decision useful:** allowing comparisons of companies and portfolios with peers, tracking progress over time, and incentivising transition
- **Robust:** analytically rigorous and consistent with climate science
- **Broad coverage:** across sectors, assets, and end users
- **Actionable:** methodologically transparent and feasible given data requirements

Existing climate-related metrics serve important purposes for the finance community, but do not yet meet the above criteria for investors and creditors.

The methods for measuring portfolio alignment are new and still evolving. At its core, any assessment of the position of a company or portfolio on the transition path is, fundamentally, an assessment of their performance relative to a benchmark – a fraction of the carbon budget allotted to them.

It could be useful to consider approaches to measuring companies' and portfolio alignment on a spectrum of sophistication:

- **percentage of portfolio with net zero targets;**
- **deviation of portfolio from a target or benchmark;**
- **degree warming metric.**

As approaches increase in sophistication, they become potentially more decision useful - but also more complex and sensitive to assumptions and inputs.

Given this trade-off, there are merits in using a small collection of approaches on the above spectrum as a cross check on the results. It is also important to ensure transparency, robustness and consistency of building blocks across these approaches.

A degree warming metric is the focus of this report.

It shows a potential global temperature rise associated with the greenhouse gas emissions from a given company or portfolio.

This metric has the potential to be a powerful tool. It enables comparison of companies and portfolios with peers and over time, similar to deviation from benchmarks. And it has a further benefit of being simpler to communicate. But, as a new metric, it is less understood by market participants, difficult to construct and hence requires further work on key methodological judgements (Chapter 3) and data inputs (Chapter 4).

There is no one common way to estimate a degree warming metric.

As suggested by our review of seven leading methods. including Arabesque, CDP-WWF Temperature Rating Methodology, Lombard Odier, MSCI, Paris Agreement Capital Transition Assessment (PACTA), Transition Pathway Initiative (TPI), and S&P Trucost.

Estimating this metric involves three key steps, common across all reviewed methodologies, and nine key judgements, or modelling choices, across which the methods vary. Decisions made on each of these judgements affect the nature and quality of outputs. These methodological differences, alongside differences in data inputs, explain the variation of estimates across the methods.

	KEY JUDGEMENT
Step 1 Translating carbon budgets into benchmarks	1. Benchmark type: temperature path vs warming functions
	2. Benchmark granularity
	3. Intensity vs absolute emissions
Step 2 Assessing company-level alignment	4. Scope of emissions
	5. Current company level emissions
	6. Future company level emissions
	7. Cumulative vs point-in-time
	8. How is the metric expressed
Step 3 Assessing portfolio-level alignment	9. Aggregation from company to portfolio level

Importantly, some of these judgements could lead to different capital allocation, facilitating different types of transition to net zero. For example, metrics that are based on inputs consistent with necessary transition in the hard to abate sectors and jurisdictions, and that recognise future transition plans, could facilitate the flow of capital to the areas where it is needed the most. And a choice of whether to assess total company emissions or emissions per unit of output could determine whether providers of capital would prioritise transforming companies by rewarding growth in market share (e.g. expansion in renewables) or absolute emission reductions (e.g. reduction in fossil fuels). It is therefore important that investors and lenders, as well as metholdology developers, understand the implications of these and other key judgements.

The report sets out our initial views on potential best practice for portfolio warming metrics, including the following:

- **Scenarios that are used as inputs in these metrics should be sector- and region-/ country-specific and updated regularly.** This would allow to accommodate different decarbonisation trajectories and ensure consistency with the latest decarbonisation efforts and climate science.
- **Scope 3 emissions (i.e. emissions down the supply chain) should be included, where useful and can be done with rigour.** But further work is required to decide on the most appropriate approach to capturing Scope 3, as discussed below.
- **Company-level emissions should be based on the best available emissions data and targets.** Often this will be self-reported primary data that should be subject to third party verification rather than estimates. Improving the availability and quality of emissions data is essential for robust portfolio warming estimates.

Making portfolio warming methods robust will require significant improvements in data and other inputs.

Much of this work is already underway by a range of industry-led initiatives. Strengthening, consolidating and harmonising these efforts will be crucial for developing robust portfolio warming metrics that rely on the following inputs:

- **Improved availability and quality of emissions data,** including Scope 3 and emissions broken down by country and sector. These data will benefit from the work by the Task Force for Climate-Related Financial Disclosure (TCFD) and various efforts to make climate disclosure mandatory.
- **Company targets that are externally validated,** e.g. by the Science Based Targets initiative or other third party to ensure credibility.
- **The sector- and country-specific pathways and scenarios**, with the ongoing work by e.g. Network for Greening the Financial System (NGFS), UN Champions Team, and Energy Transition Commission making important contributions.

But data improvements alone are not enough. Methodologies also need to develop and converge around some common key judgements and minimum standards.

Making portfolio warming metrics robust requires further work on the following issues:

- **Intensity or absolute benchmarks?** Estimating a degree warming metric requires assessing company performance against a benchmark, which can be expressed as absolute emissions (i.e. total company emissions) or emission intensity (i.e. emissions per unit of output). Further work is required to explore how to design benchmarks that could accommodate company-level growth (benefit of intensity benchmarks) while minimising the risk of degree warming underestimates (benefit of absolute emission benchmarks).
- **How to include Scope 3 emissions?** Including Scope 3 in degree warming metrics prevents underestimating them and incentivises engagement across the supply chain. But further work is required to address the challenges of including Scope 3, coming from data availability and quality, emissions double counting, and climate scenario limitations.
- **How to aggregate from company to portfolio level?** There are several approaches, and estimates are sensitive to the chosen approach, weighting schemes and approaches to attributing company emissions to investors. Further work is required to establish the most appropriate approach that could support transition and reflect both portfolio composition and its exposure to (and impact on) potential climate outcomes.

Developing transparent, robust and decision useful metrics of portfolio alignment will be an iterative process.

This report makes a step in that direction. The next phase of developing metrics of portfolio alignment could involve exploring these questions in a dialogue with industry, with an aim a) to incorporate the feedback from industry on the initial view on best practice, b) to review other new and refined methods that could develop in the next six months, and c) to deepen understanding of best practice in light of these developments and insights from public consultations by TCFD, the Net Zero Asset Owner Alliance, and the Institutional Investors Group on Climate Change, that will be released in November 2020 – February 2021.

Going forward, we hope this report will form the basis of a discussion and further collaboration with:

- Financial institutions – to evaluate the utility of degree warming metrics for capital allocation, risk management, and engagement strategies.
- Methodology developers – to contribute to further development of methodologies and convergence around key judgements and best practice for these metrics.
- Industry-led initiatives – to converge around a shared set of key judgements
- TCFD – to inform their discussions during the consultation period on implied temperature rise and other forward-looking metrics.
- Standard setters – to discuss the benefits and challenges of including these metrics in disclosure requirements.

Chapter 1

Background and rationale

As an increasing number of countries legislate for net zero, all sectors of the economy will need to adapt.

For investors and lenders, this will mean identifying risks and opportunities in the transition to a net zero economy. This will require a framework for measuring the alignment of companies and portfolios with net zero. In the absence of such a framework:

- Investors and lenders will be unable to assess the position of companies and portfolios on the path to net zero – to compare them with peers and track progress over time.
- This will in turn reduce the ability of financial institutions to effectively allocate capital in a way that supports climate goals, assess transition risks, and engage with companies to facilitate real economy emission reductions.
- This will also reduce the ability of financial institutions to track their own contribution to limiting global temperature rise and reaching net zero.
- While a number of methods exist today, their fragmentation and methodological differences prevent the methods from fulfilling their fundamental purpose, as outputs across companies and portfolios lack consistency and comparability.
- Methodological differences could also increase greenwashing risks as the metric could be adjusted to fit different purposes.

This framework requires comparable metrics that meet the following criteria:

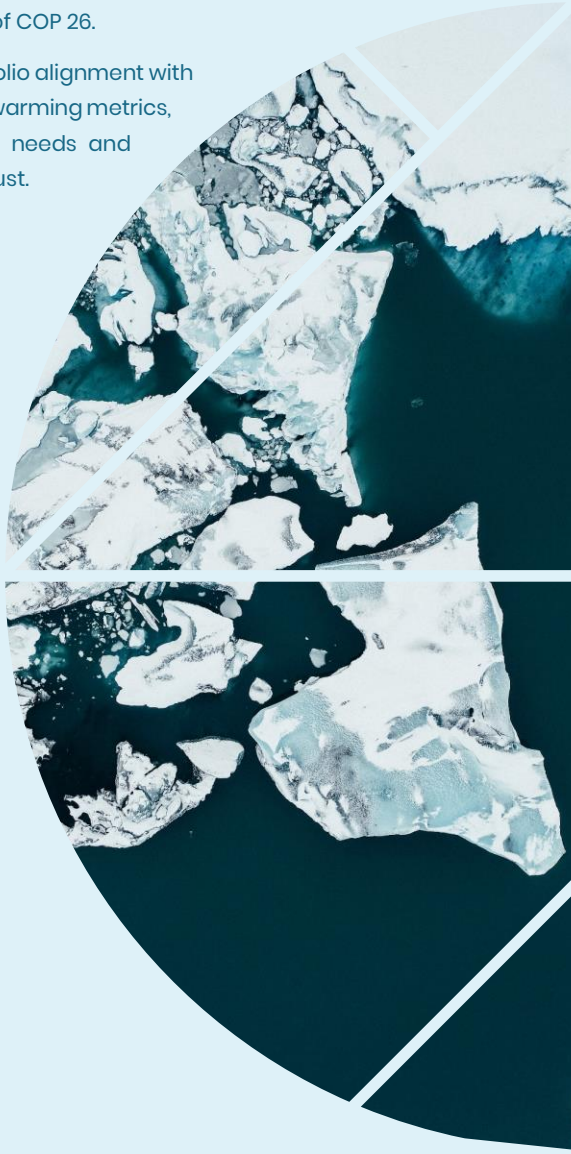
- **Forward looking:** to communicate a direction of travel and give credit to credible efforts by companies to decarbonise.
- **Decision useful:** Allow comparison of companies and portfolios with peers, tracking progress over time, and incentivising transition. To fulfil this fundamental purpose, these metrics need to be expressed on a continuous scale, indicating the distance to net zero.
- **Robust:** These metrics should be analytically rigorous and consistent with climate science. This requires an approach that, if widely adopted, would keep cumulative greenhouse gas emissions (GHG) within the carbon budget associated with a given warming target. This approach would also have a consistent internal logic and rely on rigorous analytical techniques.
- **Broad coverage** across real economy sectors and financial asset classes is important for making the metrics usable by a broad range of financial market participants, to support a whole economy transition.
- **Actionable:** The metrics should be based on best available (or soon to be available) data and other inputs, and have transparent, open source methodologies to allow investors and lenders to drill down into results and derive actionable insights.

Our overall view is that development of metrics of portfolio alignment will be an iterative process. It could be useful to have a collection (small number) of approaches. And it is crucial to ensure robustness and consistency across their common building blocks, including key judgements and data inputs.

This report is produced in support of the TCFD Consultation on forward looking metrics that was published in October.[1] The public consultation will help gather feedback on the value and some features of the forward-looking metrics, as well as benefits and challenges of their disclosure. This could in turn facilitate further development of these metrics and their convergence around some common principles.

There is growing interest among investors and lenders in approaches to measuring alignment of companies and portfolios to net zero. We hope to contribute to this discussion by setting out analytical underpinnings for robust and decision useful metrics, with an aim for the industry to converge around a common understanding of the key building blocks ahead of COP 26.

The rest of this report brings together different approaches to measuring portfolio alignment with net zero into a coherent framework, identifies key building blocks of the degree warming metrics, sets out an initial view on potential best practice and identifies the data needs and methodological questions that require further work to make these metrics robust.



[1] TCFD (2020), Implied temperature rise and forward looking metrics, Consultation.
https://assets.bbhub.io/company/sites/60/2020/09/2020-TCFD_Consultation-Forward-Looking-Financial-Sector-Metrics.pdf

Chapter 2

Framework for measuring portfolio alignment

2.1. Metrics: A spectrum of sophistication

As approaches increase in sophistication, they become potentially more decision useful – but also more complex and sensitive to assumptions and inputs.

Global warming is a function of cumulative greenhouse gas emissions, therefore limiting warming, at any level, requires reducing total emissions to net zero. Stopping warming at 1.5-2°C means reaching net zero quickly enough to keep emissions within a carbon budget of about 500-1420 Gt CO2.[2] For this reason, at its core, any assessment of the position of a company or portfolio on the transition path is a relative assessment of their emissions against a benchmark – their allocated share of the cumulative global carbon budget.

Existing climate-related measures all serve different and important purposes for the finance community, but don't yet fully meet the above criteria (Chapter 1) for the metrics necessary to guide the transition. For example, carbon footprints and corresponding emission intensities (e.g. CO2/$) only capture current emissions and fail to give credit for plans to reduce them. And taxonomies were developed to facilitate capital flows towards sustainable activities, but do not cover all business activity, and are not yet dynamic enough to accommodate changes in the market.

Approaches to measuring net zero alignment of companies and investment portfolios are new and still evolving. A range of approaches have emerged in recent years, including benchmarks, target setting frameworks and portfolio warming metrics. And there are several methods within each. But there is no common view yet on which of these approaches are more robust and decision useful, and how they fit into a coherent framework.

It could be useful to consider approaches to measuring net zero alignment on a **spectrum of sophistication:**

- the percentage of a portfolio with net zero targets;
- deviation of a company or portfolio from a target or benchmark;
- degree warming metrics.

The percentage of portfolio with net zero targets is the simplest approach on this spectrum. This allows a basic assessment of the *extent* to which a portfolio is committed to net zero. The resulting metric is simple and transparent. It could indicate, for example, that 20% of the companies in a portfolio have net zero targets in place. These could be targets stated by the company and, to improve robustness and credibility, could be supported by third-party validation (for example, by Science Based Targets initiative, SBTi, or other third parties) and accompanying transition plans.[3]

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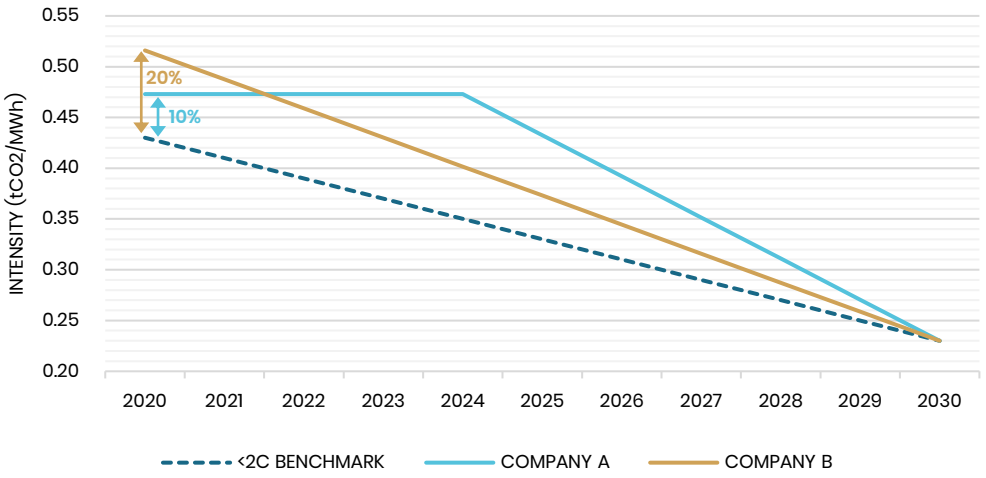
[2] As of January 2021, assuming a baseline 0.97C warming in 2006-2015, and a 50% chance to limit warming to less than 1.5°C and 2°C respectively. See IPCC (2018) 'Global Warming of 1.5°C Special Report', Table 2.2 (p. 108): https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf

[3] This is similar to SBTi portfolio coverage approach – one of the three target setting methods for financial institutions recommended by SBTi,. The other methods include Sectoral Decarbonization Approach and the temperature rating approach. See SBTI (2020) 'Financial Sector Science-based Targets Guidance' https://sciencebasedtargets.org/wp-content/uploads/2020/10/Financial-Sector-Science-Based-Targets-Guidance-Pilot-Version.pdf

However, as this assessment is binary, it is not suitable for assessing the *position* of companies and portfolios on the transition path to net zero. This metric does not provide information on the alignment of the part of the portfolio without targets. And it does not differentiate among companies that have identical targets but different distance to achieving them. It is therefore possible for two portfolios to have 20% of assets with net zero targets, and yet have a different position on the transition path. This makes the approach less decision useful for investors and lenders that seek to compare companies and portfolios with peers or track progress over time. Therefore, the resulting metric is also less useful as a measure of transition risks and opportunities, or as a guide to engagement strategies with the real economy.

Measuring **the deviation of companies or portfolios from targets or benchmarks** could help address some of these limitations. This approach assesses companies and portfolios against their targets or benchmarks. It also differentiates between companies or portfolios with identical targets, but different deviation from them. For example, this metric could distinguish between two companies with identical benchmarks but starting 10% and 20% above them, respectively (**Figure 2.1**).

Figure 2.1: Hypothetical power sector portfolio decarbonisation trajectory



There is a range of approaches that could be a basis of this metric, from global sector-agnostic benchmarks to more granular pathways and target setting frameworks and, finally, specialised tools specifically designed for these purposes. For example, EU Climate Benchmarks require portfolios to decarbonise at an average rate of 7% per year, to be aligned with a global 1.5°C International Panel on Climate Change (IPCC) scenario.[4] And NZAOA recommends several net zero-aligned targets for asset owners, including sector-specific and asset class targets consistent with a 1.5°C IPCC scenario (e.g. target for equity portfolio emissions to reduce by 16-29% by 2025).[5]

[4] EU Technical Experts Group (2019) 'Final report on EU climate benchmarks and benchmark ESG disclosures' (p. 46): https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/190930-sustainable-finance-teg-final-report-climate-benchmarks-and-disclosures_en.pdf

[5] NZAOA (2020), 'Draft 2025 Target Setting Protocol' (p. 8): https://www.unepfi.org/wordpress/wp-content/uploads/2020/10/Alliance-Target-Setting-Protocol_Final-Consultation-Draft.1.pdf

Framework for measuring portfolio alignment

Benchmarks and target setting frameworks usually do not offer guidance on how to calculate or interpret the deviation from a target. By design, these frameworks provide a binary assessment of whether a company or portfolio is aligned with a given temperature path based on their performance. But in principle, with some further work, these frameworks could be a valuable building block for measuring *degrees* of alignment.

To overcome some of these limitations, specialised tools have been developed to estimate deviation from sector benchmarks. These tools could help investors and lenders distinguish between companies with different trajectories to achieving targets**.** For example, TPI reports whether a company's emission intensity is above or below a given sectoral pathway, consistent with one of three scenarios. And PACTA shows the percentage deviation of a portfolio's asset allocation from one that would be consistent with a given temperature warming scenario. These tools are considered in greater detail alongside degree warming metrics in Chapter 3, given that these approaches have many common building blocks, except their output is expressed in different units – deviation from benchmarks and temperatures, respectively.

Finally, **degree warming metrics** go one step further by converting this deviation from the benchmarks into a temperature score. For example, the SBTi target setting framework not only provides guidance on how to set targets, but also includes an approach to converting different types of targets into a common metric – a temperature score. All other portfolio warming methods, considered in detail in Chapter 3, have a similar underlying principle.

The resulting metric shows a potential global temperature rise above pre-industrial levels associated with the GHG emissions from a given company or portfolio. The main benefit of this approach is its ability to summarise differences in decarbonisation paths in one number. For example, in **Figure 2.1**, Company B would have a lower temperature score than Company A**,** consistent with the differences in their decarbonisation trajectories. This conclusion cannot be reached by looking at the current deviation from the benchmark.

There is growing interest from investors and lenders in these metrics. Some large asset owners and asset managers have started disclosing degree warming metrics alongside other similar metrics. For example, in 2020, the Japanese Government Pension Fund (GPIF) disclosed that its equities and bonds portfolios are aligned to 2.8-3.0°C, while CalPERS' overall portfolio was aligned to 3.2°C, tracking the global warming potential of the wider economy.[6]

Asset owners and asset managers that disclose these metrics recognise that the metrics need further work, and that the accuracy will improve over time. But they consider degree warming metrics to be a useful forward looking tool that indicates their portfolio trajectory. They tend to use these metrics for three purposes – to assess climate related risks, to allocate capital in line with climate objectives and to facilitate engagement with

[6] GPIF (2020) 'Analysis of Climate Change-Related Risks and Opportunities in the GPIF Portfolio': https://www.gpif.go.jp/en/investment/trucost_report_en.pdf
CalPERS (2020) 'Investment Strategy on Climate Change': https://www.calpers.ca.gov/docs/board-agendas/202006/invest/item08c-01_a.pdf%20

companies to drive decarbonisation efforts. Some investors also use the metric to assess the impact of specific investment strategies. For example, AXA assessed their climate-related divestments (coal, oil sands) and found that divestment only slightly reduced the degree warming of their portfolios.[7]

A degree warming metric has the potential to be a powerful tool. It has all the benefits of the deviation from benchmark approach: it is forward looking and allows assessment of the position of companies and portfolios on a continuous transition path. This enables comparison of companies and portfolios with peers and tracking progress over time. And it has a further benefit of being a simple to communicate metric, expressed as a number directly linked to potential future temperature outcomes. This makes it a consumer-friendly metric potentially valuable for both wholesale and retail investors alike.

While simple to communicate, this metric is not simple to construct. Degree warming metrics require many assumptions and data inputs, which makes the estimates sensitive to these methodological choices and inputs. This makes it harder to ensure analytical robustness and to understand the drivers of the results. For example, an analysis in *The Alignment Cookbook* compared the results of 13 different temperature warming methodologies applied across the Euronext LC100 and SBF120 indices, finding little consistency and correlation across the resulting temperature estimates.[8] The report attributes the difficulty in comparability to the disparate assumptions and levels of data coverage across methodologies. This issue is also recognised by Net Zero Asset Owner Alliance (NZAOA) that has published a call for convergence around the key principles for implied temperature rise (or degree warming) metrics.[9] And the Institutional Investors Group on Climate Change (IIGCC) has published criteria for forward-looking metrics as part of their consultation on a framework for investors. [10]

[7] Axa (2020) 'Climate Report': https://www-axa-com.cdn.axa-contento-118412.eu/www-axa-com%2F3800520b-ce0f-4aa7-908d-3ec367b21d39_2020_climate_report_axa.pdf%20%20

[8] Institut Louis Bachelier (2020) 'The Alignment Cookbook' Table 22, (p. 81): https://gsf.institutlouisbachelier.org/publication/the-alignment-cookbook-a-technical-review-of-methodologies-assessing-a-portfolios-alignment-with-low-carbon-trajectories-or-temperature-goal

[9] NZAOA (2020)' A Call for Comment on carbon neutrality / "implied temperature rise" methodology convergence': https://www.unepfi.org/net-zero-alliance/call-for-comment-alliance-methodological-criteria/

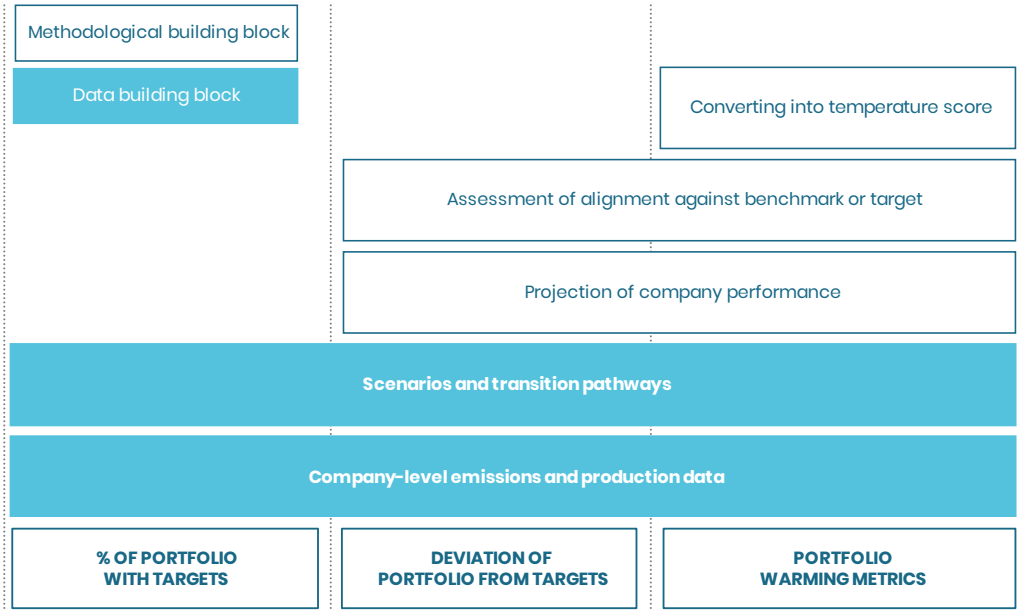
[10] IIGCC (2020) Net Zero Investment Framework Consultation': https://www.iigcc.org/resource/net-zero-investment-framework-for-consultation/.

2.2. Interactions among approaches

There is value in using a small collection of approaches on the spectrum of sophistication.

Approaches on the above spectrum rely on an increasing number of building blocks (**Figure 2.2**). They all require company level emissions and economic data. And they all require pathways or climate scenarios, because at the core, all these metrics are different ways of assessing companies and portfolios' performance against their fraction of a given carbon budget. Approaches that measure portfolio deviation from targets are an important building block for degree warming metrics. The former rely on as inputs (and often develop) pathways that the individual sectors or the entire economy should follow to achieve net zero. Degree warming metrics rely on these foundations, but also introduce the additional steps to convert companies' and portfolios' deviation from benchmarks into a temperature score.

Figure 2.2: Common building blocks across approaches



There is value in using a small collection of approaches on the spectrum of sophistication as a cross check on the results, given the trade-off between potential benefits and greater complexity, both of which come with sophistication. And it is crucial to ensure transparency, robustness and consistency across their common building blocks, including key judgements and data inputs. This is particularly important given that the methods have different objectives, audiences and use cases.

A further benefit of using a collection of approaches is that development of any one approach will facilitate the development of the others. For example, further development of target validation frameworks (e.g. SBTi) would strengthen the quality of corporate targets as inputs in other approaches. And expanding the coverage of target setting frameworks to private equity, mortgages, and other asset classes not yet covered today (e.g. as planned by NZAOA) will enable broader coverage of portfolio warming metrics.

Among the approaches, a degree warming metric has the potential to be a powerful tool – but it is less understood, difficult to construct and requires further work on both methods and data inputs, to ensure transparency, robustness and consistency across the degree warming methodologies. Therefore, the rest of this report focuses on these metrics, with an aim to contribute to their transparency and evolution towards minimum standards and best practice. Chapter 3 focuses on the methodological issues and sets out initial views on best practice and identifies areas that require further work to make the metrics robust. And drawing on these analytical findings, Chapter 4 then considers necessary improvements in data and other inputs that are required for robust metrics.

Chapter 3

Portfolio warming metrics and their key building blocks

Overview

This chapter sets out a framework for thinking about portfolio warming metrics, including the steps in constructing these metrics and the judgements, or modelling choices, that need to be made on the way.

We evaluate these key judgements, with an aim to set out an initial view on best practice and identify the areas that require further work – to enable investors and lenders to coalesce around more robust and decision useful metrics over time. This framework and assessment is based on a review of the seven leading methods, including Arabesque, CDP-WWF[11], Lombard Odier, MSCI, PACTA, TPI, and Trucost, summarised in **Annex 1.**[12]

There is no one common way to estimate a portfolio warming metric. Our review suggests that estimating this metric involves **three steps** common across different portfolio warming methods: translating carbon budgets into benchmarks, assessing company-level alignment, and assessing portfolio-level alignment **(Figure 3.1).** But implementing these broad steps requires making **nine key judgements**, across which the methods vary. These methodological differences, alongside differences in inputs, influence the nature and quality of the end results.

Figure 3.1: Common steps and key judgments across which methods vary

	KEY JUDGEMENT
Step 1 Translating carbon budgets into benchmarks	1. Benchmark type: temperature path vs warming functions
	2. Benchmark granularity
	3. Intensity vs absolute emissions
Step 2 Assessing company-level alignment	4. Scope of emissions
	5. Current company level emissions
	6. Future company level emissions
	7. Cumulative vs point-in-time
	8. How is the metric expressed
Step 3 Assessing portfolio-level alignment	9. Aggregation from company to portfolio level

[11] The CDP-WWF temperature rating approach is a public methodology for determining the temperature rating of targets, companies, and portfolios. It has been adopted by the SBTi as a target setting method for financial institutions who use the temperature rating methodology as the basis to create science-based targets.

[12] Some of these tools may have been designed for different use cases, e.g. to provide greater granularity and context in specific areas of the economy. For example, the Poseidon approach to assessing financed shipping emissions, or PACTA's asset-level granularity for high-emitting sectors.

Portfolio warming metrics and their key building blocks

Importantly, some of these judgements determine how a portfolio warming metric allocates the responsibility of emissions reductions to companies. This in turn leads to different capital allocation**, resulting in different transition paths to net zero**. For example, metrics that are consistent with a necessary transition in the hard to abate sectors and jurisdictions (granular scenarios) and recognise future transition plans (emissions targets) could facilitate the additional flow of capital to the areas where it is needed the most. And a choice of intensity vs absolute benchmarks could determine whether providers of capital would prioritise transforming companies and sectors by rewarding growth in market share (e.g. expansion in renewables) or absolute emission reductions (e.g. fossil fuel reduction). It is therefore important that investors and lenders, as well as methodology developers, understand the implications of these and other key judgements.

Relatedly, it is important that the metrics are designed in a way to avoid the unintended consequence of divestment. Divestment will not be enough to reduce emissions to a level needed to limit the increase in global temperatures. Even though in some circumstances the implications of divestment for the cost of capital for the assets not aligned with net zero may benefit the transition.

Step 1: Translating carbon budgets to benchmarks

Translating the emissions of a single company or portfolio into a temperature score requires assessing these emissions against a benchmark that makes assumptions about what all other actors are doing. Such benchmarking is necessary, because global warming is a function of total global emissions, and not the emissions of any one actor. In principle, it could be possible to estimate marginal contribution to warming of a given company or portfolio, but that would result in immaterial estimates. Establishing such a benchmark requires three key judgements:

- the type of benchmark (i.e. a temperature pathway or a warming function);
- the degree of granularity of the benchmark (i.e. global or sector/country specific);
- a unit in which to express this benchmark (i.e. emissions intensity or absolute emissions).

KEY JUDGEMENT 1

Type of benchmark

There are two approaches to translating emissions to a temperature score – by assessing them against one (or several) temperature pathways and by estimating a warming function that relates emissions to a range of temperature outcomes. While both approaches have the same functionality, they have different requirements with respect to the number of scenarios and different degrees of complexity.

The simplest of these two approaches assesses alignment **against one or several specific temperature pathways**.[13] In this method the performance of a given company is measured as the deviation from an emissions pathway associated with a given temperature. This approach is used by methods like Arabesque, Lombard Odier, PACTA and TPI (**Annex 2**).[14]

This deviation from a benchmark, or a "carbon budget overshoot", is then translated to a temperature score by asking the question: If the whole economy maintained the same percent deviation, what would be the global temperature increase? This can be done using the relationship established by IPCC that each marginal Gt CO2 emitted corresponds to an additional 0.000545 C warming.[15] For example, if a company overshoots its illustrative 1700 ktCO2 2°C benchmark by 40% (**Figure 3.2**), and the remaining global 2°C carbon budget is 1000 GtCO2, this

[13] There is also a question of whether to use one or many pathways for a given temperature outcome. In practice approaches using multiple pathways per temperature outcome collapse them to a single scenario, chosen as their central tendency (e.g. SBTi).

[14] This approach is also used by the methods that assess alignment as the deviation from targets or benchmarks. For example, the NZAOA target setting framework allows to assess emissions against 1.5C pathways.

[15] IPCC (2013), Climate Change 2013: The Physical Science Basis. https://www.ipcc.ch/report/ar5/wg1/ Of the full 0.8-2.5C likely range provided by the IPCC, this assumes a TCRE of 2C per 3670 Gt CO2, following Allen et al (2009). 2C/3670 yields 0.000545 C warming per Gt CO2.

can be translated into a temperature score as follows: 2°C + (1000 * 40% * 0.000545) = 2.2°C. While the deviation of company emissions can be measured against either an intensity or absolute benchmark, to be converted to a temperature score, it will have to be expressed in or converted to absolute units. This is because warming is caused by the number of tons of GHG in the atmosphere, not by the tons released per unit of output.

Figure 3.2: Illustrative cumulative benchmark overshoot

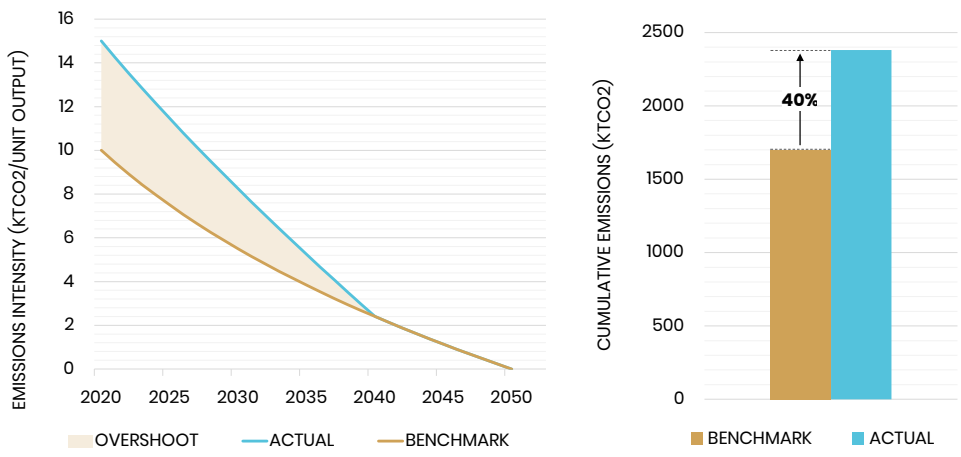
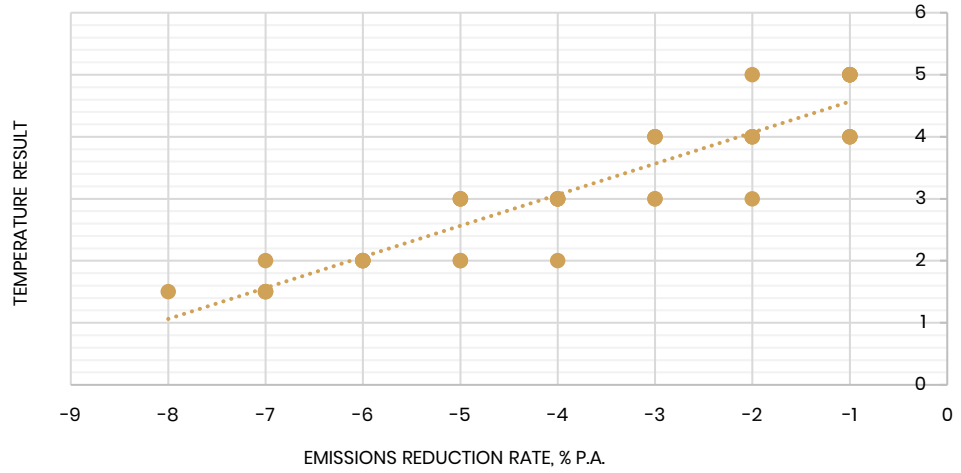


Figure 3.3: Illustrative sector warming function



A more complex approach to converting emissions to a temperature score involves **estimating a warming function** that establishes an empirical relationship between emissions and a range of temperature outcomes, drawing on multiple scenarios (**Figure 3.3**). This function is then used to map a temperature score based on a given company's emissions. By design, this approach requires several temperature pathways. For example, MSCI estimates a logarithmic function to relate expected future emissions intensity and degrees of warming, using three scenarios (**Annex 2**). The CDP-WWF method estimates a linear relationship between different types of emissions targets and temperature outcomes in 2100 by leveraging descriptive statistics from hundreds of IPCC scenarios. This approach could use either intensity or absolute metrics. However, the latter

could be more robust, given that the link between emissions intensity and temperature is correlative, while the link between absolute emissions and temperature is causal.

Both approaches – those based on assessment relative to a pathway or a warming function – provide the same functionality and are based on scientifically robust concepts. The warming function approach is more complex, and therefore leaves more room for error in construction. But it also allows to estimate an average of a broad range of scenarios, instead of using only one, which theoretically should improve the quality of the benchmark.

KEY JUDGEMENT 2

Benchmark granularity

The methods also vary by the degree of geographic and sectoral granularity of the benchmarks. The simplest approach is to assess the performance of companies and portfolios relative to a global, sector-agnostic scenario. This is similar to the EU Climate Benchmark that requires a 7% year-on-year reduction in emission intensity, consistent with a 1.5°C IPCC scenario, on average. On the other end of the spectrum, benchmarks could vary by sector and geography, with different degrees of granularity.

If all portfolios were diversified across all sectors and geographies, and every provider of capital was a "universal owner", the granularity of benchmarks would matter less. Portfolio exposures would be compared to the total global carbon budget. But in practice, this is not the case, and the degree of granularity of benchmarks will affect degree warming estimates.

Deciding between these options requires taking a view on how to trade off the merits of simplicity and flexibility of a benchmark (that decrease with granularity) against benefits of incentivising engagement in areas where decarbonisation is particularly crucial (that increase with granularity).

The simplicity of **sector- and country-agnostic** benchmarks reduces the likelihood of misleading estimates, especially given uncertainty around both actual and desired future decarbonisation pathways. These approaches also have a broader coverage. For example, Sectoral Decarbonisation Approach (SDA), a well-established sectoral approach based on an International Energy Agency (IEA) 2 degree scenario, covers over 60% of current annual GHG emissions and up to 87% of the CO2 budget up to 2050.[16] Coverage of sector-specific approaches is likely to increase as sectoral pathways continue to develop.

On the other hand**, sector- and country-specific** benchmarks are more realistic as they reflect different abilities to decarbonise across sectors and geographies, as recognised by the SBTi SDA approach and several ongoing initiatives to develop increasingly detailed sector decarbonisation pathways. By allowing difficult-to-decarbonize sectors and regions (and countries, where decision useful and practical) to decarbonise at a slower rate than others, this approach reduces deviation from benchmarks and translates emissions for those sectors into lower temperature scores. This in turn is consistent with the capital flow to those sectors and regions, and helps identify leaders and laggards within them more effectively. The disadvantage of this approach is

[16] SBTi (2015), Quick Guide to the Sectoral Decarbonisation Approach. https://sciencebasedtargets.org/wp-content/uploads/2015/05/A-Quick-Guide-to-the-Sectoral-Decarbonization-Approach.pdf

that the more detailed a scenario becomes, the more opportunities it has to diverge from the real world, resulting in increasingly inaccurate benchmarks over time.

Recommendation

On balance, given the importance of a whole economy transition, methods should use sector- and region-specific (and country-specific, where useful and practical) scenarios to construct degree warming metrics. The disadvantages of this approach could be minimised by regularly (ideally, annually) updating the reference scenarios. This would ensure the scenarios are consistent with the latest economic reality and climate science. More research is required on the preferred level of granularity.

KEY JUDGEMENT 3

Intensity vs Absolute Emissions

The final key judgement for constructing a benchmark is whether to use absolute emissions or emissions intensity (or both) as an input. Absolute emissions are the total emissions of a company or portfolio, while intensity refers to emissions per unit of output expressed in physical units (e.g. megawatt hours) or economic units (e.g. revenue). Several methods use intensity benchmarks (e.g. MSCI, TPI), others use absolute (e.g. Lombard Odier), and some use both – either sequentially (Trucost) or in parallel (CDP-WWF).

At the core, absolute and intensity benchmarks are an expression of the same carbon budget, and therefore should lead to the same overall emissions outcome provided that the input assumptions for deriving the global benchmark are realised (e.g. realised sector outputs match forecasted sector output).

As a result, absolute and intensity metrics can be designed to have many similar properties. For example, it could be argued that an absolute metric disadvantages large companies with high levels of emissions, whereas an intensity benchmark does not since it considers emissions after adjusting for the level of output. However, this issue could be mitigated by assessing companies against a rate of change in absolute emissions. All else equal, benchmarks set as intensity level and rate of change in absolute emissions accommodate differences in firm size and result in equivalent temperature scores (**Table A1** in Annex 2).

Absolute and intensity metrics may however support different types of transition towards net zero. This is because companies can reduce intensity in two ways – through decarbonising or by increasing market share – while only the former affects absolute emissions. Intensity benchmarks therefore accommodate companies transitioning towards net zero through growing their market share (e.g. adding renewables), be it organic growth or through mergers and acquisitions. All else equal, a company maintaining constant absolute emissions but increasing its market share would reduce its temperature score when assessed against an intensity benchmark, but not against an absolute benchmark (**Table A2**).

The flip side of this benefit of an intensity metric is that it comes with a risk of underestimating degree warming, if companies achieve the intensity benchmark by growing output more than was assumed, instead of reducing emissions (**Table A3**). Empirical evidence suggests this is an important issue. For example, a study of over 3000 global utilities by Alova (2020) recently published in Nature found that, over the past two decades, of 375 companies that expanded by growing renewables (hence reduced their emission intensity), only 15% reduced their fossil fuel assets (i.e. absolute emissions).[17]

This is consistent with a recent industry interest in absolute reduction targets which have a closer link to cumulative carbon budgets and are therefore less exposed to the risk of underestimating temperature outcomes. For example, in the recently published target setting framework for financial institutions, SBTi allows both types of targets, but intensity targets are allowed conditional on meeting sufficient absolute emission reductions. And in their framework for asset owners, NZAOA recommends absolute emissions targets as a preferred approach for asset (portfolio)-level targets, although they also highlight the strengths of and allow intensity sector-level targets.

There are several options to mitigate the risk of underestimating temperature scores, when using intensity benchmarks. For example, regularly updating the benchmarks with latest emissions and output data would reduce the risk of sector outputs growing significantly beyond that assumed when constructing the benchmark. This would in turn reduce the risk of underestimating degree warming. Where possible, it is also preferable to use intensity metrics with denominators expressed in physical units (e.g. megawatt hours) that are more closely linked to emissions and less exposed to price volatility[18] than economic units (e.g. revenue). For example, the SDA approach uses physical intensity metrics for sectors with comparable units of output, such as steel. It could also be possible to supplement degree warming metrics with guardrails (i.e. complementary tools to mitigate the risk of temperature score underestimates), similar to SBTi and NZAOA that require intensity targets for financial institutions to be accompanied by absolute emission reductions.

Recommendation

When intensity benchmarks are used, they should be regularly updated and, where possible, have denominators expressed in physical units. These measures might, however, be insufficient to address the risk of degree warming underestimates from using intensity benchmarks. Therefore, further work is required on possible benchmark design for degree warming metrics, to accommodate company-level growth (benefits of intensity benchmarks) while minimising the risk of underestimating degree warming (benefits of absolute benchmarks).

[17] Alova, G (2020), A global analysis of the progress and failure of electric utilities to adapt their portfolios of power-generation assets to the energy transition, *Nature*. https://www.nature.com/articles/s41560-020-00686-5
[18] Price volatility includes e.g. currency rates and inflation.

Step 2: Assessing company-level alignment

KEY JUDGEMENT 4

Scope of emissions

4.1. Opportunities and challenges from including Scope 3

The emissions associated with a company can be generated directly by their owned or controlled assets (Scope 1), from the generation of their purchased energy (Scope 2), and from elsewhere in their up-and downstream activities (Scope 3).[19]

Estimating company level degree warming requires taking a view on what scope of emissions a given company is responsible for. This decision, and in particular a judgement on whether to include Scope 3 (and if so, under which conditions and adjustments), has significant implications for the estimates.

A robust and accurate portfolio warming metric should capture all global emissions. **Scope 3 inclusion is required to capture emissions emitted by companies indirectly,** such as those by consumers in the use phase of products (e.g. cars), for two reasons:

- For many companies these emissions form the majority of their carbon footprint. For example, 97% of the total carbon footprint for Autos is in Scope 3 (**Table 3.1**). Without being held accountable for the impact of business across the full value chain, corporates could be less focussed on decarbonising outside of their direct operations.
- Moreover, downstream emissions are to some extent captured in the climate scenarios for some sectors, for example Autos, Oil & Gas, and Mining under IEA.[20] Excluding company level Scope 3 emissions would flatter these sectors and likely result in *underestimating* portfolio warming metrics.[21]

However, there are also challenges with including Scope 3 data at a portfolio level. There are issues around data availability and quality that are discussed in Chapter 4. Climate scenarios do not have a consistent and comprehensive treatment of Scope 3 emissions across different sectors. And including Scope 3 at a portfolio level could also lead to double counting of emissions, as a direct consequence of Scope 3 representing emissions across the value chain. It will include emissions already reported by multiple other up- and- downstream stakeholders. For example, Scope 3 emissions of an Oil & Gas company will include the Scope 1 emissions of a trucking

[19] World Resources Institute, World Business Council for Sustainable Development (2004) 'GHG Protocol Corporate Accounting and Reporting Standard' (p. 25): https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf

[20] A focus on sector-specific scenarios is consistent with Key Judgement 2 of this report. Downstream emissions factored into the climate scenarios are related to, but not directly comparable with, company reported Scope 3 emissions.

[21] As company reported Scope 3 emissions captures both up- and- downstream, including Total Scope 3 for relevant sectors would result in *overestimating* portfolio warming metrics.

company. If both companies are in the same portfolio, these emissions would be counted twice and the temperature score overestimated, unless these duplicated emissions within portfolios are removed.

4.2. Options for incorporating Scope 3 in degree warming metrics

While it is important to be ambitious with Scope 3 inclusion, it is also important to identify the most robust and decision useful way of capturing Scope 3 given the above challenges. There are three options for incorporating Scope 3 into portfolio warming metrics.

Option A: Include for all companies

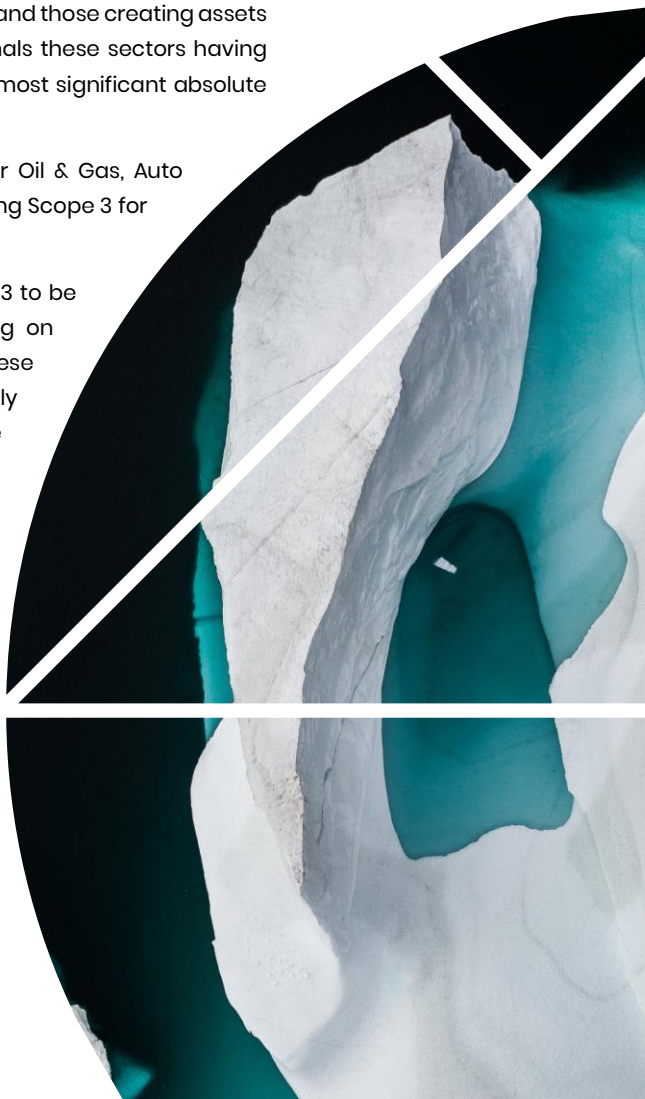
By including Scope 3 for all companies, a portfolio warming metric would account for the largest portion of real-world emissions, but also introduce the largest amount of double-counting which may require adjustments. To avoid *overestimating* the portfolio warming metric, these emissions would also need to be reflected in the sector-specific benchmarks that are not currently available for all sectors. MSCI currently includes Scope 3 for all companies by applying a Scope 3 de-duplication multiplier to all sectors and benchmarking against a warming function derived from sector-agnostic scenarios.

Option B: Include for the most exposed sectors

Alternatively, Scope 3 emissions could be attributed to companies only in sectors with significant use phase emissions, namely those producing fossil fuels (e.g. Oil & Gas) and those creating assets that consume fossil fuels (e.g. Autos). Evidence in **Table 3.1** clearly signals these sectors having both the highest proportion of Scope 3 to total GHG footprint and the most significant absolute Scope 3 footprint.

This option is currently adopted by TPI, where Scope 3 is included for Oil & Gas, Auto Manufacturers and Diversified Mining. And Trucost are exploring including Scope 3 for Oil & Gas and Auto Manufacturers in their warming metric.

There are a number of benefits to this approach. It would allow Scope 3 to be incorporated in a targeted and decision useful manner, by focusing on sectors with the most material use phase emissions. Incorporating these emissions could also make the estimates more robust by more accurately reflecting the perimeter of emissions in the IEA scenarios that capture some downstream emissions for a few sectors. Finally, methods to adjust for double counted emissions could also be more accurate when they involve tracing emissions across a more narrowly defined supply chain.



Option C: Include when material

The other alternative is to focus on Scope 3 for high emitters, but at the company level, and include Scope 3 when material (e.g. if it exceeds a given percentage of total emissions). This option would also require adjustment for double counting. And more work is required to understand how sector-specific climate scenarios might accommodate only some companies within a sector including Scope 3 for benchmarking purposes.

The CDP-WWF method currently uses a hybrid of Options B and C. Scope 3 is included for all companies in the oil and gas sectors and for companies in all other sectors, when their Scope 3 exceeds 40% of their total carbon footprint.

Table 3.1: Median Scope 3 disclosures for MSCI ACWI constituents, latest available data (2017-present)

GICS 2 Sectors	# Co's in ACWI	Scope 3 disclosure	Scope 1 & 2 disclosure[1]	Median Scope 3% of Total GHG[2]	Median Scopes 1-3 Total GHG[2]	Median Scope 3[2]
Automobiles & Components	78	36%	74%	97%	26,392,781	24,973,362
Technology Hardware & Equipment	133	29%	56%	86%	2,888,062	1,888,000
Energy	111	36%	85%	86%	58,100,306	51,351,300
Consumer Durables & Apparel	75	44%	67%	85%	1,192,850	501,500
Household & Personal Products	38	50%	74%	83%	1,044,342	868,934
Food, Beverage & Tobacco	153	33%	64%	82%	3,290,422	1,819,210
Retailing	89	30%	52%	78%	511,267	380,073
Software & Services	136	33%	40%	65%	180,839	114,880
Media & Entertainment	103	19%	28%	61%	143,753	63,924
Health Care Equipment & Life Sciences	108	23%	54%	55%	351,018	70,851
Capital Goods	265	37%	65%	53%	1,686,140	680,000
Pharmaceuticals, Biotechnology & Life Sciences	157	23%	54%	52%	376,305	151,495
Diversified Financials	151	36%	52%	43%	26,305	13,206
Materials	260	36%	72%	37%	10,039,319	2,157,000
Insurance	110	59%	70%	36%	59,749	17,747
Commercial & Professional Services	44	52%	64%	33%	201,332	49,682
Utilities	146	50%	84%	25%	20,471,869	6,451,432
Consumer Services	62	24%	63%	23%	1,051,104	55,692
Semiconductors & Semiconductor Equipment	65	31%	63%	22%	995,076	127,626
Real Estate	174	32%	64%	22%	251,728	31,496
Banks	201	49%	67%	19%	77,027	13,562
Transportation	108	31%	66%	16%	8,018,590	792,2247
Food & Staples Retailing	57	44%	61%	16%	2,141,000	255,474
Telecommunications Services	77	60%	84%	14%	666,089	77,666
MSCI ACWI	**2,901**	**37%**	**63%**	**44%**	**771,479**	**145,243**

[1] Includes companies reporting combined Scope 1 and 2 in a single disclosure, and those reporting Scope 1 and 2 separately
[2] Median values across columns may not reflect the same company. Only companies with Scopes 1 & 3 disclosed were included

Source: Goldman Sachs Global Investment Research

4.3. Double-counting adjustment methods

The above options for including Scope 3 in degree warming methods introduce some level of double counting within portfolios. Methods to adjust for this are new and still evolving. There is no consensus yet on which is the most appropriate and robust. Some portfolio warming methods accept the duplication and do not make adjustments, for example, because the degree of duplication is deemed to be small, does not skew the temperature score, or because adjustment methods are judged to introduce a greater bias than the double counted emissions (e.g. Lombard Odier). Others attempt to adjust, by either distributing lifecycle emissions across the supply chain using macroeconomic value-added models or by applying adjustment rules at a company level.

For example, Inrate's Climate Impact model utilises an economic input-output lifecycle assessment (EIO LCA) model, a type of value-added approach which calculates the full lifecycle emissions (supply chain, use, and disposal) associated with an economic activity and distributes them proportionally through the supply chain based on monetary flows.[22] However, this approach makes it challenging to identify leaders and laggards, as it is not based on company performance.

MSCI adjusts for double counting by applying a de-duplication multiplier of 25% to all portfolio companies' Scope 3 emissions. The estimated discount factor is designed to reduce the portfolio's aggregated Scope 1, 2, and 3 emissions down to a level more closely reflecting the real-world footprint (using Scope 1 as a proxy).[23]

Carbon Impact Analytics provides a two-layered approach to remove double counting in portfolios. First, only a third of both induced and avoided emissions from energy suppliers, energy and carbon intensive companies, and companies providing equipment and solutions are accounted for when aggregating emissions at the portfolio level. And for companies operating in the same value chain, a value-added model is then used to distribute the induced and avoided emissions.[24]

Recommendation

As initiatives across the market continue to promote more standardised corporate Scope 3 disclosures, data availability and quality will improve over time. However, to recommend an approach to including Scope 3 in a robust and decision useful way, further work is required, with an aim to:

- assess how sector-specific climate scenarios incorporate Scope 3;
- quantify the potential scale of emissions double counting;
- and if it is material, assess and if necessary develop an appropriate method to remove double counting of emissions within portfolios.

[22] Inrate (2020) Inrate Climate Impact Methodology: https://www.inrate.com/cm_document/Inrate_Climate_Impact_Methodology.pdf
[23] MSCI (2020) 'Scope 3 Carbon Emissions: Seeing the Full Picture': https://www.msci.com/www/blog-posts/scope-3-carbon-emissions-seeing/02092372761
[24] Carbone 4 et al (2018) 'Carbon Impact Analytics: How to measure the contribution of a portfolio to the energy and climate transition': http://www.carbone4.com/wp-content/uploads/2019/09/CarbonImpactAnalytics_November18.pdf

KEY JUDGEMENT 5

Current company-level emissions

There are two ways to estimate company-level emissions – using **external sources** or **self-reported** emissions. All methods reviewed for this report, except for PACTA, relied on self-reported emission estimates. PACTA estimates company-level emissions by matching proprietary databases on ownership of real assets (i.e. databases compiling a list of all active power plants, all active oil wells, all cars produced, etc.) with financial data from Bloomberg, which allows to attribute ownership of a given asset to a specific company. PACTA for banks, however, provides the functionality to also use self-reported data.

Recommendation

The best available data should be used for analysis. Self-reported company emissions data increases the transparency and accountability of data inputs – and hence of the outputs as well. This approach is, however, currently limited by the availability and quality of emissions data. Other sources of primary data, such as from earth observation and other sensors can also provide important insights and enhance transparency and accountability. Where appropriate, primary datasets should be prioritised. Where estimation is used or required, which it currently is in many instances, it should be done transparently, and underlying assumptions used properly referenced. Data improvements will be essential for robust degree warming metrics.

KEY JUDGEMENT 6

Future company-level emissions

A forward-looking degree warming metric requires an approach to determining companies' future emissions. To date, there is a range of approaches across providers and little methodological consensus. There are many possible options, including holding emissions constant at current levels, extrapolating historical emissions, using self-reported targets, estimating performance based on proxy data or a hybrid of these approaches. Approaches vary along three dimensions: the weight on targets versus historical emissions, the use of proxy data, and whether they employ a single or a hybrid approach.

The crux of the challenge is to find the best predictor of future emissions, in a world where future ambition (i.e. targets) can be unrealistically high, past behaviour (i.e. historical emissions) not indicative of the future, data availability is limited, and future technology development unknowable.

Self-reported emission targets, subject to third party validation and periodic evaluation, could be used as an indicator of a likely path for future emissions. Targets reflect companies' actual ambitions. Companies are increasingly pressured to meet these targets, as a response to growing public pressure to meet climate goals. However, to assess portfolio alignment, one should also take a view on the likelihood of achieving those targets through third-party validation and regularly reviewing progress as part of credible transition plans. Otherwise, companies with highly ambitious but implausible targets may be unduly rewarded. Some initiatives such as SBTi have developed robust criteria to assess the plausibility of targets, under a range of scenarios and given recent historical performance. This approach is currently limited by data availability. As of start of November 2020, about 1,000 companies have committed to set targets with SBTi, of which just under 500 have completed the process and been validated.[25] That said, momentum is growing: the number of validated targets has almost doubled since November 2019.[26] And data availability will continue to increase, as countries commit to net zero and as the investor community increasingly requires target-setting by portfolio companies.

An alternative approach to forward looking assessment is to **extrapolate historical emissions or hold current emissions constant** (e.g. Arabesque). Historical emissions data are more widely available than emission reduction targets, which would increase the coverage of the degree warming metrics. Companies reporting historical emissions to CDP comprise about half of total market capitalization, or around 8,400 companies globally. But this would come at a cost of not capturing companies' ambitions and planned decarbonization paths. This would be sub-optimal for degree warming metrics that should be forward looking to be able to serve their purpose.

On balance, a robust approach should be guided by ambition, subject to it being credible and reviewed regularly. Until targets are set widely and these data are available, a hierarchy of approaches could be used as substitutes. Methodologies should prioritise the approaches available to them in order of credibility. For example, Trucost uses disclosed emission reduction targets as a starting point. Absent those, it uses the following hierarchy of approaches, depending on data availability: asset-level data, extrapolation of firm- or industry-level historical trends, and holding emissions constant. This allows to increase the coverage of degree warming estimates. Asset-level data is a useful supplement to targets as it provides information that can help verify progress towards targets and serve as a leading indicator of alignment. However, the availability of both targets and asset-level data in the public domain needs to be improved.

Recommendation

Ideally, as more companies set targets, degree warming metrics could be based on externally validated and regularly reviewed self-reported targets. Until then, a hierarchy of approaches could be used as substitutes, to compensate for data gaps.

[25] See evidence provided by SBTi (2020): https://sciencebasedtargets.org/companies-taking-action/. Companies have 24 months from committing to set a target to have it validated, or the target will be removed.
[26] SBTi (2019) 'Raising the Bar: Exploring the Science-Based Targets initiative's progress in driving ambitious climate action': https://sciencebasedtargets.org/wp-content/uploads/2019/12/SBTi-Progress-Report-2019-FINAL-v1.2.pdf

KEY JUDGMENT 7

Cumulative vs point-in-time

Given that achieving any climate target requires reducing emissions to net zero, evaluation benchmarks for a given company becomes more stringent over time. When measuring compliance with these benchmarks, an important design question is whether a company is considered aligned if it meets a benchmark only for a given point in time or consistently over time.

Most methodologies assess progress on a **point-in-time** basis, without accounting for companies' historical misalignment. For example, Arabesque assesses compliance by mapping a company's emission intensity ratio at two points in time (2030 and 2050) against three possible emissions pathways. Similarly, MSCI and PACTA assess alignment of a company by examining projected performance at a given point in time. By contrast, Trucost and Lombard Odier assess **cumulative** performance, which ensures that total cumulative emissions remain within their allotted carbon budget.

KEY JUDGMENT 8

How is the metric expressed

Most methodologies express the degree of alignment as an implied temperature rise metric. It could be a single number on a continuous spectrum, e.g. 2.7°C or 3.3°C, as in the CDP-WWF method, MSCI, and Lombard Odier. Or it could be an indication of alignment with one of the discrete scenarios, like in Arabesque that expresses alignment with one of five discrete scenarios (1.5°C, 2°C, 2.7°C, >2.7°C or 3°C). Or it could be a temperature range, e.g. <1.5°C, 1.5-2°C, etc, as in Trucost at portfolio level.

That said, some approaches express the metrics in other ways. For example, TPI reports a time-series of company-level emissions intensities, compared to a time-series of sector-level benchmarks for three warming scenarios (Below 2 Degrees, 2 Degrees, Paris Pledges). And others report the percentage of overshoot/undershoot relative to a benchmark. For example, PACTA could express alignment as the percentage difference from an asset allocation that would be consistent with a 2°C scenario (e.g. a portfolio is 20% overweight in oil exposure in Canada).

Step 3: Assessing portfolio-level alignment

KEY JUDGEMENT 9

Aggregation from company to portfolio level

Aggregating company-level performance is the final step in determining portfolio warming. This step requires overcoming some challenges of cross-sector portfolio aggregation. Among them are issues around sector-specific benchmarks, disparate denominators of emissions intensities (when expressed in physical units discussed in Judgement 3 above), and adjusting for double counting to capture Scope 3 emissions. As a result, some methods choose not to aggregate company-level assessment to a portfolio-level, aggregating only to a sector level instead (e.g. PACTA). Others focus only on company-level assessments, thereby leaving aggregation open to investors and lenders (e.g. TPI). Moreover, aggregating across asset classes would pose further challenges.

Investors and lenders may need portfolio-level tools to inform their investment decisions – to be able to compare portfolios regardless of their asset class and sectoral mix. And they would increasingly need portfolio level tools to assess their own alignment as net zero legislation becomes more common. In response to that, some approaches have started emerging in an attempt to address the aggregation issues to a portfolio level.

There are currently two high-level approaches to estimating a portfolio level temperature score:

- as a weighted average of company-level temperature scores, and
- as an aggregated over (under)-shoot of the company-level absolute emissions, relative to allocated carbon budget, translated into a temperature score.

The estimates associated with these approaches are sensitive to weighting and ownership-allocation approaches. The type of benchmark chosen in Key Judgement 1 affects whether both approaches could be used. Both approaches are feasible for methods that assess company performance against a pathway. But methods based on a warming function, e.g. the CDP-WWF method and MSCI, do not estimate a carbon budget over (under)-shoot. Therefore, these methods could only estimate a portfolio warming score as a weighted average of company level scores.

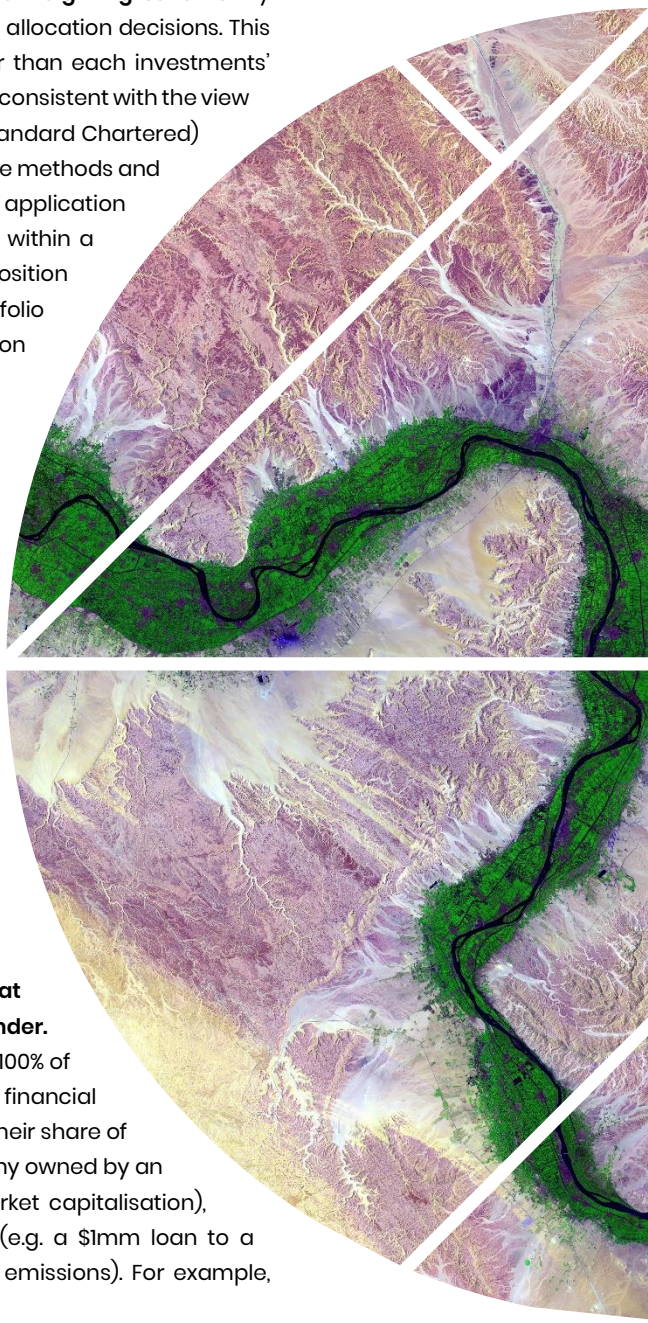
The first, and analytically simpler method, estimates portfolio level temperature score as a weighted average of company-level scores. There are two broad types of weights, illustrated in more detail in Annex, **Table A4**:

- **Portfolio weight approach** weights companies' scores with their proportion in the *investor's portfolio* (e.g. 25% of investor's portfolio invested in Company A and 75% in Company B). This approach is used by MSCI and Katowice banks at sector level.

Portfolio warming metrics and their key building blocks

- **Portfolio-owned emissions** approach weights companies' scores with their proportion in the *total invested company emissions* (e.g. 88% of emissions associated with portfolio exposure come from Company A and 12% from Company B). This approach is used by the CDP-WWF method and requires data on every investee's total emissions. There are different ways to measure the proportional ownership of total emissions, including by market capitalisation, enterprise value, enterprise value plus cash, and total assets.

Importantly, the portfolio-level temperature score is sensitive to the weighting scheme. By design, the portfolio weight approach clearly reflects the link to capital allocation decisions. This is because the weights reflect the composition of the portfolio rather than each investments' contribution to temperature outcomes, i.e. their level of emissions. This is consistent with the view of the Katowice Banks (BBVA, BNP Paribas, ING, Société Générale and Standard Chartered) – a group of banks that at COP24 in 2018 pledged to develop open source methods and to align lending portfolios with the goals of the Paris Agreement.[27] In their application of PACTA, they use portfolio weights to aggregate to a portfolio level within a sector, but not across sectors, as that would imply that portfolio composition reflects the contribution of different sectors to total emissions.[28] Portfolio weight approach is less suitable for capturing the impact of investment on future temperature outcomes.



A portfolio-owned emissions weight approach partly adjusts for the limitation and better reflects portfolio companies' relative share in portfolio total emissions. But this approach tends to overweight high emitting companies' temperature scores and it also introduces volatility.

The second method is to aggregate over (under)-shoot of the company-level absolute emissions, relative to the allocated carbon budget, and translate it into a temperature score. This is similar to estimating a company-level temperature score based on its deviation from the company-level benchmark (Key Judgement 1), but in this instance applied to a portfolio as a whole. This can be done directly, if the benchmark is expressed in absolute emissions units (e.g. Lombard Odier), or indirectly by converting company-level emissions intensity under/overshoot to absolute emissions by multiplying it by the relevant denominators (e.g. Trucost).

A key step in aggregating company-level emissions is deciding what proportion of an investee's emissions to allocate to an investor or lender. This is an important step, since if all investors or lenders were allocated 100% of company emissions, there would be significant double counting across financial sector actors and investors would be held accountable for more than their share of investment. Typically, this allocation reflects the proportion of a company owned by an investor and could be measured using the value of equity (total market capitalisation), enterprise value, sum of enterprise value and cash, or total assets (e.g. a $1mm loan to a company with $10mm in total assets would imply "owning" 10% of its emissions). For example,

[27] Katowice Banks (2018) 'The Katowice Commitment': https://group.bnpparibas/uploads/file/katowice_commitment_letter.pdf
[28] For a portfolio level assessment Katowice banks use an alternative metric – the percentage of portfolio exposure above or below the temperature target. See Katowice Banks (2020), Credit Portfolio Alignment: An application of the PACTA methodology by Katowice Banks in partnership with the 2 Degrees Investing Initiative. https://2degrees-investing.org/resource/credit-portfolio-alignment-katowice-report/

Trucost use enterprise value and Lombard Odier use the sum of enterprise value and cash as a weight.

A related question is whether allocation of emissions to investors should be consistent or vary across asset classes (as recommended by the Partnership for Carbon Accounting Financials, PCAF). PCAF has developed a new approach that allows to attribute emissions to several asset classes, which enables to broaden asset class coverage beyond debt and equity. For example, attribution could be based on total property value at origination for commercial real estate, and the value of purchased fleets for business vehicle loans.

By design, the second approach – that aggregates to portfolio level by translating the overshoot into a temperature score – reflects the portfolio contribution to the potential warming, because total absolute portfolio emissions are compared to the allocated carbon budget, which in turn is directly linked to temperature outcomes, as shown in **Annex, Table A5**.

The main limitation of this approach is the volatility introduced in the process of allocating emissions to an investor or lender, according to their ownership share. Allocated emissions can be affected by changes in the denominator (e.g. market capitalisation or enterprise value) without necessarily any changes in a company's emissions, thereby potentially diluting the link to climate outcomes. Some methods are more prone to volatility than others. For example, equity and enterprise value-based approaches introduce stock market volatility. But this could be mitigated by using book value or by adjusting market value for enterprise value inflation. Further work is needed on developing adjustment factors.

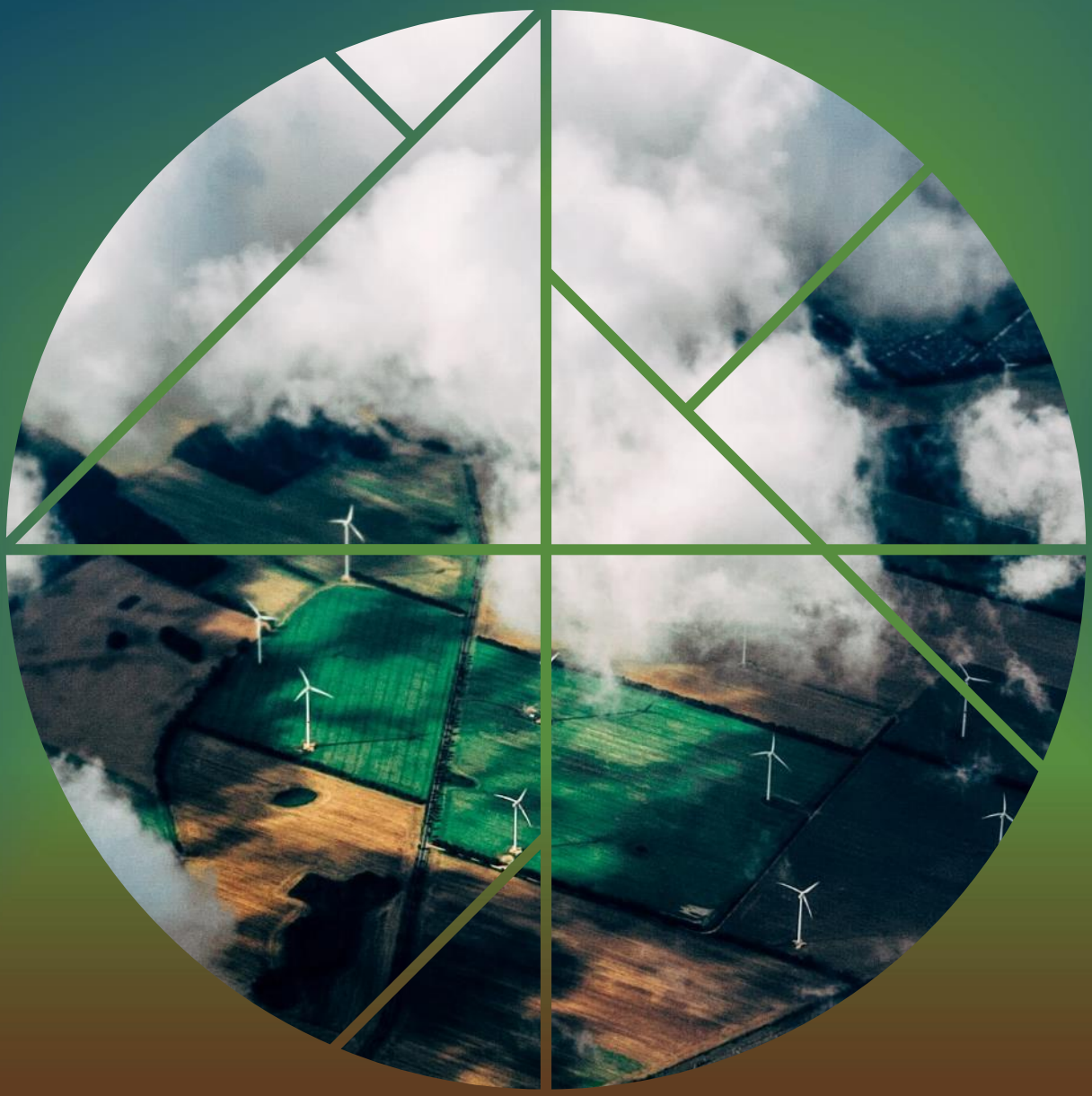
Recommendation

Further work is required to establish the most suitable aggregation method to reflect the position of companies and portfolios on the transition path. This could involve answering the following questions:

- What are the differences in the type of transition associated with different approaches to aggregation and weighting schemes?
- Which of these approaches and weighting schemes are consistent with the transition of investors and lenders' own portfolios, and for driving the real economy transition?
- Which approaches to aggregation and weighting schemes are most suitable for capturing both portfolio composition and its impact on temperature outcomes?
- Whether (and if so, how) to aggregate across asset classes?

Chapter 4

Data improvements



To be robust and comparable, degree warming metrics require not only further development and convergence of methodologies around key judgements, discussed in Chapter 3, but also improved availability, quality and consistency of data inputs.

In particular, the metrics would benefit from:

- improved quality and availability of emissions data, including break-down by sector and country and Scope 3 data, and targets – the key building blocks for measuring company performance;
- further development of scenarios and transition pathways – the key building block for benchmarks in degree warming metrics and deviation from target approaches.

4.1. Improving emissions data

The quality of degree warming metrics can only be as good as the quality of inputs that go into them.

All portfolio alignment approaches rely on emissions data as a measure of a company's performance. This highlights the crucial role of improving availability and quality of emissions data – both carbon footprints and targets – to ensure robust and consistent degree warming estimates. Moreover, some of the assumptions and methodological complexities in the currently existing methods exist to compensate for the lack of data. Improving availability and quality of the data would make some of these assumptions unnecessary, improving the robustness and simplifying the methods as a by-product.

Degree warming metrics require country- and sector-specific data points to match the granularity of benchmarks. As discussed in Chapter 3, methods should use sector- and country-specific benchmarks to help capital flow to the greatest opportunities in all sectors and regions, including the hard-to-abate ones. Without data points at an equivalent level of granularity, benchmarks will not be able to serve their purpose. For example, a multinational oil and gas producer may have operations spread across different countries. If it does not disclose country-level emissions, its performance cannot be assessed against country benchmarks taking account of geographical factors and different decarbonisation responsibilities.

The metrics also require improved availability and quality of Scope 3 data. Only 37% of companies in MSCI ACWI disclose Scope 3 data, compared to 63% for Scopes 1 and 2 (**Table 3.1**). With combustion of oil and gas accounting for 50% of global CO_2 emissions, of which more than 60% is typically from use of sold products (one element of Scope 3), the lack of Scope 3 data

creates challenges for investors to accurately capture the real-world carbon footprint of their investments and to set Scope 3 targets on carbon-heavy sectors.[29]

Data improvements

There is also need for improvements in quality of Scope 3 data.

Flexible reporting standards currently limit the data comparability across companies and create challenges of aggregation to the portfolio level. The GHG Protocol Scope 3 Standard that provides companies with a framework to measure their Scope 3 emissions is only ***"intended to enable comparisons of a company's GHG emissions over time"*** *and* ***"not designed to support comparisons between companies."***[30] This reflects, for example, differences in a company's own operational boundary and inventory methodology.

This issue is amplified by lack of data assurance. Only 40% of corporate ESG/CSR reports currently have some level of assurance, compared to financial data where it is a base requirement.[31] Where emissions data are audited, it almost always includes only Scopes 1-2. Adequate assurance of Scope 3 data will likely follow the development of more standardised and consistent reporting frameworks. However, until adequate assurance mechanisms are developed, the voluntary nature of Scope 3 disclosures and lack of assurance raises reliability and quality concerns.

Portfolio warming metrics also require improved quality and availability of emissions reduction targets. While validated emissions targets would serve as the ideal indicator of a company's future trajectory, holding companies accountable to their stakeholders, there remains a lack of high quality targets data to incorporate into portfolio warming metrics. Robust target frameworks such as SBTi's can promote consistent target setting and support the development of comparable metrics of alignment by placing standardised validation rules on companies by sector. In November 2019, only 700 companies representing approximately 1Gt of emissions – around 3% of 2019 global emissions[32] – had committed to set SBTi targets.[33] A year later, this has increased to about 1,000 companies. While progress is clearly being made, more companies setting targets using standardised initiatives would enable higher-quality forward-looking estimates and more robust portfolio warming metrics.

Metrics should also adopt a consistent approach to attributing ownership of emissions, where needed. This will ensure that any two investors using the same data account for emissions in their portfolio in the same way, enabling better comparisons across portfolios. . PCAF's Global GHG Accounting and Reporting Standard has methods for equity

[29] Gold Standard, Navigant, SBTi (2018), Best Practices in Scope 3 Greenhouse Gas Management. https://www.goldstandard.org/sites/default/files/documents/draft_-_scope_3_best_practices_v1.5.pdf

[30] World Resources Institute, World Business Council for Sustainable Development (2011) 'GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard' (p. 6): https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf

[31] Data sourced from Goldman Sachs Global Investment Research. Analysis is based on the most recent CSR report published for each company in the MSCI ACWI, looking over a 3-year period (2017-present) to help solve for the lag in reported ESG data.

[32] IEA (2019) 'Global CO2 emissions in 2019': https://www.iea.org/articles/global-co2-emissions-in-2019

[33] SBTi (2019) 'Raising the Bar: Exploring the Science-Based Targets initiative's progress in driving ambitious climate action': https://sciencebasedtargets.org/wp-content/uploads/2019/12/SBTi-Progress-Report-2019-FINAL-v1.2.pdf

Data improvements

and corporate bonds, corporate loans, commercial real estate, motor vehicle loans, project finance and mortgages.

Asset coverage should also be broadened, to allow cross-asset class aggregation to a portfolio level. The majority of portfolio alignment methods currently cover only listed debt and equity, with only CDP-WWF and PACTA also covering corporate loans (**Table 4.1**). To measure financial institutions' own alignment and to enable comparison across portfolios regardless of asset mix, these metrics will require full asset class coverage, including unlisted debt and equity and sovereign bonds.

Table 4.1: Asset class coverage of degree warming metrics

Arabesque	Listed equity
CDP-WWW	Listed equity / debt, corporate loans
Lombard Odier	Listed equity/debt
MSCI	Listed equity/debt
PACTA	Listed equity / debt, corporate loans
TPI	Equity
Trucost	Listed equity / debt

4.2. Improving scenarios and sectoral pathways

Scenarios and sectoral pathways are inputs in metrics of portfolio alignment, including portfolio warming metrics and deviation from pathways. As discussed in Chapter 3, scenarios should be sector- and region- specific (and country-specific, when decision useful and feasible), and be updated regularly (ideally, annually) to reflect the latest decarbonisation efforts and climate science.[34] The scenarios should also incorporate 1.5°C temperature outcomes to set the level of ambition. And to be realistic, the scenarios should rely as little as possible on methods to capture and store carbon from the atmosphere, because these technologies are still nascent.

The role of carbon capture will change over time, as companies producing avoided emissions technologies and negative emissions investments (e.g. carbon capture and storage) will play a critical role in the transition towards net zero. This would require further development of data to capture the impact of these companies on avoided emissions, as well as methods to reflect it in degree warming metrics and incentivise investment in climate solutions. MSCI has recently developed a "cooling potential" part of their model, which utilises avoided emissions estimates. And Lombard Odier has been working to quantify company contributions to avoided emissions and to develop solutions to ensure that avoided emissions are not counted twice.

[34] This could draw on the latest scientific methods to estimate GHG emissions, For example, remote sensing techniques use natural science data to monitor emissions using satellite-derived estimates. By calculating the total amount of CO2 in the air above a region, satellites can provide an estimate of total natural and anthropogenic emissions in real-time – this would allow faster data updating versus corporate reporting.

Data improvements

Annex 4 highlights the benefits of the key scenarios. IPCC scenarios have the widest range of temperature outcomes, including those using limited carbon capture to achieve 1.5°C. IEA scenarios are the most granular, as they include sector- and region-specific pathways that have the further benefit of being updated annually. The recently published IEA Net Zero Emissions 2050 scenario also uses limited carbon capture and storage to achieve 1.5°C. Finally, NGFS scenarios have been specifically designed for use by the financial sector, so provide a set of easy to understand transition pathways.

A variety of initiatives are already underway to broaden the coverage and increase granularity of sectoral pathways. For example, Mission Possible Platform (MPP), the Energy Transitions Commission (ETC), and NZAOA are developing granular pathways for hard-to-abate sectors. MPP and TPI are working on pathways for chemicals, a branch of heavy industry still without a well-defined net zero path. World Business Council for Sustainable Development (WBCSD) are developing oil and gas, transport, and utilities pathways, aligned with NGFS scenarios. And the COP26 Champion's Team are drawing on a wide range of initiatives (including some of the above) to develop 25 sector and sub-sector pathways, identifying action areas in each to be delivered before COP26 in November 2021. This additional granularity will contribute to further development of degree warming metrics that could support the flow of capital to the sectors and regions where decarbonisation is crucial, to facilitate a whole economy transition.

Convergence of different initiatives around similar or comparable pathways over time will contribute to consistency and comparability of degree warming estimates, by ensuring that companies are assessed against the same or comparable benchmarks.

Chapter 5

Ways forward

Developing transparent, robust and decision useful metrics of portfolio alignment will be an iterative process.

This report makes a step in that direction and identifies several issues that require further work. They include the following:

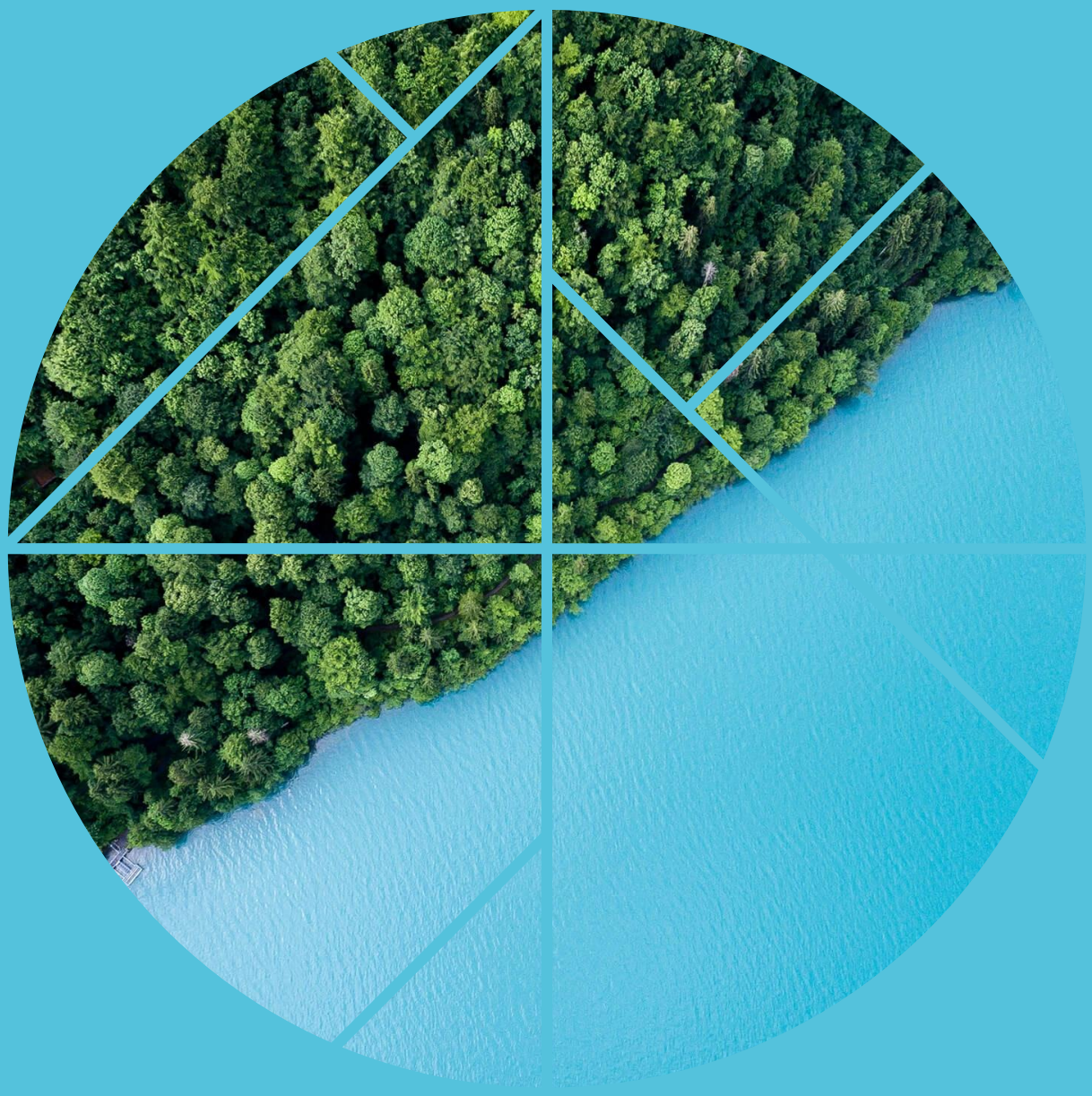
- How to design **benchmarks** that could accommodate company-level growth (benefit of intensity benchmarks) while minimising the risk of degree warming underestimates (benefit of absolute emission benchmarks)?
- How to **adjust for scope 3 emissions double counting?**
- How to **aggregate from company to portfolio level?** This approach should support transition and reflect both portfolio composition and its exposure to (and impact on) potential climate outcomes.

The next phase of developing metrics of portfolio alignment could involve exploring these questions in a dialogue with industry, with an aim a) to incorporate the feedback from industry on the initial view on best practice, b) to review other new and refined methods that could develop in the next six months, and c) to deepen understanding of best practice in light of these developments and insights from public consultations by TCFD, NZAOA, and IIGCC that will be released in November 2020 – February 2021.

Going forward, we hope this report will form the basis of a discussion and further collaboration with:

- Financial institutions – to evaluate the utility of degree warming metrics for capital allocation, risk assessment, and engagement strategies
- Methodology developers – to contribute to further development and convergence around key judgements and best practice
- Industry led initiatives – to converge around a shared set of key judgements
- TCFD – to inform their discussions during the consultation period on implied temperature rise and other forward-looking metrics
- Accounting standard setters – to discuss the benefits and challenges of including these metrics in disclosure requirements

Appendices

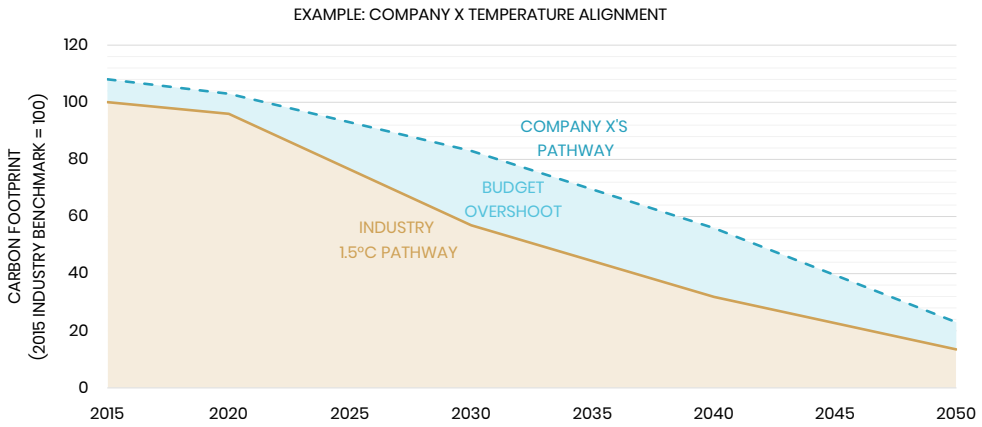


Annex 1. Overview of portfolio warming methods

	Key Judgement	Arabesque	Lombard Odier	MSCI	PACTA	SBTi	TPI	Trucost
1	**Benchmark type**	IEA scenarios	Proprietary 1.5C, 2C, 3C and 5C scenario	Multiple, incl 1.5C and 2.0C UNEP, 3.0C NDC, and 3.8C BAU	All IEA scenarios included as standard Any scenario that includes both production capacity and emission forecasts would work (PACTA for banks)	Hundreds of IPCC scenarios	Three IEA scenarios for most sectors	Adapted from IEA and IPCC scenarios
2	**Benchmark granularity**	Time, sector	Time, geography, and sector/industry/sub-industry-prescribed scenario	Two versions: 1. Time, sector-specific for Scope 1, and 2. Time only for Scopes 2-3	Time, geography, and sector-prescribed scenario	Time, sector	Time, sector	Two methods: 1. Time and sector-prescribed, and 2. Time only
3	**Intensity vs Absolute emissions**	Intensity	Absolute (directly)	Intensity	Absolute production (for power, automotive, coal, oil & gas) and emissions intensity (steel and cement)	Absolute or intensity may be used	Intensity	Intensity
4	**Scope of emissions**	Scope 1-2	Scope 1-3 assigned to all companies	Scope 1-3 assigned to all companies	Scope 1-3 boundary depends per sector, however minimum of 85% coverage of scopes 1-3 per sector	Scope 1-3 (3 where material)	Scopes 1, 2 and/or 3 depending on the sector	Scope 1 and 2 (Scope 3 work in progress)
5	**Current company level emissions**	Self-reported	Self-reported and gap-filling using sectoral models	Self-reported	External estimates	Self-reported	Self-reported	Self-reported
6	**Future company-level emissions**	Current emissions intensity held constant to 2030 and 2050	Hybrid combining historical assessment of the company's level of ambition and future emissions	Emissions targets (for Scope 1-3) and patents and green revenues (for cooling potential)	Self-reported asset investment plans combined with business intelligence and permit requests	Emissions targets, otherwise 3.2C default score	Self-reported emissions reduction targets	Hierarchy: Targets, Asset-level data, extrapolation of company or sub-industry historical trend, holding current intensity constant
7	**Cumulative vs point-in-time**	Compares point-in-time alignment of emissions intensity with given pathway	Compares cumulative emissions to allotted carbon budget	Inputs point-in-time emissions intensity into warming function to derive temperature	Compares point-in-time alignment with a given pathway	Compares point-in-time alignment of emissions with given scenario pathway	Compares point-in-time (current and future) alignment of emissions intensity with given pathway	Compares cumulative emissions 2012-2025 with carbon budget under a range of scenarios
8	**How is the metric expressed**	One of five temperature scores: 1.5°C, 2°C, 2.7°C, >2.7°C and 3°C	Degrees warming	Degrees warming	Percentage alignment of exposure (e.g. 20% too many GW power generated from coal)	Degrees of warming	Visual time series comparison of emissions intensity to benchmark values	Company- and portfolio-level cumulative absolute over/(under)shoot and degree warming
9	**Aggregation to portfolio level**	Recalculate intensity for the entire portfolio (with 100% emission attribution), to compare with an aggregated benchmark	Aggregated cumulative firm-level over-/ undershoot relative to total carbon budget based on enterprise value plus cash share, converted to temperature	Weighted average of companies' warming potentials	Reports at a sector / technology level	Weighted average of company level scores	Only company-level assessments	Aggregates company-level absolute cumulative over / (under)shoot based on ownership share then converts to portfolio warming metric

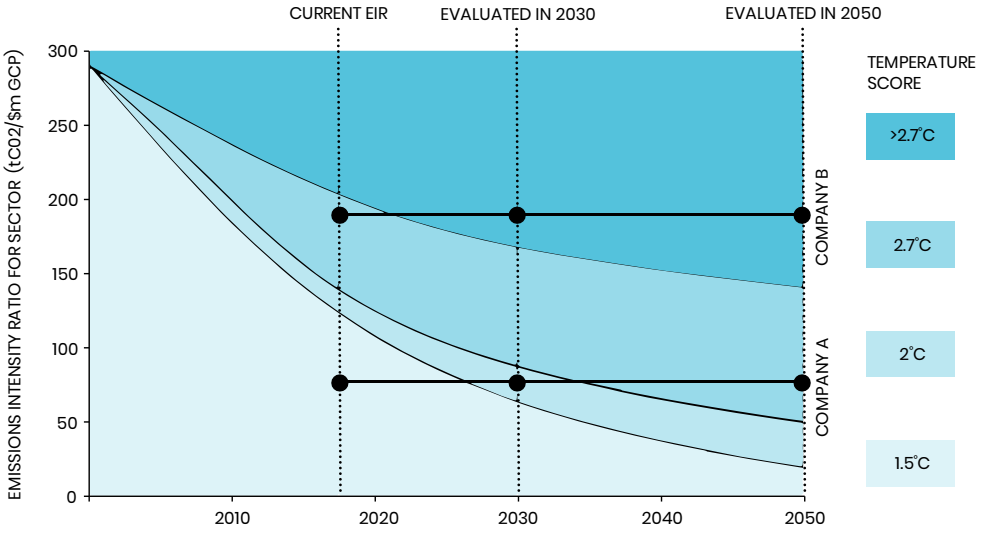
Annex 2. Benchmarking by different methods

Figure A1: Lombard Odier



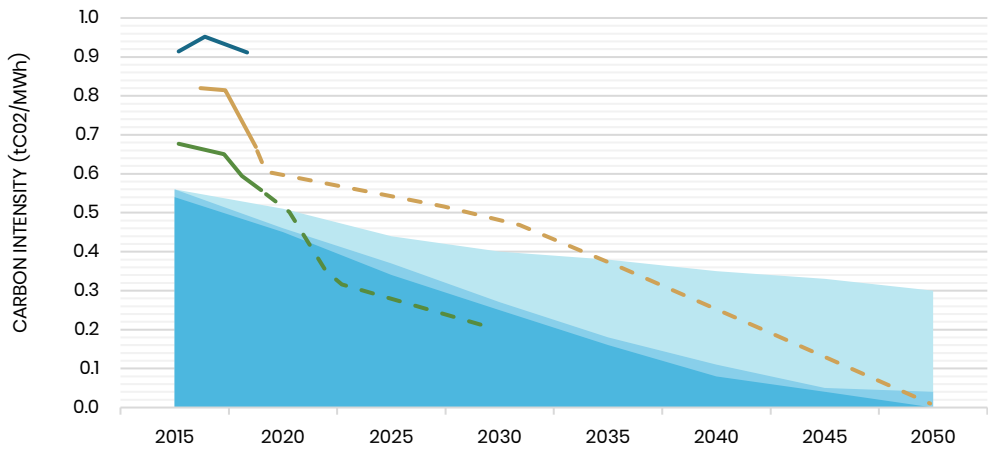
Source: Lombard Odier analysis

Figure A2: Arabesque



Source: Arabesque S-Ray.
Horizontal lines show projected emissions intensities for two companies. Each shaded area represents a range of emissions consistent with a given discrete scenario for a given sector.

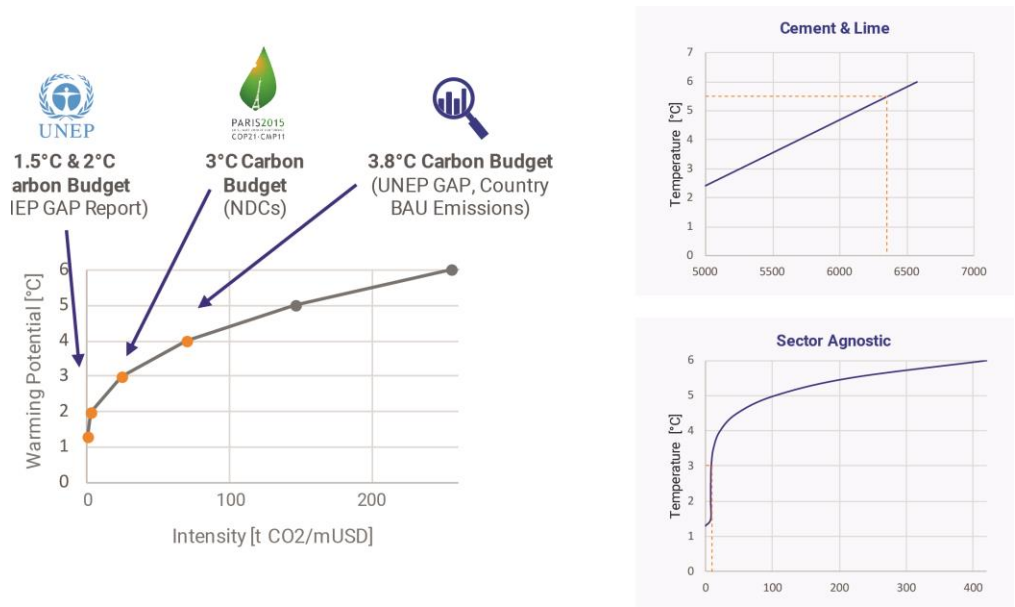
Figure A3: TPI



Source: TPI.

The lines show historical emission intensities (solid lines) and declared future targets (dotted lines) for three companies. The shaded areas represent pathways consistent with three scenarios (Paris Pledges, 2 Degrees, Below 2 Degrees).

Figure A4: MSCI



Source: MSCI ESG Research

Annex 3.

Table A1: Impact of company size on absolute and intensity benchmarks

Intensity level and absolute growth rate benchmarks can accommodate differences in firm size and associated differences in the level of emissions. While the absolute level of emissions overshoot in Year 1 is higher for Company B (130) than Company A (65), the relative emission reduction is equivalent in both benchmarks (15% and 13pp). As a result, both companies would have the same temperature scores with the intensity level and absolute growth rate benchmarks.

	Company A		Company B	
Variables	**Year 0**	**Year 1**	**Year 0**	**Year 1**
Absolute Emissions	500	490	1000	980
Activity	500	500	1000	1000
Intensity	1.00	0.98	1.00	0.98
Absolute benchmark (-15% p.a.)				
Absolute benchmark (-15%)		425		850
Benchmark overshoot		65		130
Benchmark % overshoot		15%		15%
Temperature Score[1]		2..1C		2.1C
Intensity benchmark (-15pp p.a.)				
Intensity benchmark (-15pp)		0.85		0.85
Benchmark pp overshoot		13pp		13pp
Temperature Score[1]		2.1C		2.1C

KEY: Benchmark overshoot / Benchmark undershoot

Table A2: Impact of company growth on absolute and intensity metrics

Consider two identical companies reducing emissions, with the only difference being that Company C also increases its output. This company has a lower temperature score than Company D, using the intensity benchmark. But the temperature scores would be identical using the absolute benchmark.

	Company C		Company D	
Variables	**Year 0**	**Year 1**	**Year 0**	**Year 1**
Absolute Emissions	1000	950	1000	950
Activity	1000	1200	1000	1000
Intensity	1.00	0.79	1.00	0.95
Absolute benchmark (-15% p.a.)				
Absolute benchmark (-15%)		850		850
Benchmark overshoot		100		100
Benchmark % overshoot		12%		12%
Temperature Score[1]		2..1C		2.1C
Intensity benchmark (-15pp p.a.)				
Intensity benchmark (-15pp)		0.85		0.85
Benchmark pp overshoot		6pp		10pp
Temperature Score[1]		2.0C		2.1C

KEY: Benchmark overshoot / Benchmark undershoot

[1] Calculated as: 2C + (remaining 2C Emissions budget * % overshoot * TCRE scalar)

Table A3: Impact of sector growth on absolute and intensity metrics

Degree warming may be underestimated if the intensity benchmark is achieved through growth rather than emission reductions.

Benchmark	Emissions	Activity	Intensity
Year 1	500	500	1.0
Year 2	300	750	0.4
Year 3	200	1000	0.2
Carbon Budget	**1000**		

Sector / Company	Emissions	Activity	Intensity
Year 1	500	500	1.0
Year 2	500	1250	0.4
Year 3	500	2500	0.2
Total	**1500**		

Overshoot	Emissions	Activity	Intensity
Total Overshoot	500		0.0
Total Overshoot (% / pp)	50%		0pp
Temperature Warming Score[1]	2.3C		2.0C

KEY: Benchmark overshoot / Benchmark undershoot

[1] Calculated as: 2C + (remaining 2C Emissions budget * % overshoot * TCRE scalar)

Table A4. Temperature outcome using portfolio and portfolio-owned emissions weights

A portfolio of two companies, emitting 3500 and 500 CO2 respectively, could be associated with 1.9C using portfolio weights and 2.4C using portfolio owned emissions weights.

REAL ECONOMY VIEW

	Company A	Company B	Total
Company accumulated emissions	3500	500	4000
2C Benchmark accumulated emissions	2500	1170	3670
(+) Over/ (-) Undershoot	1,000	-670	330
Temperature Score[1]	**2.5C**	**1.6C**	2.2C

PORTFOLIO VIEW

Portfolio weights	Company A	Company B	Total
Portfolio weights	25%	75%	100%
Company-level temperature scores	2.5C	1.6C	
Weighted average temperature score	**0.6C**	**1.6C**	1.9C

Portfolio owned emissions weights	Company A	Company B	Total
Company ownership	100%	100%	
Portfolio owned emissions	3,500	500	4000
Company-level temperature scores	2.5C	1.6C	
Owned emissions weight in portfolio	88%	13%	100%
Weighted average temperature score	**2.2C**	**0.2C**	2.4C

[1] Company level temperature scores have been calculated based on their absolute emission under/overshoot and IPCC's relation where a marginal Gt CO2 emitted corresponds to an additional 0.000545C warming.

Table A5. Temperature outcome for portfolio-level aggregated absolute emissions method

Abs. emissions over (under)-shoot aggregatio	Company A	Company B	Total
Company ownership	100%	100%	
Company accumulated emissions	3500	500	4000
2C Benchmark accumulated emissions	2500	1170	3670
(+) Over/ (-) Undershoot	1,000	-670	330
Temperature Score	**2.5C**	**1.6C**	2.2C

Annex 4. Overview of key climate scenarios

	IPCC[a] Representative Concentration Pathway (RCP)	IEA[b] WEO & ETP Models	NGFS[c] (Hot House, Orderly and Disorderly Transition Scenarios)
Temperature warming target	4.3°C, 2.8°C, 2.4°C, 2°C, 1.5°C	6°C, 3-4°C, 2.7°C, 2°C, 1.75°C, 1.5°C	2 scenarios targeting 3°C+ 3 scenarios targeting 1.5°C 3 targeting 2°C
Sectors	Sector-agnostic approach Covers Energy, Transport, Industry, Agriculture/Forestry and Other Land Use, Buildings	Sector-specific approach Covers Energy, Industry, Transport & Buildings	Sector-agnostic approach Covers Energy, Transport, Buildings, Industry
Geographical coverage	World, regional and country coverage	World, regional and country coverage	World Regional and country coverage varies by Integrated Assessment Model
Update frequency	Every 6-7 years	Annual	TBC

[a] IPCC scenarios are 'not likely' to result in temperature rise above target temperature, i.e. with 66% chance. IPCC pathways are representative of hundreds of scenarios produced by IPCC to limit global warming to a target temperature outcome. Guidance on how to interpret IPCC language be found at: https://www.ipcc.ch/site/assets/uploads/2017/08/AR5_Uncertainty_Guidance_Note.pdf

[b] IEA scenarios target each temperature outcome with 50% chance. The World Economic Outlook family of scenarios include the Current policies scenario, Stated Policies Scenario (SPS), Sustainable Development Scenario (SDS), and Net Zero Emissions 2050 (NZE 2050). The Energy Transition Pathway scenarios are the Reference technology scenario (RTS), 2°C Scenario, (2DS), and Beyond 2°C Scenario (B2DS).

[c] NGFS scenarios target each temperature outcome with 67% chance. The 'Hot House' scenario is close to 4°C, and the Nationally Defined Contributions scenario is over 3°C.