



# Overview

## TCFD Recommendations and 2021 Guidance

November 2021

## Introduction

The Task Force on Climate-related Financial Disclosures (hereafter TCFD or the taskforce) was established in December 2015 by the Financial Stability Board (FSB), an international body that monitors and makes recommendations about the global financial system by coordinating national financial authorities and international standard-setting organisations. The creation of the TCFD was prompted by the recognition that financial market participants had insufficient information about climate risks and opportunities faced by companies, with obvious negative implications for efficient asset pricing and capital allocation, and possible risks to financial stability.

In 2017, the TCFD released climate-related financial disclosure recommendations designed to help companies provide better information to support better financial-decision making amongst stakeholders.

These recommendations have rapidly become a central reference for reporting of financially material climate-related risks<sup>1</sup> and opportunities. This is primarily due to voluntary uptake by corporates and the financial sector and regulatory initiatives requiring or encouraging reporting according to TCFD recommendations.<sup>2</sup>

On 14 October 2021, the TCFD published a status report highlighting the accelerated uptake of its recommendations (TCFD, 2021c)<sup>3</sup> along with a new Guidance on Metrics, Targets, and Transition Plans (TCFD, 2021d) and the first update to the implementation guidance on its June 2017 recommendations (TCFD, 2021e).

This note reviews the background and architecture of the TCFD recommendations and presents the updated guidance with a focus on new or updated disclosures requirements and advice.

## Background: Climate-related Risks, Opportunities, and Financial Impacts

The taskforce divided climate-related risks into two major categories:

- (1) risks related to the transition to a lower-carbon economy, and
- (2) risks related to the physical impacts of climate change.

With respect to the former, it explained: “Transitioning to a lower-carbon economy may entail extensive policy, legal, technology, and market changes to address mitigation and adaptation requirements related to climate change. Depending on the nature, speed, and focus of these changes, transition risks may pose varying levels of financial and reputational risk to organisations.”

As for the latter, it noted: “Physical risks resulting from climate change can be event driven (acute) or longer-term shifts (chronic) in climate patterns. Physical risks may have financial implications for organisations, such as direct damage to assets and indirect impacts from supply chain disruption.

1 - Efforts to standardise the reporting of climate-related material impacts notably involve a cooperation between the European Financial Reporting Advisory Group (EFRAG) and Global Reporting Initiative (GRI).

2 - Financial regulators worldwide have endorsed TCFD recommendations with the European Union, Japan, the United Kingdom, Brazil, Switzerland, Singapore and Hong Kong having set, or announced they would set, reporting requirements aligning with the work of the TCFD. In addition, the International Financial Reporting Standards Foundation (IFRS) announced that the work of its sustainability standards board, which ambitions to issue standards that will provide a globally consistent baseline for sustainability reporting and is supported by the International Organisation of Securities Commissions (IOSCO), would initially focus on climate change and build on established frameworks, such as TCFD. In November 2021, the IFRS announced that it would form the International Sustainability Standards Board (ISSB) through consolidation with the Value Reporting Foundation (itself the merger of the Sustainability Accounting Standards Board, SASB, and the International Integrated Reporting Council, IIRC) and the Climate Disclosure Standards Board (a CDP initiative) by June 2022. The Technical Readiness Working Group (TRWG) chaired by the IFRS Foundation and tasked with advising the ISSB released a prototype of general requirements for disclosure of sustainability-related financial information (TRWG, 2021a) and a prototype for climate-related disclosures (TRWG, 2021b) that align with TCFD Recommendations. The latter is supplemented by technical protocols specifying disclosure requirements across eleven sectors and subsectors (TRWG, 2021c).

3 - We present some of the highlights of this report in the Appendix.

Organisations’ financial performance may also be affected by changes in water availability, sourcing, and quality; food security; and extreme temperature changes affecting organizations’ premises, operations, supply chain, transport needs, and employee safety.”

Table 1 below presents the characterisation of climate-related risks by the TCFD.

Table 1: Climate-Related Risks according to the TCFD Classification

Physical Risks	Transition Risks
<b>Acute</b> Event-driven, e.g., storms and cyclones, heatwaves and droughts, extreme rainfalls and floods	<b>Policy Risks</b> Policy actions (curtailing activities that contribute to climate change or promoting activities that help mitigate it, e.g., through carbon pricing, taxes and subsidies, norms and standards) and Legal Risks (exposure to litigation claims linked to contribution to climate change, failure to act or improper disclosure)
<b>Chronic</b> Long-term shift in the mean and variability of climate patterns, e.g., in relation to temperatures, precipitations, sea-level, water availability	<b>Technology Risks</b> Impact of climate friendly technology on competitiveness, costs and risks of development of and transition to new technologies
	<b>Market Risks</b> Shifts in supply and demand for products and services, e.g., due to changes in consumer behaviour, changes in production costs, increased volatility of resources prices, asset repricing risks
	<b>Reputation Risks</b> Changes to customer or stakeholder preferences and perceptions of the company and its sector in relation to its contribution to climate change with impact on supply and demand of goods and services, human resources, funding and implementation of investments

Source: TCFD (2017a).

The taskforce noted that efforts to combat or adapt to climate change could also produce opportunities for organisations, including cost savings from resource efficiency and adoption of low-emission energy, revenues from low(er) emission products and services and new markets; and suggested that organisations developing resilience to climate change would better manage transition and physical risks and seize opportunities.

To make more informed financial decisions, an understanding of how these climate-related risks and opportunities are likely to impact the future financial performance of an organisation (as reflected on its income and cashflow statements), position (as reflected on its balance sheet), as well as the terms and conditions of its access to capital markets. Table 2 below presents the four transmission channels through which climate change risks and opportunities may affect an organisation’s financial position according to the TCFD. Naturally, the financial impacts of climate-related issues on an organisation will depend both on its exposure to climate-related risks and opportunities, and on its management of risks (which it may attempt to mitigate, transfer, accept, or control) and opportunities.

Table 2: Major Categories of Financial Impact

Income Statement	Balance Sheet
<p><b>Revenues</b></p> <p>Transition and physical risks may affect demand for products and services.</p> <p>Organisations should consider the potential impact on revenues and identify potential opportunities for enhancing or developing new revenues. In particular, given the emergence and likely growth of carbon pricing as a mechanism to regulate emissions, it is important for affected industries to consider the potential impacts of such pricing on business revenues.</p>	<p><b>Assets and Liabilities</b></p> <p>Supply and demand changes from changes in policies, technology, and market dynamics related to climate change could affect the valuation of organisations' assets and liabilities.</p> <p>Use of long-lived assets and, where relevant, reserves may be particularly affected by climate-related issues.</p>
<p><b>Expenditures</b></p> <p>An organisation's response to climate-related risks and opportunities may depend, in part, on the organisation's cost structure. Lower-cost suppliers may be more resilient to changes in cost resulting from climate-related issues and more flexible in their ability to address such issues.</p>	<p><b>Capital and Financing</b></p> <p>Climate-related risks and opportunities may change the profile of an organisation's debt and equity structure, either by increasing debt levels to compensate for reduced operating cash flows or for new capital expenditures or R&amp;D. They may also affect the ability to raise new debt or refinance existing debt or reduce the tenor of borrowing available to the organisation. There could also be changes to capital and reserves from operating losses, asset write downs, or the need to raise new equity to meet investment.</p>

Source: TCFD (2017a).

## TCFD Recommendations and Recommended Disclosures

### Overview

The work of the TCFD is intended to help organisations provide better climate-related financial information to support informed capital allocation.<sup>4</sup> The TCFD recommendations and recommended disclosures are organised around four pillars: Governance, Strategy, Risk Management and Metrics and Targets and 11 associated disclosures (see Table 3).

Table 3: TCFD Recommendations and Supporting Recommended Disclosures

Pillar recommendation	Supporting disclosures
<p><b>Governance</b></p> <p>Disclose the organisation's governance around climate-related risks and opportunities.</p>	<p>a) Describe the board's oversight of climate-related risks and opportunities.</p> <p>b) Describe management's role in assessing and managing climate-related risks and opportunities.</p>
<p><b>Strategy</b></p> <p>Disclose the actual and potential impacts of climate-related risks and opportunities on the organisation's businesses, strategy and financial planning where such information is material.</p>	<p>a) Describe the climate-related risks and opportunities the organisation has identified over the short, medium, and long term.</p> <p>b) Describe the impact of climate-related risks and opportunities on the organisation's business, strategy, and financial planning.</p> <p>c) Describe the resilience of the organisation's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.</p>
<p><b>Risk Management</b></p> <p>Disclose how the organisation identifies, assesses, and manages climate-related risks.</p>	<p>a) Describe the organisation's processes for identifying and assessing climate-related risks.</p> <p>b) Describe the organisation's processes for managing climate-related risks.</p> <p>c) Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organisation's overall risk management.</p>
<p><b>Metrics and Targets</b></p> <p>Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.</p>	<p>a) Disclose the metrics used by the organisation to assess climate-related risks and opportunities in line with its strategy and risk management process.</p> <p>b) Disclose Scope 1, Scope 2, and if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks.</p> <p>c) Describe the targets used by the organisation to manage climate-related risks and opportunities and performance against targets.</p>

Source: TCFD (2017a).

Implementation guidance is provided across pillars for all sectors and supplemental guidance is offered for some, namely the financial sector (with breakdown into Banks; Insurance Companies;

4 - A precondition to better disclosures is the identification of issues and the proper assessment of their potential impacts; and the TCFD can be credited for providing some assistance in these regards ever since its inaugural recommendations (see for example, Tables 1-2 of TCFD, 2017a and Section A.4 of TCFD, 2017b).

Asset Managers and Asset Owners) and non-financial sectors potentially most affected by climate change (with specific recommendations for Energy (Coal; Oil and Gas; and Electric Utilities); Transportation; Materials & Buildings; and Agriculture, Food, and Forest Products).

To assist entities in preparing disclosures aligned with its recommendations, the TCFD published an annex report (TCFD, 2017b) providing general and sector-specific implementing guidance.<sup>5</sup>

### Scope and Principles

The TCFD recommends that entities issuing public securities adopt its recommendations and invites all organisations to follow suit, in particular asset managers and asset owners.<sup>6</sup>

The TCFD recommends that disclosures related to its Governance and Risk Management pillars be included in annual financial filings irrespective of financial materiality whenever possible; this is meant to promote broader utilisation of these disclosures, hedge against the risk of companies mistakenly discounting the importance of climate change risks and is also predicated on the view that climate-related risk is non-diversifiable and pervasive and thus of interest to users of financial disclosures. The 2017 view of the TCFD was that disclosures pertaining to its Strategy and Metrics and Targets pillars were to be included in financial filings when deemed material; the 2021 guidance introduces an exception by requiring the disclosure of Scope 1 and Scope 2 greenhouse gas (GHG) emissions irrespective of their materiality.<sup>7</sup> Asset managers and owners are also expected to integrate TCFD recommendations into their reporting to clients and beneficiaries and approach the question of materiality in the context of their mandates and investment performance.

Underpinning TCFD recommendations since inception are principles for effective disclosures which are meant both to assist organisations in preparing quality and decision-useful disclosures for users and help guide developments in climate-related financial reporting.<sup>8</sup>

## Guidance on TCFD Recommended Disclosures

In this section we detail the guidance given by the TCFD in relation to its recommended disclosures, including both advice applying to all sectors and additional instructions for Scientific Beta's main clients, i.e., asset owners. Where changes have been introduced by the 2021 update, we highlight those.

### Governance

Disclosures in relation to governance are meant to help users of climate-related financial disclosure understand the role of the organisation's management in assessing and managing climate issues and how its board is informed about these issues and tracks their management. These disclosures are intended to support users' assessments of whether material climate-related issues receive the required attention from the organisation's management and oversight bodies.<sup>9</sup>

5 - The 2017 recommendations were also accompanied by a technical supplement on scenario analysis (TCFD, 2017c). In 2020, the organisation released additional guidance pertaining to scenario analysis for use by non-financial companies (TCFD, 2020a) and additional guidance on how to integrate climate-related risks into existing risk management processes and disclosing information on such processes (TCFD, 2020b).

6 - This is justified by the promotion of better understanding of risks and performance by clients and beneficiaries and more informed investment choices. Naturally, adoption by asset owners and managers creates trickle-down pressure on investee entities to adopt the recommendations.

7 - As per the Greenhouse Gas Protocol (WRI and WBCD, 2004), the global standard for calculating and reporting GHG emissions, Scope 1 emissions are direct emissions, i.e., emissions occurring from sources owned or controlled by the reporting entity; Scope 2 are indirect emissions from this entity's consumption of electricity, steam, heating or cooling provided by other parties; and Scope 3 emissions are other indirect emissions occurring in the value chain.

8 - Namely, disclosures should 1. represent relevant information; 2. be specific and complete; 3. be clear, balanced, and understandable; 4. be consistent over time; 5. be comparable among companies within a sector, industry, or portfolio; 6. be reliable, verifiable, and objective; and 7. be provided on a timely basis.

9 - The draft IFRS Sustainability Disclosure Standards (TRWG, 2021a) explains that governance disclosures should help users understand "the governance processes, controls and procedures used to monitor and manage sustainability-related risks and opportunities" and goes beyond TCFD recommendations by requiring a description of (i) how the oversight body ensures that relevant skills and competencies are available to oversee strategies designed to respond to sustainability-related issues; and (ii) how (vs whether) it considers these issues "when overseeing the entity's strategy, decisions on major transactions, and risk management policies, including any assessment of trade-offs and analysis of sensitivity to uncertainty that may be required." The draft standards also call for governance disclosures to clarify whether sustainability-related performance metrics are incorporated into remuneration policies. While this is not part of the TCFD governance-themed disclosures, the updated guidance calls for the "Proportion of executive management remuneration linked to climate considerations" to be presented under metrics and targets disclosures.

Describe the board's oversight of climate-related risks and opportunities.	Consider including a discussion of: (i) the processes by which the board of the reporting organisation is informed about climate-related issues; (ii) whether these are considered when the board discharges its governance duties; and (iii) how the board tracks progress against goals and targets for addressing these issues.
Describe management's role in assessing and managing climate-related risks and opportunities.	Consider disclosing: (i) whether the organisation has assigned climate-related responsibilities to management-level positions or committees; and, if so, whether those include assessing/managing climate-related issues and whether there is related reporting to the board; (ii) a description of the associated organisational structure(s); (iii) processes by which management is informed about these issues; and (iv) how it monitors these.

## Strategy

Disclosures in relation to strategy are meant to help users of financial disclosures understand how climate-related issues may impact the organisation's businesses, strategy and financial planning at different time horizons and inform their expectations about the organisation's financial performance. Such disclosures can also help users assess the extent to which climate issues are incorporated into an organisation's strategy.<sup>10</sup>

As the amount of reporting in relation to the financial impact of climate change remains limited, including amongst institutions supporting TCFD recommendations, the updated guidance insists on the disclosure of actual and potential financial impacts on organisations.<sup>11</sup>

Management of climate change issues is naturally improved by strategic thinking and planning in relation to transition and adaptation. Taking note of the growing interest in transition plans supporting organisational and country-level climate targets, including net-zero targets, the updated TCFD guidance calls for the disclosure of key information on plans for transitioning to a low carbon economy by organisations that either have made voluntary decarbonisation commitments, or have agreed to meet investor expectations in relation to decarbonisation,<sup>12</sup> or operate in jurisdictions that have committed to decarbonisation.<sup>13</sup>

The TCFD explains that information from transition plans can be used as input for estimating financial impacts. The Guidance on Metrics, Targets, and Transition Plans also discusses the key characteristics of effective transition plans<sup>14</sup> and provides elements to support the development of such plans (refer to Table E1 p.42 of TCFD, 2021d). The TCFD then calls for disclosure of key information from these plans, including current emissions performance; impact on businesses, strategy, and financial planning from a low-carbon transition; and actions and activities to support transition, including emissions reduction targets and planned changes to businesses and strategy. Emissions targets should come with precise dates and scope. Progress on the execution of the plan should be reported annually.

10 - This is underlined by the draft IFRS standards (TRWG, 2021a) that read: "26 The objective of sustainability-related financial disclosure on strategy is to enable users of general purpose financial reporting to understand the entity's strategy for addressing significant sustainability-related risks and opportunities. Such information supports evaluations of whether sustainability-related financial risks and opportunities are incorporated into an entity's strategic planning and are core to an entity's strategy."

11 - Disclosures in relation to strategy as per the draft IFRS standards (TRWG, 2021a) align with the updated TCFD recommendations but are somewhat more granular; for example, they call for reporting "plans and critical assumptions for legacy assets, where applicable;" and detailed analysis of where value chain exposures are concentrated "(for example, geographic areas, facilities or types of assets, inputs, outputs or distribution channels)."

12 - On investor expectations, the reader is referred to our overview note covering the asset-owner led net-zero investment frameworks (Scientific Beta, 2021).

13 - With close to universal ratification of the Paris Agreement pledges, jurisdictions without decarbonisation pledges are extremely rare.

14 - These plans should be aligned with strategy; anchored in quantitative elements (including climate-related metrics and targets; subject to effective governance processes; actionable (describing specific initiatives); credible; periodically reviewed and updated; and reported upon annually.

<p>Describe the climate-related risks and opportunities the organisation has identified over the short, medium, and long term.</p>	<p>Provide a description of:</p> <ul style="list-style-type: none"> <li>(i) what the organisation considers short-, medium-, and long-term time horizons;</li> <li>(ii) the climate-related issues potentially arising in each time horizon (with potential materiality for the organisation), to be classified as transition or physical risks;</li> <li>(iii) how the materiality of climate-related risks and opportunities are assessed.</li> </ul> <p>Consider providing a description of risks and opportunities by sector and/or geography, as appropriate.</p>
<p>Describe the impact of climate-related risks and opportunities on the organisation's businesses, strategy, and financial planning.</p>	<p>Discuss how identified issues have affected businesses, strategy, and financial planning. Consider including: products and services; supply/value chain; adaptation/mitigation activities; investment in R&amp;D; operations (types, locations); acquisitions or divestments; access to capital.</p> <p>Describe how climate-related issues serve as an input to financial planning process, time period(s) used, and how risks and opportunities are prioritised.</p> <p>Describe the impact of climate-related issues on financial performance (e.g., revenues, costs) and financial position (e.g., assets, liabilities).</p> <p>If climate-related scenarios have been used to inform strategy, describe these.</p> <p><a href="#">Organisations concerned by emissions reduction targets (because they operate in jurisdictions that have made such commitments, or have made such commitments, or have signalled they would meet investor expectations about emissions reductions)<sup>15</sup> should describe their transition plans which could include emissions targets and specific activities intended to reduce these emissions in their operations and value chain or to otherwise support the transition.</a></p> <p><b>Supplemental Guidance for Asset Owners</b></p> <p>Asset owners should describe how climate-related risks and opportunities are factored into relevant investment strategies (from the perspective of the total fund or investment strategy or individual investment strategies for various asset classes).</p>
<p>Describe the resilience of the organisation's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.</p>	<p>Describe how resilient strategies are to climate-related risks and opportunities (with reference to a transition consistent with a 2°C or lower scenario<sup>16</sup> and, where relevant, scenarios consistent with increased physical risks).</p> <p>Consider discussing:</p> <ul style="list-style-type: none"> <li>(i) where the organisation believes its strategies may be affected by climate-related risks and opportunities;</li> <li>(ii) how strategies might change to address these;</li> <li>(iii) <a href="#">the potential impact of climate-related issues on financial performance and financial position;</a></li> <li>(iv) the climate-related scenarios and associated time horizon(s) considered.</li> </ul> <p><b>Supplemental Guidance for Asset Owners</b></p> <p>Asset owners that perform scenario analysis should consider providing a discussion of how climate-related scenarios are used, such as to inform investments in specific assets.</p>

## Risk Management

Disclosures in relation to risk management are intended to help users of climate-related financial disclosures in evaluating the reporting organisation's exposure to and management of climate-related risks. This evaluation is facilitated by an understanding of the reporting organisation's processes for identifying, assessing, and managing existing and emerging climate-related risks and of their degree of integration into the organisation's overall risk management architecture.<sup>17</sup>

15 - The TCFD notes that meeting investor expectations could be, inter alia, out of "concerns about access to or the cost of capital".

16 - The use of a scenario consistent with Article 2 of the Paris Agreement is encouraged ("holding the increasing in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels").

17 - The draft IFRS standards (TRWG, 2021a) are perfectly aligned with the TCFD recommendations in terms of risk management disclosures.

Describe the organisation's processes for identifying and assessing climate-related risks.	<p>Describe risk management processes for identifying and assessing climate-related risks (and their relative significance)</p> <p>Describe whether the organisation considers existing and emerging regulatory requirements related to climate change and other relevant factors.</p> <p>Consider disclosing:</p> <p>(i) processes for assessing the potential size and scope of identified risks;</p> <p>(ii) definitions of risk terminology used or references to existing risk classification frameworks used.</p> <p><b>Supplemental Guidance for Asset Owners</b></p> <p>Asset owners should describe, where appropriate, engagement activity with investee companies to encourage better disclosure and practices related to climate-related risks to improve data availability and asset owners' ability to assess climate-related risks.</p>
Describe the organisation's processes for managing climate-related risks.	<p>Describe processes for managing climate-related risks, including decision making process for mitigation, transfer, acceptance, or control of those risks.</p> <p>Describe processes for prioritising climate-related risks, including how materiality is assessed.</p> <p><b>Supplemental Guidance for Asset Owners</b></p> <p>Asset owners should describe how they consider the positioning of their total portfolio with respect to the transition to a low-carbon energy supply, production, and use. This could include explaining how asset owners actively manage their portfolios' positioning in relation to this transition.</p>
Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organisation's overall risk management.	

## Metrics and Targets

Disclosures relating to metrics and targets are intended to help users understand how the reporting organisation measures its climate-related risks and opportunities and monitors its progress and performance in relation to these issues. Information about these metrics and targets can serve as input in assessments of default risks or risk-adjusted returns.<sup>18</sup> Such information may also be used to assess organisational impact on climate change.

### *Key metrics used for measurement and management of climate-related issues*

The 2017 guidance (TCFD, 2017b) called for reporting organisations to disclose the key metrics they use to measure and manage climate-related risks and opportunities. Preparers and users of climate-related financial disclosures have since lamented the lack of standardised metrics and securities regulators have identified as a priority the improvement of "the consistency, comparability, and reliability of sustainability reporting," starting with climate change-related issues.<sup>19</sup>

Noting the clearly expressed demand for comparable disclosures, the updated implementing guidance (TCFD, 2021e) introduces a requirement to disclose metrics (and where relevant, targets) consistent with seven cross-industry categories (see Table 4 below).<sup>20</sup>

18 - There is no discernible gap in principles between TCFD recommendations and the draft IFRS standards (TRWG, 2021a). Draft IFRS standards require the reporting organisation to disclose cross-industry, industry-based and activity metrics as well as the targets set by its governance and the key performance indicators allowing progress to be tracked. The aforementioned metrics are not specified as part of the draft standards and will have to be defined in accordance with these standards, using implementation guidance where available. In the absence of such guidance, management must use its judgement to present metrics that are fit-for-the over-arching purpose of sustainability-related financial disclosures, and meet the general principles of relevance, faithfulness, and neutrality. When doing so, management may also consider the latest recommendations of other standard setting bodies and accepted industry practices when aligned with this purpose and principles.

19 - IOSCO sees an urgent need for globally consistent, comparable, and reliable sustainability disclosure standards and announces its priorities and vision for a Sustainability Standards Board under the IFRS Foundation, Press Release, IOSCO/MR/05/2021, 24 February 2021.

20 - These complement the disclosure of the industry- and company-specific metrics that reporting organisations use to measure and manage climate-related risks and opportunities.

Table 4: Cross-Industry, Climate-Related Metric Categories in the 2021 TCFD Implementing Guidance

Metric Category	Example Unit of Measure	Rationale for Inclusion
<b>GHG Emissions</b> Absolute Scope 1, Scope 2, and Scope 3; emissions intensity	MT of CO <sub>2</sub> e	Crucial for users to understand an organisation's exposure to climate-related risks and opportunities. Disclosure of both absolute emissions across an organisation's value chain and relevant emissions intensity provides insight into how a given organisation may be affected by policy, regulatory, market, and technology responses to limit climate change.
<b>Transition Risks</b> Amount and extent of assets or business activities vulnerable to transition risks	Amount or percentage	Allows users to better understand potential financial exposure to issues such as possible impairment or stranding of assets, effects on the value of assets and liabilities, and changes in demand for products or services.
<b>Physical Risks</b> Amount and extent of assets or business activities vulnerable to physical risks	Amount or percentage	Allows users to better understand potential financial exposure to such issues as impairment or stranding of assets, effects on the value of assets and liabilities, and cost of business interruptions.
<b>Climate-Related Opportunities</b> Proportion of revenue, assets, or other business activities aligned with climate-related opportunities	Amount or percentage	Provides insight into the position of organisations relative to their peers; allows users to understand likely transition pathways and potential changes in revenue and profitability over time.
<b>Capital Deployment</b> Amount of CapEx, financing, or investment deployed toward climate-related risks and opportunities	Amount (in reporting currency)	Capital investment disclosure by non-financial organisations and financing by financial organisations gives an indication of the extent to which long-term enterprise value might be affected.
<b>Internal Carbon Prices</b> Price on each ton of GHG emissions used internally by an organisation	Price per MT of CO <sub>2</sub> e (in reporting currency)	Provide users with an understanding of the reasonableness of an organisation's risk and opportunity assessment and strategy resilience. Can help identify which organisations have business models that are vulnerable to future policy responses to climate change, and which are adapting to ensure resilience.
<b>Remuneration</b> Proportion of executive management remuneration linked to climate considerations <sup>21</sup>	Percentage, weighting, description, or amount	May provide insight on an organisation's governance, oversight, and accountability for managing climate-related issues.

Source: TCFD (2021e).

The TCFD asserts that these categories are not new and justifies the new requirement by the importance of these metrics to understanding climate-related issues and in estimating financial impacts (Table 8 in the appendix describes how the TCFD sees these metrics informing such estimation.) This is certainly true for GHG emissions and emissions intensity. Disclosure of material GHG emissions has indeed been a recommended disclosure since inception of the TCFD Recommendations. GHG emissions drive global warming and their abatement must be the focus of efforts to combat climate change. It follows for the TCFD (2017a) that: “organizations with significant emissions are likely to be impacted more significantly by transition risk than other organizations. In addition, current or future constraints on emissions, either directly by emission restrictions or indirectly through carbon budgets, may impact organizations financially.” The 2021 guidance requires disclosure of Scope 1 and Scope 2 emissions irrespective of materiality and puts the reporting of emissions and emissions intensity at the top of the list of cross-industry disclosures. In its consultation document (TCFD, 2021a), the TCFD describes emissions as “the critical starting point for any discussion of cross-industry, climate-related metrics” and as an input for many other climate-related metrics. In the finalised guidance, the TCFD represents that emissions and emissions intensity are indicative of an organisation's exposure and vulnerability to transition risks. This requirement is uncontroversial and preparers can rely on tested and trusted methodologies to produce user-

21 - While the TCFD calls for quantitative disclosures, it concedes that organisations “may include descriptive language on remuneration policies and practices, such as how climate change issues are included in balanced scorecards for executive remuneration”.

relevant disclosures in relation to emissions. Global standards exist for GHG emissions accounting, which allow for comparability of Scope 1 and Scope 2 emissions and related metrics; they also create a common language to interpret corporate disclosures of targets and metrics in relation to Scope 3 emissions).<sup>22</sup> Owing to the extension of mandatory GHG reporting programs, changing listing requirements and increasing investor pressure, the reporting of Scope 1 and Scope 2 emissions has improved markedly over the last decade and this has contributed to the convergence of Scope 1 and 2 emissions estimated by data providers (as observed by Busch et al., 2020, inter alia).

Preparers do not have the same familiarity with the other metric categories highlighted by the TCFD.<sup>23</sup> Informed by industry feedback, the guidance recognises that some organisations may need time before disclosing along these metric categories and the TCFD also concedes that some categories may be less relevant for certain industries. In addition, the lack of standardisation with respect to metrics to be disclosed hampers reporting and limits the latter's relevance for external users. Despite industry feedback underlining that comparability requires consistent definitions and methodologies, the Taskforce chose to keep its metrics definitions broad and left further standardisation work to the IFRS Foundation<sup>24</sup> and to dialogue between standard setters, e.g., in relation to convergence between environmental taxonomies.

Metric problems are compounded for financial institutions acting as preparers since they need to work with sparse and non-standardised reporting by corporates and may also face specific issues with the aggregation and presentation of results at portfolio level. In this regard, the TCFD acknowledges that data and methodologies for certain metrics for asset owners, e.g., impact of climate change on investment income, remain in the early stages of development and that more time will be needed before such metrics can be disclosed. Likewise, the TCFD acknowledges the challenges in sourcing and aggregating data allowing for the quantification of exposure to climate-related risks at the portfolio level.

There is little doubt that widespread disclosure of relevant metrics along the cross-industry categories identified by the TCFD would considerably improve users' ability to assess preparers' exposure to climate change risks and opportunities, and the reality of their efforts to manage risks and seize opportunities.<sup>25</sup> Getting there presupposes standardisation of the definitions and methodologies upon which corporate disclosures depend as well as capacity-building by preparers and their service providers. The production of comparable and reliable disclosures by corporates is a necessary pre-requisite to the reporting of decision-useful metrics by asset owners and managers but further methodological work may be required to establish sound methodological bases for portfolio-level metrics.

### *Emissions and related risks*

The 2017 guidance required disclosure of GHG emissions when material and suggested reporting industry-specific GHG efficiency ratios, e.g., physical intensities expressing emissions per unit of output, where relevant.<sup>26</sup> The updated implementing guidance requires disclosure of Scope 1 and 2 emissions irrespective of materiality and encourages disclosure of Scope 3 emissions when

22 - The Greenhouse Gas Protocol (WRI and WBCD, 2004), also known as the Corporate Standard, is the global standard for calculating and reporting GHG. While the organisations behind the Corporate Standard released a Scope 3 standard 10 years ago (WRI and WBCD, 2011), Scope 3 reporting remains voluntary for compliance with the Corporate Standard. Voluntary uptake has been modest due to the inherent challenges of assessing emissions from multiple sources throughout reporting companies' value chains. As noted by Ducoulombier (2021), the Scope 3 standard is not intended to support cross-company comparisons but instead to guide an organisation's decarbonisation efforts.

23 - The TCFD consultation on metrics, targets and transition plans found that close to three-fourths of preparers reported difficulties with the disclosure metrics other than emissions, slightly more than a third of preparers estimated metrics these metrics and only a fifth reported them (TCFD, 2021b, figures are averaged across all metric categories). Data access and methodology selection were by far the most common challenges hampering disclosure.

24 - The TRWG advising the International Sustainability Standards Board on climate-related disclosures has identified this as a priority (TRWG, 2021b).

25 - Users who contributed to the TCFD consultation on metrics, targets and transition plans rated Scope 1+2 emissions as the most useful disclosure by far (91% of respondents finding it very useful), followed by Scope 3 emissions (80%). Disclosures of capital deployment, climate-related opportunities, physical and transition risks were also rated as very useful by a large majority (about 72%) of respondents. Less than a majority of respondents (about 42%) considered disclosures about carbon price and remuneration very useful (TCFD, 2021b).

26 - For a brief discussion of the relevance of and challenges with GHG efficiency ratios, refer to Ducoulombier and Liu (2021).

materiality does not require it.<sup>27</sup> Reporting of Scope 3 emissions is voluntary for most companies and Scope 3 accounting, being concerned with emissions from multiple third-party sources throughout the reporting company’s value chain, is challenging (Ducoulombier, 2021).<sup>28</sup> While the reporting of Scope 3 emissions, in the absence of further standardisation, will not produce data that may reliably support direct cross-company comparisons, it will nevertheless be very useful to track corporate progress on value chain decarbonisation.

### Targets

The disclosure of targets in relation to climate-related issues has been part of recommended disclosures since inception. The updated guidance calls for the disclosure of targets consistent with the aforementioned cross-industry, climate-related metric categories, where relevant and for reporting interim targets where an organisation discloses medium- or long-term decarbonisation targets.

<p>Disclose the metrics used by the organisation to assess climate-related risks and opportunities in line with its strategy and risk management process.</p>	<p>Provide the key metrics used to measure and manage climate-related risks (policy and legal, technology, market, and reputation dimensions of transition risks; acute and chronic physical risks) and opportunities (resource efficiency, energy source, products and services, markets, resilience), <a href="#">as well as metrics consistent with cross-industry, climate-related metric categories (see details in Table 2)</a>. Consider including metrics on climate-related risks associated with water, energy, land use, and waste management.</p> <p>Where climate-related issues are material, the organisation should consider describing whether and how related performance metrics are incorporated into remuneration policies.</p> <p>Where relevant, the organisation should provide its internal carbon prices as well as climate-related opportunity metrics such as revenue from products and services designed for a low-carbon economy. Metrics should be provided for historical periods to allow for trend analysis. <a href="#">Where appropriate, the organisation should consider providing forward-looking metrics for the metric categories described in Table 2, consistent with their business or strategic planning time horizons.</a><sup>29</sup></p> <p><b>Supplemental Guidance for Asset Owners</b>                  Asset owners should describe metrics used to assess climate-related risks and opportunities in each fund or investment strategy. Where relevant, asset owners should also describe how these metrics have changed over time.</p> <p><a href="#">Where appropriate, asset owners should provide metrics considered in investment decisions and monitoring. Asset owners should describe the extent to which assets they own and their funds and investment strategies, where relevant, are aligned with a well below 2°C scenario, using whichever approach or metrics best suit their organisational context or capabilities. They should also indicate which asset classes are included.</a></p>
<p>Disclose Scope 1, Scope 2, and, if appropriate, Scope 3 GHG emissions, and the related risks.</p>	<p><a href="#">Provide Scope 1 and Scope 2 emissions independent of a materiality assessment, and, if material, Scope 3 GHG emissions. Consider disclosing Scope 3 emissions irrespective of materiality.</a></p> <p>Consider providing generally accepted industry-specific GHG efficiency ratios.</p> <p>Emissions and associated metrics should be provided for historical periods to allow for trend analysis.</p> <p><b>Supplemental Guidance for Asset Owners</b>  <a href="#">Asset owners should disclose emissions for assets they own (in line with the PCAF Standard or a comparable methodology)</a> and the weighted average carbon intensity (WACI) for each fund or investment strategy, where data and methodologies allow.</p> <p>Asset owners should consider providing other carbon foot-printing metrics they believe are useful for decision-making (see Table 3).</p>
<p>Describe the targets used by the organisation to manage climate-related risks and opportunities and performance against targets.</p>	<p>Describe the key climate-related targets such as those related to GHG emissions, water usage, energy usage, etc., consistent with the categories in Table 2 where relevant, and in line with anticipated regulatory requirements or market constraints or other goals (e.g., efficiency or financial goals, financial loss tolerances, avoided emissions through the entire product life cycle, or net revenue goals for products and services designed for a low-carbon economy).</p> <p>In the description, consider including:</p> <ul style="list-style-type: none"> <li>(i) whether the target is absolute or intensity based;</li> <li>(ii) time frames over which the target applies;</li> <li>(iii) the base year from which progress is measured; and</li> <li>(iv) key performance indicators used to assess progress against targets.</li> </ul> <p><a href="#">Disclose interim targets (in aggregate or by business line, where available) if medium- or long-term targets are disclosed.</a></p>

27 - The TCFD avoids indicating a threshold for materiality but cites the Science Based Targets initiative (SBTi) whose criteria and recommendations consider Scope 3 emissions material (from an impact point of view) when they make up 40% or more of estimated total emissions (SBTi, 2021). This is a low bar to clear given the centrality of Scope 3 emissions in most sectors (Ducoulombier, 2021).

28 - Only about half (54%) of the preparers responding to the TCFD consultation on metrics, targets and transition plans were reporting Scope 3 emissions. The reporting of Scope 3 emissions was considered very difficult by 39% of respondents, the highest number across the seven metric categories. This was primarily due to difficulties with sourcing relevant data. Meanwhile, 80% of users rated the disclosure of Scope 3 emissions as very useful (vs 91% for Scope 1 and 2 emissions).

29 - Where not apparent, a description of the methodologies used to calculate or estimate climate-related metrics or targets should be provided.

### *Supplemental guidance for asset owners*

#### Assessing climate issues – role of portfolio alignment tools

Since inception asset owners (and asset managers) have been required to describe the metrics they use to assess climate issues at fund (or product) or strategy level and disclose what metrics are used in investment management, where relevant. The updated guidance goes further in requiring them to disclose the extent to which their assets (and, where relevant, their funds and investment strategies) are aligned with a well-below 2°C scenario. Preparers are left free to determine what approach or metrics should be used to assess alignment.<sup>30</sup>

After considering industry feedback,<sup>31</sup> the TCFD shelved its proposal that would have required asset owners (and all other financial institutions) to incorporate forward-looking alignment metrics into their target-setting frameworks and management processes. This comes across as a wise decision given the immaturity of portfolio alignment tools and the risks of greenwashing and counter-productive action associated with mandating their use at this stage. Summarising a thorough review of alignment tools (Raynaud et al, 2020a) commissioned by the French Ministry of Ecology and WWF France, Raynaud et al (2020b) conclude that: “in their current state, alignment assessment methodologies may be useful for reporting purposes, e.g., to monitor the evolution of a company’s climate performance using a single metric. However, these methods are not yet mature enough to be used for financial decision-making nor for regulatory purposes. In particular, the Implied Temperature Rise metrics computed by several data providers, appear to be oversimplifications of the reality, and their meaning and practical use (...) are debatable.” The review commissioned by the TCFD (Blood and Powis, 2021) itself concedes that gaps in data and analytics are such that resulting alignment scores diverge across providers and that: “as portfolio alignment tool adoption increases, these gaps could become barriers to effective portfolio alignment, expose financial institutions to greenwashing accusations, and cause investors to make incorrect assessments about the forward-looking trajectory of portfolios and individual investees/counterparties”. A description and discussion of temperature alignment metrics is found in the appendix.

#### Recommended metric for reporting – balancing exposure and responsibility metrics

The 2017 implementing guidance recommended that asset owners and asset managers (but not other financial institutions) report weighted average carbon intensity (WACI) to their beneficiaries and clients. WACI is a carbon exposure metric that is often used as a proxy for overall portfolio exposure to carbon-intensive companies and, by leap-of-faith extension, overall transition risk. TCFD endorsement has contributed to firming this metric up as the market standard and it is the climate-related metric most frequently disclosed across the investment management industry.<sup>32</sup>

The updated guidance requires banks, asset owners and asset managers to disclose the emissions associated with their activities as financial intermediaries, in line with the Partnership for Carbon Accounting Financials (PCAF) Standard or a comparable methodology.<sup>33</sup> Asset owners and managers are required to disclose emissions associated with the assets they own or manage, for each fund/product or investment strategy.

The PCAF aims to harmonise disclosures of absolute greenhouse emissions associated with the portfolios of financial institutions. The first version of the PCAF Standard (PCAF, 2020) covers listed equity and corporate bonds, business loans and unlisted equity, project finance, commercial real

30 - As the TCFD (2021e) observes, this could “include forward-looking metrics, GHG emissions targets and progress against them, reducing emissions in their operations and value chains, and engagement with investee companies on their transition to a low-carbon economy”.

31 - More than half (57%) of the consultation respondents were using portfolio alignment tools, but these users reported (TCFD, 2021b) significant data challenges (data availability, 87%; data standardisation, 86%; internal data quality, 86%) and methodological limitations (integration of Scope 3, 77%; climate scenario development or application, 72%).

32 - It is disclosed by 31% of the asset managers and 39% of the asset owners who participated in the TCFD consultation – the frequencies of disclosure of financed emissions by these institutions are 20% and 22%, respectively. WACI is disclosed by 64% of the respondents from the insurance industry who shun financed emissions, but the situation is reversed for banks with close to half (48%) reporting financed emissions (TCFD, 2021b).

33 - Insurance companies are required to disclose WACI, which reflects the CRO Forum’s efforts to adapt the metric to insurance underwriting activities (CRO Forum, 2020), or emissions associated with commercial property and specialty lines of business where data and methodologies allow. The latter option anticipates standardisation work performed between the insurance industry and the PCAF.

estate, mortgages, and motor vehicle loans. The PCAF Standard conforms with the requirements of the Scope 3 Standard (WRI and WBCSD, 2011) for investment activities.<sup>34</sup> This requires allocating emissions from activities financed by loans and investments to the preparer based on its proportional share of lending or investment in the borrower or investee. PCAF Standard Financed Emissions thus represent the indirect responsibility of the preparer in respect of these emissions. Financed emissions are also known as “portfolio climate impact”, which is a fair designation since they are climate impact metrics.<sup>35</sup> This notwithstanding, they may be – and are – used to capture exposure to climate risks and opportunities.

The TCFD calls the PCAF Financed Emissions metrics “Greenhouse Gas Emissions Metrics” and presents (at pp.50-51 of the updated guidance) formulae for the asset types covered by the PCAF Standard. Box 1 delves into this new family of metrics and explains how, in the case of listed companies, financed emissions relate to the enterprise-value (weighed average) carbon intensity metric used in EU climate benchmark standards. Note that whenever possible financed emissions should cover all scopes under the Greenhouse Gas Protocol (WRI and WBCD, 2004), i.e., direct emissions occurring from sources owned or controlled by the relevant entity (Scope 1), indirect emissions from this entity’s consumption of electricity, steam, heating or cooling provided by other parties (Scope 2), and other indirect emissions occurring in the value chain of that entity (Scope 3).

#### Box 1: PCAF Financed Emissions

Financed emissions is a responsibility metric whereby the financial institution is allocated a portion of the borrower’s and investee’s relevant annual emissions, which is determined by the ratio between the outstanding value of the investment or financing (numerator) and the value of the financed company, project, or asset (denominator). The PCAF calls this ratio the attribution factor; the approach requires that the numerator be measured in a manner that is coherent with how the denominator is measured. The financed emissions of a loan or an investment are calculated by multiplying the attribution factor by the relevant emissions of the respective borrower or investee company.

For listed companies, the PCAF aligns with the EU Benchmark Regulation (Delegated Regulation (EU) 2020/1818, hereafter EU BMR) and defines the denominator as the enterprise value including cash (EVIC), i.e., the sum of the market capitalisation of ordinary shares at fiscal year-end, the market capitalisation of preferred shares at fiscal year-end, and the book values of total debt and minorities’ interests.<sup>36</sup>

Across listed companies, the formula for PCAF financed emissions for listed equity and bonds investments as well as business loans is:  $Financed\ emissions = \sum_i \frac{Outstanding\ amount_i}{EVIC_i} \times Company\ emissions_i$

The outstanding amount is based on market value for listed equities, book value of debt owed to the lender for listed corporate bonds and value of debt owed to the lender for business loans (i.e., disbursed debt minus any repayments).

In the context of a portfolio tracking an index of listed equities,<sup>37</sup> with  $w_i$  representing the weight of issuer  $i$ , we can write:  $Financed\ emissions = \left( \sum_i \frac{Company\ emissions_i}{EVIC_i} \times w_i \times Portfolio\ amount \right)$

$$Financed\ emissions = Portfolio\ EU\ BMR\ Carbon\ Intensity \times Portfolio\ amount^{38}$$

For unlisted companies, balance sheet equity and debt are used in lieu of EVIC and numerator values are defined in relation to book values; a comparable approach is used for project finance. For loans and investments for the purchase or refinance of commercial real estate (“commercial real estate”) or residential property (“mortgages”) as well as loans and lines of credit used to finance motor vehicles (“motor vehicle loans”), the attribution factor is the ratio of the outstanding amount to the value at origination and the emissions to be apportioned are determined using energy consumption and emissions factors.

34 - A preparer’s Scope 3 emissions from investments (Category 15) are the Scope 1 and Scope 2 emissions of investees.

35 - In practical implementation, the blending of market and book values leads to omissions and double counting in the allocation of emissions.

36 - For those institutions only investing in equity and approaching GHG accounting from a risk perspective, the PCAF allows emissions to be attributed to total market capitalisation; this Carbon Footprint exception is possible for a maximum of three years (i.e., to the end of 2023).

37 - This does not hold for a bond index as the outstanding amount is defined based on the book value of the debt that the borrower owes to the lender, for consistence with the denominator.

38 - Portfolio EU BMR Carbon Intensity is reported as part of the Scientific Beta Carbon Reduction analytics introduced for reporting on EU Climate Benchmarks compliant indices.

Relative to the consultation proposal, the finalised guidance reaffirms WACI as recommended disclosure for funds, products and strategies (while also requiring the disclosure of financed emissions, where possible). While respect should be owed to WACI as the existing market standard, it would also have been particularly dangerous to substitute financed emissions for WACI, notably if investment management is to support the transition towards a low GHG emissions economy (refer to Box 2 below for a detailed explanation).

### **Box 2: Dangers of steering investment management by financed emissions**

There is understandable appeal in the PCAF project to establish a framework for coherent measurement and disclosure of emissions associated with financing activities across a variety of asset classes.<sup>39</sup> However, while financed emissions may have relevance for portfolio reporting, the corresponding asset-level metric for listed companies, i.e., emissions to enterprise value (including cash), should not be allowed to guide security selection and issuer engagement where the investor intends to incentivise real-world decarbonisation (see Ducoulombier and Liu, 2021).

Indeed, reliance on enterprise value introduces capital market volatility into carbon intensity measurement and obscures the relationship with real-world emissions. Where real-world impact is an important investor consideration, the traditional economic intensity measure, i.e., the ratio of emissions to revenues, while not perfect, is preferable. Since WACI is simply the portfolio average of this asset-level metric, the reporting of WACI is consistent with encouraging the use of a sensible asset-level metric for investment management that aims to account for corporate-level climate performance (whether for risk or impact considerations).

Putting financed emissions at the centre of reporting naturally creates incentives to adopt a consistent metric for asset-level decisions, with unintended and counterproductive effects from the perspective of supporting the transition to a low-carbon economy. The adoption of EVIC-based weighted average carbon intensity as the metric by which to assess the decarbonisation and alignment of the EU Climate Benchmarks provides a natural experiment. Indeed, run-of-the-mill EU Climate Transition Benchmarks and Paris-aligned Benchmarks select or weight constituents on the basis of security-level EVIC-based intensity. While this is unsurprising given the regulatory incentives to do so, it is quite unfortunate as this metric weakens the link between changes in measured carbon intensity and underlying emissions and produces metric volatility that rewards an issuer's market performance over its decarbonisation performance (Ducoulombier, 2020). Ducoulombier and Liu (2021) document that over 2014-2020, only 45% of the companies showing a yearly compression of 7% or more in EVIC-based carbon intensity (as defined by EU regulation and computed from Scope 1+2) also recorded a compression in emissions of 7% or more. In addition, a whopping 30% of these companies with attractive EVIC-based carbon intensities recorded increases in emissions. The traditional definition of carbon intensity (emissions / revenues as in the 2017 TCFD recommendations) produces a much better profile (60% vs 45% and 18% vs 30%, respectively) and allows to fairly represent that companies that fail to reduce their emissions by 7% nevertheless demonstrate gains in process efficiency, which are also of the essence in the transition towards a net-zero economy.

While arising from the same cause, i.e., capital market volatility, the above problem is more fundamental than the "moving target" issue that the PCAF Standard (PCAF, 2020) acknowledges as justifying further work on the challenges linked to steering on financed emissions ("Under the influence of this fluctuation, an objective to reduce relative financed emissions (...) becomes a moving target.").

Such steering naturally promotes portfolio rebalancing driven by security-level EVIC-based carbon intensity and thus incentivises strategies that give more importance to capital market prices (momentum) than to climate performance (progress) as predicted in Ducoulombier (2020) and shown in Ducoulombier and Liu (2021). This remains true after detrending (which comes with additional issues discussed by the PCAF): securities with price momentum above/below trend are rewarded/penalised (Ducoulombier and Liu, 2021).

39 - Ducoulombier and Liu (2021) note that the application of PCAF-type financed emissions across listed and unlisted companies can create biases that favour listed companies (as their book values typically tend to be lower than market values). Likewise, the authors note that geographic biases can emerge as a result of varying degrees of access to public markets across regions, as well as differences in book-to-market ratios attributable to local accounting standards.

### Other metrics of interest

The 2021 guidance also updates the table of “Common Carbon Footprinting and Exposure Metrics” that details formulae for WACI and other metrics that asset owners and asset managers should consider reporting to their beneficiaries and clients. Emissions to be apportioned remain Scope 1 and Scope 2 emissions. The three carbon footprinting<sup>40</sup> metrics are unchanged from 2017 (Table 5).

Table 5: Common Carbon Footprinting Metrics listed by the TCFD

<p><b>Total (Carbon) Emissions</b>                  Absolute GHG emissions associated with a portfolio, as allocated based on equity ownership, expressed in tons of CO2e.</p>	$\sum_i \frac{\text{Current market value of investment}_i}{\text{Current market capitalisation}_i} \times \text{emissions}_i$
<p><b>Carbon Footprint</b>                  GHG emissions associated with a portfolio, as allocated based on equity ownership and ‘normalised’ by the market value of the portfolio, expressed in tons of CO2e per (USD) billion (or million) invested</p>	$\frac{\sum_i \frac{\text{Current market value of investment}_i}{\text{Current market capitalisation}_i} \times \text{emissions}_i}{\text{Current market value of portfolio}}$ <p>With <math>w_i</math> the relative market value of issuer <math>i</math> securities in the portfolio, this is:</p> $\sum_i w_i \times \frac{\text{emissions}_i}{\text{Current market capitalisation}_i}$
<p><b>Carbon Intensity (aka financed emissions/financed revenue)</b>                  GHG emissions associated with a portfolio, as allocated based on equity ownership and ‘normalised’ by the revenues associated with the portfolio, expressed in tons of CO2e per (USD) million of revenues</p>	$\frac{\sum_i \frac{\text{Current market value of investment}_i}{\text{Current market capitalisation}_i} \times \text{emissions}_i}{\sum_i \frac{\text{Current market value of investment}_i}{\text{Current market capitalisation}_i} \times \text{revenues}_i}$

Source: TCFD (2017b, 2021e).

As for carbon exposure metrics (see Table 6 below), the 2021 update introduces details how WACI can be applied to an insurance portfolio<sup>41</sup> and suggests that the definition of Carbon-related Assets be expanded beyond the Energy and Utilities sectors to include all industries identified as being at higher risk to be financially impacted by climate change “due to their exposure to certain transition and physical risks around GHG emissions, energy, or water dependencies associated with their operations and products”.<sup>42</sup>

Table 6: Common Carbon Exposure Metrics listed by the TCFD

<p><b>WACI</b>                  Average exposure of portfolio to carbon-intensive companies, expressed in tons of CO2e per (USD) million of revenues</p>	$\sum_i \frac{\text{Current market value of investment}_i}{\text{Current market value of portfolio}} \times \frac{\text{emissions}_i}{\text{revenues}_i}$ <p>With <math>w_i</math> the relative market value of issuer <math>i</math> securities in the portfolio (or for an insurance portfolio, the relative value of the gross written premium of the insurance transaction pertaining to company <math>i</math> in the overall GWP volume of the insurance portfolio), this is:</p> $\sum_i w_i \times \frac{\text{emissions}_i}{\text{Current market capitalisation}_i}$
<p><b>Exposure to Carbon-related Assets</b>                  Carbon-related assets in the portfolio, expressed in USD millions (absolute) or percentage of current portfolio value (relative).</p>	<p>Absolute:</p> $\sum \text{Current value of investments in carbon related assets}$ <p>Relative:</p> $\sum \frac{\text{Current value of investments in carbon related assets}}{\text{Current market value of portfolio}}$

Source: TCFD (2017b, 2021e).

These industries can be grouped into four non-financial groups as per Table 7; however, the TCFD correctly observes that there may be sub-industries that should be excluded from the computation.<sup>43</sup> The TCFD continues to encourage the adoption of a consistent definition for Carbon-related Assets but also continues to shy away from providing it.

40 - Carbon footprinting refers to a responsibility approach whereby emissions are allocated to investors based on the equity ownership approach of the Greenhouse Gas Protocol.

41 - This follows the general approach of the CRO Forum which also has recommendations for a finer grain approach by industry or line of business (CRO Forum, 2020).

42 - This is of particular relevance to banks, whose Supplemental Guidance for the Strategy pillar requires them to describe significant concentrations of credit exposure to carbon-related assets.

43 - In 2017, it had suggested defining carbon-related assets as those assets tied to the Energy and Utilities sectors (under the Global Industry Classification Standard) but excluding water utilities and independent power and renewable electricity producer industries.

Table 7: Carbon-related Assets – Industries Associated with the Four Non-Financial Groups

Energy	Transportation	Materials and Buildings	Agriculture, Food, and Forest Products
Oil and Gas Coal Electric Utilities	Air Freight Passenger Air Transportation Maritime Transportation Rail Transportation Trucking Services Automobiles & Components	Metals and Mining Chemicals Construction Materials Capital Goods Real Estate Management and Development	Beverages Agriculture Packaged Food & Meats Paper and Forest Products

Source: TCFD (2021d).

## Appendix

### Highlights from the TCFD 2021 status report

The review (TCFD, 2021c) assessed the disclosures of 1,651 public companies (other than asset owners and managers) from 69 countries across eight sectors and found that levels of TCFD-aligned disclosure increased by a record 9% year on year. However, on average companies report in line with only three recommended disclosures (out of 11). The most frequent aligned disclosures pertained to climate-related risks and opportunities (Strategy pillar, 52%), climate-related metrics (Metrics and Targets pillar, 44%), and impact of climate-related risk and opportunities on the organisation (Strategy pillar, 39%). Disclosure of corporate resilience under different climate scenarios (Strategy pillar) remained the least frequent (but increased to 13%). Disclosures of climate-related targets (Metrics and Targets pillar) increased sharply (from 24% to 34%) and disclosures of GHG emissions also increased markedly (Metrics and Targets pillar, from 31% to 37%). Risk Management disclosures and Governance disclosures increased sharply but continued to trail. Europe remained the clear leader in terms of alignment with TCFD recommendations (50%) and 75% of European companies reviewed were found to disclose climate-related metrics. The top three sectors in terms of disclosure alignment were Materials and Buildings (38%); Energy (36%) and Insurance (34%); Technology and Media companies trailed (16%). Bottom tercile companies (capitalisation below USD3.4bn) had average percentage of disclosures at less than half (20% vs 44%) that of top tercile companies (capitalisation above USD12.2bn). Given the limited amount of reporting pertaining to the financial impact of climate change, the FSB requested that the TCFD look further into this. The TCFD conducted an in-depth survey on disclosures of financial impact and found they remained limited, (one issue being getting potential disclosures approved), were more common for impact on financial performance than for impact on financial position, and for potential impact rather than actual impact (due to challenges with attribution of monetary amounts to climate events). The TCFD also looked at uptake by asset owners and asset managers using PRI disclosures from 2,182 asset managers and 538 asset owners across 60 countries. It found that levels of disclosure against the governance, strategy and risk management pillars were considerably higher than for public companies, but disclosure against the metrics and targets pillar remained low (19% of asset managers and 21% of asset owners were disclosing climate-related metrics, 8% and 12% were disclosing emissions, and 7% and 10% were disclosing targets).

### Climate-related risks and financial impacts

Table 8 illustrates how metrics consistent with the cross-industry metric categories may inform estimation of financial impact.

Table 8: Link between Cross-industry Metric Categories and Financial Impacts

	Key Questions	Cross-Industry Metric Categories	Financial Impacts
Governance	<i>Is the organization's governance enabling oversight, assessment, and management of climate-related risks and opportunities?</i>	Proportion of executive management remuneration linked to climate considerations	Impact of climate-related risks or opportunities on financial performance e.g.: <ul style="list-style-type: none"> <li>• increases in revenue from new products or services from climate opportunities</li> <li>• increases in cost due to carbon prices, business interruption, contingency, or repairs</li> <li>• changes to operating cash flow from changes in upstream costs</li> <li>• impairment charges due to assets exposed to transition risks</li> <li>• changes to total expected losses due to physical risks</li> </ul>
		Proportion of revenue, assets, or other business activities aligned with climate-related opportunities	
Strategy	<i>Is the organization aligning its businesses, strategy, and financial planning in light of climate-related risks and opportunities?</i>	Amount of capital expenditure, financing, or investment deployed toward climate-related risks and opportunities	Impact of climate-related risks or opportunities on financial position e.g.: <ul style="list-style-type: none"> <li>• changes to the carrying amount of assets due to exposure to physical and transition risks</li> <li>• changes to the expected portfolio value given climate-related risks and opportunities</li> <li>• changes in liability and equity due to increases or decreases in assets</li> </ul>
		Absolute Scope 1, Scope 2, and Scope 3 GHG emissions and emissions intensity	
Risk Management	<i>What is the organization's exposure to climate-related risks?</i>	Price on each ton of GHG emissions used internally by an organization	
		Amount and extent of assets or business activities vulnerable to physical risks	
		Amount and extent of assets or business activities vulnerable to transition risks	

Source: TCFD (2021d).

## Comments on temperature alignment metrics

While temperature alignment metrics are a rather recent innovation, with some foremost ESG data providers still in the process of developing their tools, there already exists a dizzying array of methodologies corresponding to different objectives, scenarios, assumptions, data choices and inputs, which naturally produce divergent information. The views of Scientific Beta on these metrics align with those recently stated by the Bank of England (BoE, 2021): “These promise to be highly valuable, though at present they remain in their infancy and are heavily reliant on assumptions, model-based projections, and partial data.”<sup>44</sup>

The approach to developing a temperature alignment metric involves: (i) selecting an overall (macro) transition scenario (or a series thereof) such as those used by the Intergovernmental Panel on Climate Change (IPCC);<sup>45</sup> (ii) choosing scenario-consistent transition pathways (ideally as specific to sectors, and arguably geographies, as possible); (iii) measuring the distance (sometimes called benchmark divergence) between the estimated climate performance of a company and the required performance under the relevant pathway(s) (this may represent the consumption of the sectoral carbon budget allotted to the firm, or the distance to a technological benchmark) and possibly converting it into an “Implied Temperature Rise” (ITR) metric (note that this is often presented as more sophisticated but may give the misleading impression that the metric amounts to something comparable to the complex temperature modelling performed by the IPCC<sup>46</sup>). Once a metric is available at the level of firm, aggregation to the portfolio level may be tempted.<sup>47</sup> Uncertainties and options abound at every step.

An in-depth technical review of eleven alignment assessment methodologies<sup>48</sup> commissioned by the French Ministry for the Ecological and Inclusive Transition and WWF (Raynaud et al., 2020a) observes that data providers and investors face a range of trade-offs when developing or using such approaches.<sup>49</sup> The review documents the divergence of portfolio alignment assessment results (and attributes its cause primarily to objectives and methodological choices). The conclusion to a paper summarising these findings (Raynaud et al., 2020b) reads as follows: “in their current state, alignment assessment methodologies may be useful for reporting purposes, e.g., to monitor the evolution of a company’s climate performance using a single metric. However, these methods are not yet mature enough to be used for financial decision-making nor for regulatory purposes. In particular, the Implied Temperature Rise metrics computed by several data providers, appear to be oversimplifications of the reality, and their meaning and practical use (...) are debatable.” The authors suggest that regulators should determine the minimum requirements that methodologies should meet to be considered fit for purpose.

44 - The Bank notes that Implied Temperature Rise (ITR) metrics, in particular, “are highly sensitive to their underlying assumptions.” For illustration, the Bank’s 2020 climate risk disclosure estimated that its Corporate Bond Purchase Scheme portfolio was aligned with 3.5°C of warming by the end of the century but it writes that, using S&P Trucost and MSCI data, “relatively minor methodological variations (...) produced alternative estimates ranging from <1.75°C to 4°C”.

45 - Scenarios depend on assumptions made about population, policies, economic growth, technological advances. Scenarios are typically drawn from the Integrated Assessment Modeling Consortium (IAMC) and the International Energy Agency (IEA).

46 - Certainly, a tool that would translate the degree of alignment of a firm with its benchmark into its consequence in terms of warming (in a manner that would be coherent with the original physical modelling) would be precious. To the best of our knowledge, this is not on offer.

47 - Even if firm-level ITRs were correct, it is not obvious how a science-based portfolio-level ITR could be obtained through their linear combination. However, communicating portfolio-level ITRs obtained from aggregation of firm-level ITRs may give the false impression that the portfolio is consistent with a science-based climate model.

48 - 2DII, Arabesque, Carbon4 Finance, CDP, EcoAct, Urgentem, I Care & Consult, ISS, MSCI Carbon Delta, right. based on science, S&P Trucost, and Sycomore AM.

49 - The main trade-offs identified pertain to 1. Value chain perimeter; 2. Future performance forecasting; 3. Choice of scenario under practical and conceptual limitations; 4. Temperature benchmark derivation.

A more cursory review of seven methods supported by nine financial institutions (Blood and Levina, 2020) identifies key steps<sup>50</sup> and judgments or modelling choices<sup>51</sup> which, along differences in data inputs, affect the nature and quality of outputs (and explain their divergence across providers). The review attempts to identify a set of best practices to recommend,<sup>52</sup> and explains that making portfolio warming methods robust will require both significant improvements in data and other input<sup>53</sup> and convergence of methodologies “around some common key judgements and minimum standards.”<sup>54</sup> The TCFD commissioned an extension of this paper ahead of its consultation on Metrics, Targets, and Transition Plans. The work (Blood and Powis, 2021) reviews the tools of eleven providers<sup>55</sup> to “lay out emerging best practice as it relates to the construction and use of these tools, in the hope it will advance industry thinking and promote more widespread adoption of consistent, robust, and decision-useful approaches.”<sup>56</sup> The authors correctly observe that convergence is important not only to “facilitate comparability and transparency within and across financial institutions,” as is widely understood, but also to “provide clarity and consistency for companies on how their behavior related to the net-zero transition may impact their interactions with investors and lenders.” The latter observation demonstrates understanding that use of divergent data for portfolio construction and engagement undermines investor impact channels by diluting the potential cost of capital and market signals of capital allocation and the capacity to productively engage firms around clear and consistent targets shared by corporates and investors.

Despite the early-stage nature of these tools, Blood and Powis (2021) consider that they may be used for target setting and to help inform investment management towards achieving these targets. However, the report insists that these tools “should supplement existing target-setting frameworks, not supplant them.” Compared to its earlier iteration, the report contains additional recommendations.<sup>57</sup> Despite its vocal support of alignment tools, the reports concedes that gaps in data and analytics are such that resulting scores diverge across providers and that “as portfolio alignment tool adoption increases, these gaps could become barriers to effective portfolio alignment, expose financial institutions to greenwashing accusations, and cause investors to make incorrect assessments about the forward-looking trajectory of portfolios and individual investees/ counterparties.” Against this backdrop, it calls for a multi-stakeholder effort to: (i) improve corporate data and disclosures (notably emissions, targets, and transition plans); (ii) fund the development of net-zero scenarios explicitly designed for the purposes of portfolio alignment (and their regular update); and (iii) drive methodological convergence (starting with adherence to its proposed recommendations and the justification of divergences relative to these).

50 - Three key steps are named: “Translating carbon budgets into benchmarks”; “Assessing company- level alignment” and “Assessing portfolio- level alignment.” It is to be remarked that the work shows a very strong bias in favour of calculating aggregated ITR, which puts sector-level, production-based approaches at a disadvantage. Being able to communicate around a single indicator has value, but it may be argued that significant benefits come with the use of production metrics (PACTA designer 2DII argues that they are more scientifically robust, more useful for capital allocation, ease the data collection burden and increase quality (no Scope 3 modelling); support improved comparability; and allow to avoid reliance on intensities (which come with higher risks of breaching the carbon budget), see Vleeschhouwer et al. (2021).

51 - The authors identify nine key choices: “1. Benchmark type: temperature path vs warming functions; 2. Benchmark granularity; 3. Intensity vs absolute emissions; 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; 9. Aggregation from company to portfolio level.”

52 - These include: (i) using sector- and geography- specific scenarios; (ii) including Scope 3 emissions where relevant and possible given data limitation; and (iii) using the base available emissions data and target, i.e., verified self-reported primary data rather than estimates.

53 - In particular, the authors call for “improved availability and quality of emissions data, including Scope 3 and emissions broken down by country and sector”; externally validated company targets; and sector- and country- specific pathways and scenarios.

54 - The authors note that benchmarking can be done against absolute emissions or emission intensity and that 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)”. They also note the desirability and challenges of incorporating Scope 3 emissions (on this, see Ducoyombier, 2021). Finally, the authors underline that further work is required to establish the most appropriate approach to aggregate firm-level metrics into a portfolio score.

55 - 2DII, Arabesque, Barclays, Carbone4, CPR AM, Lombard Odier, LSEG, MSCI, right. Based on science, S&P Trucost, and SBTi.

56 - The paper breaks decision usefulness into seven criteria: “simplicity of use, transparency, actionability, scientific robustness, broad applicability, aggregability, and incentive optimality.”

57 - The report recommends single-scenario benchmarks over warming-function approaches for the sake of simplicity and transparency; convergence- over rate-reduction benchmarks with limited sectoral exceptions; use of intensity (including, where possible, physical intensity) for convergence benchmarks except in the fossil fuel sectors where output reduction and diversification may be more appropriate alignment strategies; use of Scope 3 limited to sectors in which they are “most material and for which benchmarks can be easily extracted from existing scenarios (fossil fuels, mining, automotive);” basing projections not only on targets but also on actual reductions; avoiding sole reliance on historical emissions or near-term CapEx plans for projections; altogether using multiple data sources for projections and weighting them based on credibility; measuring divergence on a cumulative-performance basis (vs point-in-time); generating ITR where possible by converting alignment into absolute emissions terms so that a total carbon budget consumption can be calculated and from that a temperature outcome (this requires consistence across benchmarks).

The methodologies on offer are not mature enough to be put at the core of portfolio construction<sup>58</sup> and further progress in firm-level climate disclosures, availability of science-based temperature scenarios and methodological standardisation<sup>59</sup> is required before this can change materially without undermining the cause of alignment (through dilution of the potential effectiveness of investor impact channels).<sup>60</sup>

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58 - Practical issues not discussed in this note include: insufficient sectoral coverage (disregard for medium and low impact sector, absence of some key sectors) or granularity; insufficient company-level coverage of some approaches, e.g., focus on largest emitters, as with TPI/CA100+ may make sense for prioritisation of engagement but makes alignment assessment difficult for diversified portfolios and cannot lead to proper recognition of the positive or negative contribution of many companies to the transition; sole focus on companies with targets approved by SBTi or reported via CDP may bring support to important alignment and disclosure initiatives but is a particularly biased view of alignment; reliance on corporate pledges that are insufficiently challenged if at all or weighted against achievements or solid evidence that transition plans are realistic and/or being implemented; reliance on extrapolation of recent decarbonisation performance as sustainable in the long term (whereas these could be linked to the lifecycle of the company, the business cycle, or reflect the harvesting of low hanging decarbonisation fruits).

59 - Naturally, some divergences will remain owing to differences in objectives and assumptions about scenarios and pathways.

60 - The parallel with ESG ratings is obvious. Allocation based on invalid metrics will fail to direct capital in a manner supporting the transition and divergence of metrics will undermine capital market signals and engagement efforts.

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For more information, please contact:  
Séverine Cibelly on: +33 493 187 863 or by e-mail to: [severine.cibelly@scientificbeta.com](mailto:severine.cibelly@scientificbeta.com)

Scientific Beta HQ & Asia  
1 George Street  
#15-02  
Singapore 049145  
Tel: +65 6438 0030

Scientific Beta R&D  
393 promenade des Anglais  
BP 3116 - 06202 Nice Cedex 3  
France  
Tel: +33 493 187 863

Scientific Beta—Europe  
10 Fleet Place, Ludgate  
London EC4M 7RB  
United Kingdom  
Tel: +44 20 7332 5600

Scientific Beta—North America  
One Boston Place, 201 Washington Street  
Suite 2608/2640, Boston, MA 02108  
United States of America  
Tel: +1 857 239 8891

Scientific Beta—Japan  
East Tower 4th Floor, Otemachi First Square,  
1-5-1 Otemachi, Chiyoda-ku, Tokyo 100-0004  
Japan  
Tel: +81 352 191 418

[www.scientificbeta.com](http://www.scientificbeta.com)