

TCFD-Aligned Climate Risk Reporting

**A Practical Guide for Institutional Investors Using MSCI Data
and Metrics**

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Executive summary

An increasing number of institutions, especially financial institutions, have started to disclose climate-related risks and opportunities in alignment with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD).

MSCI ESG Research LLC data and metrics can be used at the portfolio, sector and security level to support reporting on the four pillars of the TCFD recommendations: **governance, strategy, risk management and metrics and targets**.

Specifically:

1. **Carbon footprinting** across asset classes, aligned with the Partnership for Carbon Accounting Financials' (PCAF) methodology, is a starting point for analyses of climate-risk and temperature alignment. Carbon footprinting can inform governance, strategy and risk management reporting and is a key part of metrics and targets.
2. **Assessments of climate-related financial risks** using Climate Value-at-Risk (Climate VaR) for both transition and physical risks can inform strategy and risk management reporting.
3. **Portfolio-level temperature alignment metrics** such as Implied Temperature Rise can inform strategy and risk management reporting.
4. **Other climate- and carbon-related data** can provide additional insights into the climate-related risks and opportunities of a portfolio. These include exposure to fossil fuels, portfolio companies with greenhouse gas (GHG) emission reduction targets or exposure to green revenue (clean tech).

This guide is intended to support institutional investors on the use of MSCI ESG Research data and to inform TCFD-aligned reports on climate-related risks. For many examples, we compared the MSCI ACWI Climate Paris Aligned Index (CPAI) to the MSCI ACWI Index.

Why report on climate-related financial risks?

The Financial Stability Board created the Task Force on Climate-related Financial Disclosures (TCFD) in 2015, with the first recommendations issued in 2017, to help markets more effectively and efficiently price in the risks of climate change.^{1 2}

The TCFD developed a widely accepted, voluntary framework for both financial and non-financial companies to use to disclose their climate-related risks. An increasing number of governments are modeling climate-related financial disclosure rules and regulations on the TCFD recommendations.³ Some of these rules already have entered into force, and many are expected to do so throughout 2022 and 2023. In addition, TCFD recommendations provide a basis for international climate disclosure standards, such as those being developed by the International Sustainability Standards Board (ISSB).⁴ While these initiatives share the same objective — providing investors with better access to climate-related financial data — their degree of alignment with the TCFD recommendations varies (Exhibit 1).

¹ Task Force on Climate-related Financial Disclosures. [“About.”](#) TCFD. Accessed May 20, 2022. See Appendix 1 for access to the latest guidance documents from the TCFD.

² Read MSCI’s call to action on the Role of Capital in the Net-Zero Revolution: MSCI. 2021. [“The Role of Capital in the Net-Zero Revolution.”](#)

³ Wu, Emma and Uddin, Zohir. April 21, 2022. [“As TCFD Comes of Age, Regulators Take a Varied Approach.”](#) MSCI ESG Research.

⁴ IFRS. Nov. 3, 2021. [“IFRS Foundation announces International Sustainability Standards Board, consolidation with CDSB and VRE, and publication of prototype disclosure requirements.”](#)

Exhibit 1: TCFD-aligned regulations around the world measured against six criteria

		Enter into force	Forward-looking approach	Scope of firms	Scenario analysis	Double materiality	Stringency
Americas	Brazil	In 2022	<input type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
	Canada	2023 or later	<input type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
	U.S.	2023 or later	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
EMEA	EU	In 2022	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
	France	Already in place	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
	South Africa	In consultation stage	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
APAC	U.K.	In 2022	<input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
	Australia	Already in place	<input type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
	China	Already in place	<input type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
	Hong Kong	Already in place	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
	India	In 2022	<input type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
	New Zealand	2023 or later	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
	Singapore	Already in place	<input type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Transition Plans ☒ All listed firms ☒ All firms in-scope ☒ Yes ☒ Mandatory ☒

Targets ☒ Just financial firms ☐ Certain firms ☒ Optional ☐ Partially mandatory ☐

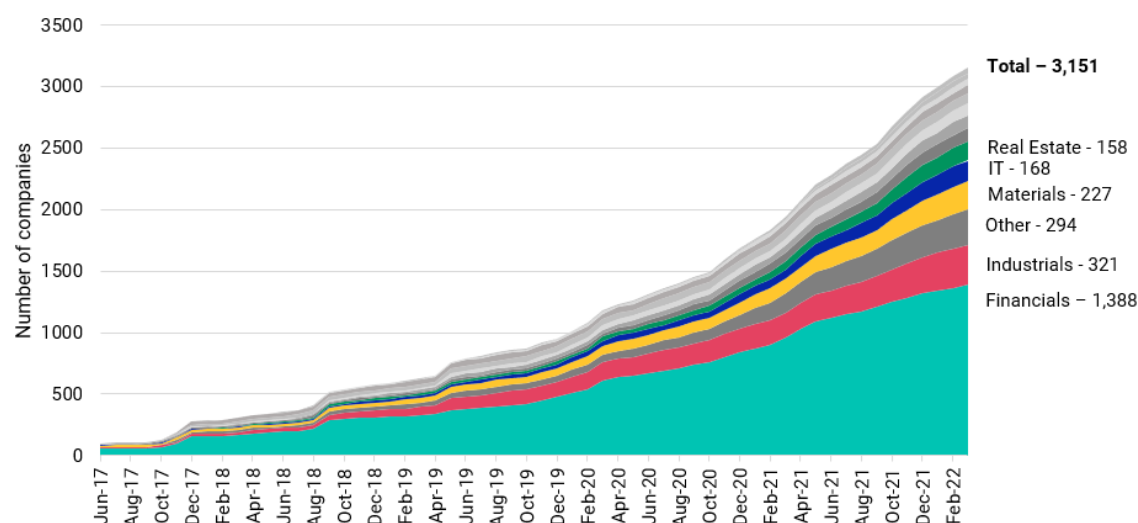
Only certain listed firms/sectors ☐ Not immediately ☐ No ☐ To become mandatory ☐

No ☐ Voluntary ☐

Source: Wu, Emma and Uddin, Zohir. April 21, 2022. "As TCFD comes of age, regulators take a varied approach." MSCI ESG Research. [As TCFD Comes of Age, Regulators Take a Varied Approach - MSCI](#).

The number of companies that support TCFD had since 2017 grown to more than 3,000, as of April 2022. The financials sector made up the largest portion of supporting companies, at nearly 1,400 (44% of total), as of April 2022.

Exhibit 2: Supporters of TCFD by sector



Using MSCI data and metrics to report on climate risk

Understanding the core pillars of the TCFD framework

Four core pillars comprise the TCFD framework: governance, strategy, risk management, and metrics and targets.⁵

- **Pillar 1: Governance:** Disclose your organization's governance of climate-related risks and opportunities.
- **Pillar 2: Strategy:** Disclose the actual and potential impacts of climate-related risks and opportunities on your organization's businesses, strategy and financial planning, where such information is material.
- **Pillar 3: Risk management:** Disclose how your organization identifies, assesses and manages climate-related risks.
- **Pillar 4: Metrics and targets:** Disclose the metrics and targets your organization used to assess and manage relevant climate-related risks and opportunities, where such information is material.

⁵ Task Force on Climate-related Financial Disclosures. [TCFD Knowledge Hub](#). TCFD. Accessed May 25, 2022

Exhibit 3: The four pillars of the TCFD framework

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

Source: *Climate and Net-Zero Solutions*, MSCI.

Using this guide

This guide provides examples of how an institutional investor can use data and metrics provided by MSCI ESG Research to help better inform their decisions.⁶ Which metrics are most appropriate for each section of a TCFD report is discussed through the sections for each pillar, while more thorough discussions and examples for these metrics appear in the metrics and targets section. This guide heavily refers to and includes examples from resources provided by the TCFD, and is meant as a complement to, rather than a replacement for, TCFD guidance.

Pillar 1: Governance

Disclose your organization's governance of climate-related risks and opportunities.

Key questions may include:

- Does the board have oversight of climate-related issues?
- How often does the board meet to discuss them, and which committees are responsible?
- How does the board monitor and track progress toward climate-related targets set as part of the institution's strategy?
- Similarly, what role does management play with regard to climate?

Pillar 2: Strategy

Disclose the actual and potential impacts of climate-related risks and opportunities on your organization's business, strategy and financial planning, where such information is material.

MSCI metrics and data can help inform the discussion of developing a strategy for managing climate risks by providing modeled estimates for the climate-related risks that your portfolio faces across a range of scenarios. They can provide an understanding of portfolio companies' climate targets and an indication of overall portfolio and company alignment with global temperature targets.

Key elements of a TCFD-aligned climate strategy include calculating your portfolio's carbon footprint, minimizing climate-related risks, capturing climate technology opportunities and ensuring portfolio alignment with decarbonization pathways such as the well-below-2°C goal of the Paris Agreement.

- **Carbon footprinting**, or calculating financed emissions, is a first step that can help inform other elements of strategy.

⁶ A list of data points used in this report can be found in the appendix.

- Minimizing transition and physical risk, using **Climate Value-at-Risk (VaR)** calculations, may involve shifting investments away from assets most sensitive to rises in carbon prices or engaging with portfolio companies with higher transition risk to better understand their climate transition plans.
- Capturing **green opportunities** that may emerge from the growing need to decarbonize could be another element of your institution's climate strategy. In addition to the Technology Opportunities Climate Value-at-Risk, investors also could use low-carbon patent and green revenue data, aggregated or by specific climate technology (e.g., wind, solar, batteries).
- Assessing alignment with portfolio-level decarbonization targets can be done with the **Implied Temperature Rise** metric, which translates company-level emissions and climate targets into degrees Celsius (°C), which can be aggregated at the fund and portfolio levels.

Pillar 3: Risk management

Disclose how your organization identifies, assesses and manages climate-related risks.

This section of the report focuses on describing your institution's processes for identifying, assessing and managing climate-related risks, and how these climate-specific processes relate to more general risk management processes.

For example, your organization may explain how it incorporates into its risk management process the results of carbon footprinting and the quantitative assessments of transition and physical Climate Value-at-Risk across climate scenarios.

In addition to your evaluation of these risks, some potential questions include how frequently you assess climate-related risks and whether the team(s) that manage climate risk are also responsible for managing other risks. If not, where, if at all, are different perspectives on risk reconciled or integrated?⁷

For asset owners and managers, TCFD recommends providing information on how they engage with investee companies on their transition to a low-carbon economy.⁸ In addition to explaining the number of engagements (by sector, for example), investors may want to explain how they chose which portfolio companies to engage with. For some, it may be as a member of a group such as Climate Action 100+ or a

⁷ For an extensive review of theory and practice regarding net-zero risk management, see: Szikszai, Monika, Sze, Donald and Verbraken, Thomas. 2022. "[Net-Zero Alignment: Managing Portfolio Risk Along the Net-Zero Journey](#)." MSCI ESG Research.

⁸ Task Force on Climate-related Financial Disclosures. October 2021. "[Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures](#)." TCFD. p. 41, 46.

Net-Zero Alliance. For others, it may be screening criteria such as company climate targets that didn't meet a specific threshold or compare poorly to sector peers (see more on climate targets below).⁹

Pillar 4: Metrics and targets

Disclose the metrics and targets your organization used to assess and manage relevant climate-related risks and opportunities, where such information is material.

This section provides more detail on the steps mentioned in the strategy and risk management pillars:

1. Calculating the GHG emissions footprint (or financed emissions) of the institution's portfolio;
2. Identifying climate-related transition and physical risks;
3. Assessing alignment with decarbonization targets (if relevant); and
4. Aligning a portfolio with the institution's targets.

1. Calculating the GHG emissions footprint of a portfolio

Investors may first want to establish the emissions footprint of their portfolio. Strategy, risk management and targets could depend on the carbon footprint of the portfolio.

A portfolio's GHG (or carbon) emissions can be summarized as weighted average carbon intensity (WACI), total carbon emissions, carbon footprint and carbon intensity.¹⁰

The TCFD recommends using emissions intensity and WACI (as of October 2021) as a starting point because it allows investors to understand the degree of carbon emissions associated with a firm's business activities. TCFD also encourages investors to extend reporting beyond WACI. These measures also enable investors to compare the climate profile of different benchmarks.



⁹ For asset owners which are also insurers, the revised 2021 TCFD framework recommends that they publish their "insured emissions." This new type of metric is under development (as of May 2022) through a partnership between the Net-Zero Insurance Alliance and PCAF: UN Environmental Programme. "[Partnership for Carbon Accounting Financials Collaborates with UN-convened Net Zero Insurance Alliance to Develop Standard to Measure Insured Emissions](#)." UNEPFI. Sept. 6, 2021.

¹⁰ Task Force on Climate-related Financial Disclosures. October 2021. "[Table 3: Common Carbon Footprinting and Exposure Metrics](#)" in Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures. TCFD.

Each carbon footprint metric answers a different question (Exhibit 4). You may choose to report all of them to give a fuller picture of your organization's portfolio.¹¹

Exhibit 4: Understanding carbon footprint metrics for listed corporations

Metric	Allocation	Purpose	Description	Use Case
Carbon emissions* Tons CO2e/USD million invested	Market cap	What is my climate impact across different portfolios, normalized by monetary unit invested?	Allocated emissions to either all financiers (EVIC) or equity holders only (market cap) normalized by millions USD invested	Compare portfolio impact across portfolios
Financed carbon emissions* Tons CO2e/USD million invested	EVIC			
Total carbon emissions* Tons CO2e	Market cap	What is the climate impact of my investments?	Allocated emissions to either all financiers (EVIC) or equity holders only (market cap)	Understand the absolute emissions of the portfolio
Total financed carbon emissions* Tons CO2e	EVIC			
Total carbon intensity Tons CO2e/USD million sales	Market cap	What is the carbon efficiency of my investments in terms of emissions per unit of output	Allocated emissions per allocated sales	Tilt portfolios for carbon efficiency
Total financed carbon intensity Tons CO2e/USD million sales	EVIC			
Weighted average carbon intensity (WACI)	Portfolio weights	What is my exposure to carbon-intensive companies?	Portfolio's exposure to carbon-intensive companies, expressed as tCO2e/USD million revenue	Understand exposure to carbon-intensive companies

Note: * = Recommended by the Partnership on Carbon Accounting Financials (PCAF). Source: MSCI ESG Research Climate Risk Report as of May 2022.

¹¹ For an extensive discussion of carbon footprinting, see: Frankel, Ken, Shakhdiwee, Manish and Nishikawa, Laura. 2015. "Carbon Footprinting 101: A Practical Guide to Understanding and Applying Carbon Metrics." MSCI ESG Research.

Exhibit 5 compares the MSCI ACWI Climate Paris Aligned Index to the MSCI ACWI Index across three carbon footprinting measures.

Exhibit 5: Carbon footprint calculations of MSCI ACWI Climate Paris Aligned Index to MSCI ACWI Index

Allocation Base: EVIC	Emissions Scope	MSCI ACWI Climate Paris Aligned Index	Coverage	MSCI ACWI Index	Coverage	Active
Financed Carbon Emissions <i>tons CO2e / \$M invested</i> Investor Allocation: EVIC	Scope 1 and 2	6.8	99.8%	56.2	99.60%	-87.9%
	Scope 3 Upstream	42.3	99.7%	79.8	99.50%	-47.0%
	Scope 3 Downstream	36.8	99.7%	201.2	99.50%	-81.7%
Total Financed Carbon Emissions <i>million tons CO2e</i> Investor Allocation: EVIC	Scope 1 and 2	352.6	99.8%	2,913.41	99.60%	-87.9%
	Scope 3 Upstream	2,195.2	99.7%	4,138.57	99.50%	-47.0%
	Scope 3 Downstream	1,906.9	99.7%	10,432.09	99.50%	-81.7%
Weighted Average Carbon Intensity <i>Corporate constituents</i> Investor Allocation: EVIC	Scope 1 and 2	30.9	100.0%	161.50	99.80%	-80.9%
	Scope 3 Upstream	193.7	99.8%	233.30	99.60%	-17.0%
	Scope 3 Downstream	141.1	99.8%	44.70	99.60%	-68.5%

Source: MSCI ESG Research Climate Risk report as of March 31, 2022.

Coverage across asset classes to calculate portfolio-level financed emissions is expanding. The TCFD has noted that it “recognizes that some asset owners may be able to report weighted average carbon intensity for only a portion of their investments, given data availability and methodological issues.”¹² MSCI ESG Research uses methodologies aligned with PCAF to cover carbon emissions for most asset classes, which is also recommended by the TCFD (as of October 2021).¹³

¹² Task Force on Climate-related Financial Disclosures. October 2021. “[Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures](#).” p. 42.

¹³ See Appendix 3 for MSCI ESG Research’s planned asset-class coverage for carbon footprinting and other metrics for year-end 2022.

Textbox 1: Dealing with low disclosure rates for corporate emissions

Company disclosure rates for GHG emissions data remain low, despite increasing in recent years. For example, among the more than 9,000 constituents of the MSCI ACWI Investable Market Index (IMI), around 38% had disclosed Scopes 1 and 2 emissions data, while less than one quarter had disclosed scope 3 (value-chain) emissions (as of March 2022).

Exhibit T1: Disclosures of GHG emissions by GICS sector and emissions scope

GICS Sector	Scope 1	Scope 2	Scope 3
Communication services	36%	37%	28%
Consumer discretionary	36%	36%	23%
Industrials	43%	42%	28%
Energy	55%	48%	28%
Information technology	31%	32%	21%
Materials	46%	45%	27%
Consumer staples	42%	42%	28%
Utilities	61%	55%	44%
Financials	37%	38%	31%
Health care	22%	22%	13%
Real estate	39%	41%	24%
MSCI ACWI IMI	38%	38%	25%

Exhibit T1.1: Emissions disclosure rate by equity constituents of the MSCI ACWI IMI

Data as of March 31, 2022. Source: MSCI ESG Research. Sectors are derived from the Global Industry Classification Standard (GICS®), which was jointly developed by MSCI and S&P Global Market Intelligence. Table excludes fixed-income-only issuers in MSCI ESG Research coverage.

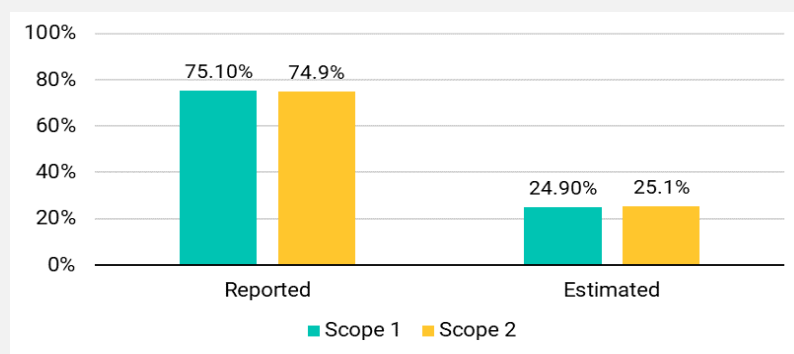
Textbox 1 (continued): Dealing with low disclosure rates for corporate emissions

However, the lack of disclosure is concentrated among smaller companies: Current disclosures make up 75% of the total Scopes 1 and 2 emissions from all constituents of the index.

This lack of disclosure presents a challenge for investors wanting to footprint their portfolio.

To help solve this problem, MSCI ESG Research estimates emissions data, when not available at the scope level, using several methodologies. For Scopes 1 and 2, MSCI ESG Research imputes missing data using either a production model, a company-specific intensity model or an industry segment-specific intensity model, depending on the company's industry and the amount of data available.

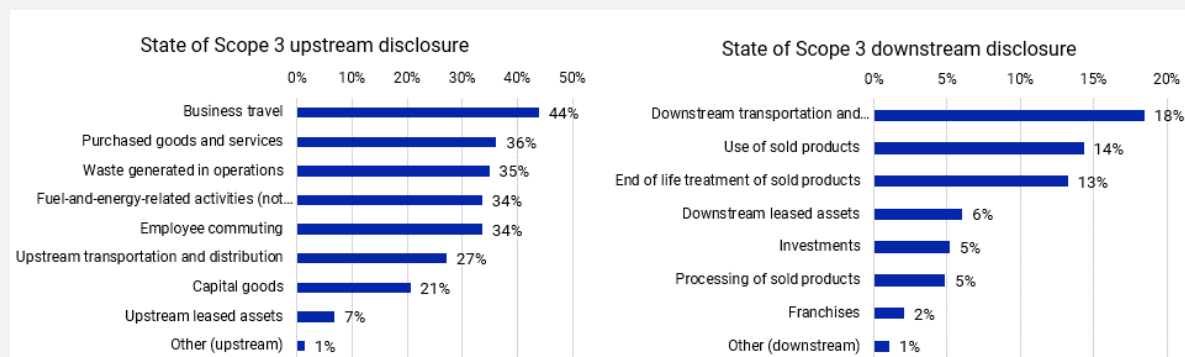
Exhibit T1.2: Emission disclosure rate as a percentage of total emissions of MSCI ACWI IMI constituents (Scopes 1 and 2)



Source: MSCI ESG Research as of March 31, 2022.

Disclosure rates for Scope 3 – emissions that occur in the up- and downstream value chains – are lower than for Scopes 1 and 2, and this level can be more difficult to estimate. MSCI ESG Research has developed a granular model to estimate Scope 3 emissions for each of the 15 categories of the GHG Protocol to cover both the upstream and downstream aspects of a company's supply chain.

Exhibit T1.3: Distribution of disclosures among Scope 3 categories



Data from 2021 CDP database, n = 5,906. Source: CDP, MSCI ESG Research as of March 2022. The 15 Scope 3 categories of the GHG Protocol are: purchased goods and services, capital goods, fuel-and-energy-related activities (not included in scope 1 or 2), upstream transportation and distribution, waste generated in operations, business travel, employee commuting, upstream leased assets, other (upstream), downstream transportation and distribution, processing of sold products, use of sold products, end of life treatment of sold products, downstream leased assets, franchises, investments, other (downstream).

2. Assessing climate-related risks with scenario analysis

Climate-related risks translate to financial risks

The premise of TCFD guidelines is that climate-related risks can become financial risks. This happens along two main vectors: physical risks, meaning business interruptions or asset damage from a changing climate, and transition risks, costs incurred from regulatory, consumer or technological changes intended to limit global temperature rise.

- *Physical risks*, such as extreme heat, coastal or fluvial (river) flooding, are set to increase along both chronic and acute dimensions as the global average temperature increases with a higher concentration of GHG emissions in the atmosphere.
- *Transition risks* stem from efforts to mitigate the worst effects of these physical risks as societies begin to transform economies and limit future emissions (and perhaps remove historical emissions), especially in the energy sector. The shifts that result from increased regulations, shifting consumer preferences or the adoption of new technologies can raise compliance and/or operational costs or erode market share.

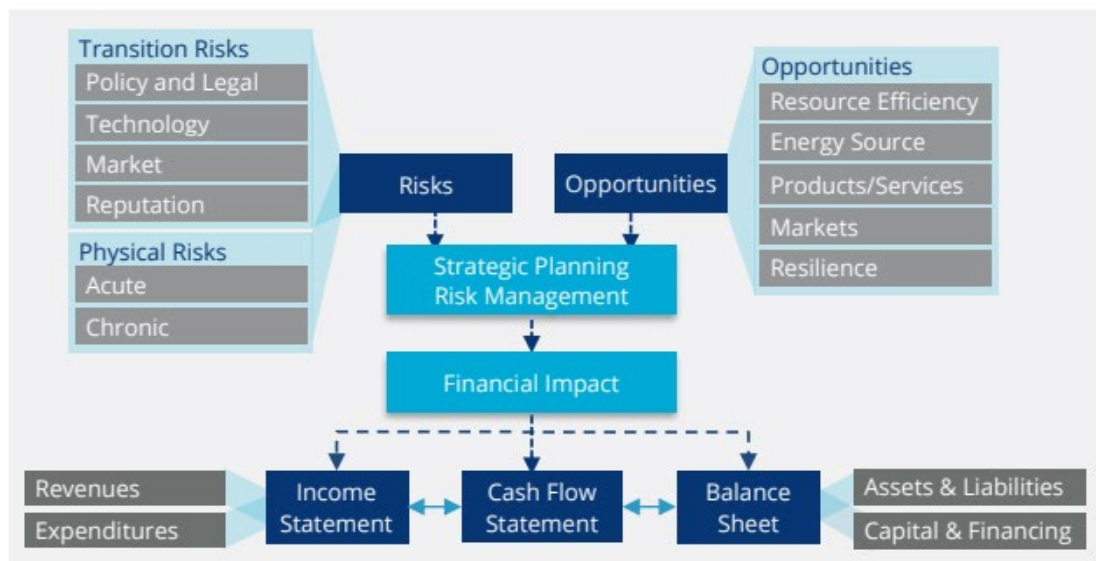


How will climate change impact the value of my investments?

Climate Value at Risk
(Climate VaR)

Together, these factors can translate into *financial risks*, including credit risk, market risk, underwriting (insurance) risk, operational risk or liquidity risk. Property damage, legal liability, stranded assets or required new capital expenditures are all examples of climate risks becoming financial risks.

Exhibit 6: Climate-related risks, opportunities and financial impact



Source: Task Force on Climate-related Financial Disclosures. "Technical Supplement: The Use of Scenario Analysis in the Disclosure of Climate-related Risks and Opportunities." TCFD. June 2017.

Scenario analysis is one way to assess and quantify a portfolio's potential exposure to climate-related risk.¹⁴

¹⁴ See more: Faigle, Nathan. March 2022. "Introduction to Climate Scenarios: Introduction to the Integrated Assessment Models and Shared Socioeconomic Pathways Used in the MSCI Climate Value-at-Risk Models." MSCI ESG Research. (Client access only).

Text Box 2: TCFD, NGFS and scenario analysis

TCFD guidelines specifically recommend the use of different climate-related scenarios, including a 2°C-or-lower scenario, to assess an organization’s resilience to climate change impacts, both from a transitional and physical risk perspective.

In November 2021, the TCFD updated its guidelines to include references to what types of climate scenarios are available to use, referencing the Intergovernmental Panel on Climate Change (IPCC), International Energy Agency (IEA) and the Network for Greening the Financial Sector (NGFS).

Since the original TCFD report, more and more institutions and industry associations have recommended or mandated the use of climate scenarios in company disclosures. This mandatory reporting includes questions on climate scenarios, such as how climate scenario analysis was conducted and what type of climate scenarios were used.

The box below compares the NGFS scenarios framework and how they translate to climate scenarios provided by MSCI ESG Research.

Exhibit T2: Translating NGFS scenarios to MSCI ESG Research scenarios

Scenario Type and Description	NGFS Scenario	MSCI ESG Research Scenario
“Orderly” scenarios assume climate policies are introduced early and become gradually more stringent. Both physical and transition risks are relatively subdued.	Net-Zero 2050	MSCI 1.5°C scenario – REMIND NGFS Orderly
	Below 2°C	MSCI 2°C scenario – REMIND NGFS Orderly
“Disorderly” scenarios explore higher transition risk due to policies being delayed or divergent across countries and sectors. For example, carbon prices would have to increase abruptly after a period of delay.	Divergent Net-Zero (1.5°C)	MSCI 1.5°C scenario – REMIND NGFS Disorderly
	Delayed transition	MSCI 2°C scenario – REMIND NGFS Disorderly
“Hothouse world” scenarios assume that some climate policies are implemented in some jurisdictions but that globally, efforts are insufficient to halt significant global warming. The scenarios result in severe physical risk, including irreversible impacts like sea-level rise.	NDCs	MSCI 3°C scenario – REMIND NGFS NDC

Source: MSCI ESG Research, NGFS.

MSCI's Climate Value-at-Risk methodology can be used to assess potential financial losses and opportunities under various climate scenarios, and was developed to align with TCFD recommendations.¹⁵ Specifically, the Climate Value-at-Risk methodology can be used to estimate security-level financial losses (or gains) to equity and debt valuations based on changes in policy (e.g., carbon prices), opportunities for clean technologies (e.g., relevant patents) and physical risk (e.g., extreme heat or coastal flooding), as defined under different climate scenarios through the end of the century.

Which scenario to choose? Given the uncertainty associated with climate change, investors may want to look across a range of scenarios to assess the potential resiliency of their investments under different eventualities. For example, a scenario with more-aggressive physical risk may lead to different types of financial risks than another that shows a faster transition trajectory. The TCFD does not specify a need to assign probability to any single scenario.

In the charts and tables that follow, we compare the Climate Value-at-Risk measures for two indexes.

- **MSCI ACWI Index**, which is designed to represent performance of the full opportunity set of large- and mid-cap stocks across 23 developed and 24 emerging markets.
- **MSCI ACWI Climate Paris Aligned Index (CPAI)**, which is designed using an optimization process to support investors seeking to reduce their exposure to transition and physical climate risks and who wish to pursue opportunities arising from the transition to a lower carbon economy, while aiming to exceed the minimum standards of the EU Paris-Aligned Benchmark as per the EU Low Carbon Benchmarks Regulation.

Exhibit 7 shows that the MSCI ACWI Climate Paris Aligned Index had lower policy and physical risks and higher technology opportunities for the REMIND 2°C Orderly scenario from the Network for Greening the Financial System (NGFS).¹⁶

¹⁵ MSCI ESG Research. April 2020. "MSCI Climate VaR Methodology Part 1: Overview." MSCI ESG Manager. (Client access only).

¹⁶ See the box on the previous page for more on NGFS climate scenarios.

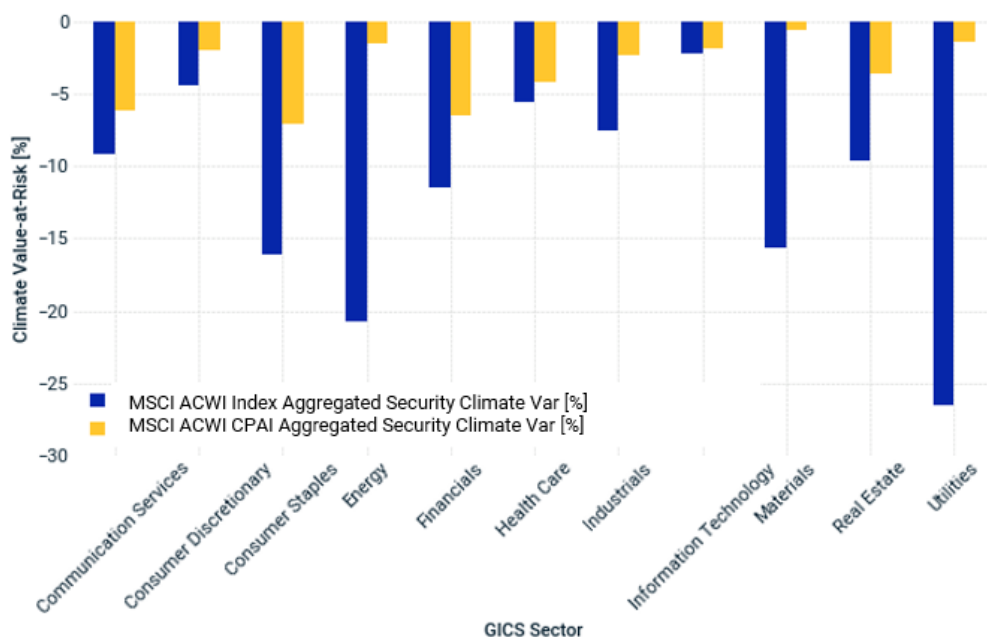
Exhibit 7: Climate scenario analysis: Climate Value-at-Risk, REMIND NGFS 2°C Orderly scenario

Climate Value-at-Risk (VaR)	MSCI ACWI Index	MSCI ACWI Climate Paris Aligned Index	Delta
Policy Climate VaR (Scope 1,2,3)	-1.8%	-0.4%	-1.4%
Technology Opportunities Climate VaR	0.6%	1.1%	-0.5%
Physical Climate VaR – Average	-7.5%	-4.3%	-3.2%
Aggregated Climate VaR	-8.6%	-3.6%	-5.0%

Source: MSCI ESG Research as of May 4, 2022.

In addition to an index-level view, a sectoral disaggregation may provide more detailed insights. For example, in Exhibit 8, which compares the MSCI ACWI Index to MSCI ACWI Climate Paris Aligned Index, we see that there is more downside risk among constituents of the MSCI ACWI Index across all sectors. The difference is most pronounced in the energy and utilities sectors, where the Climate Value-at-Risk increases from below 3% in the MSCI ACWI Climate Paris Aligned Index to 21% and 26%, respectively, for the MSCI ACWI Index. Such sectoral insights may be relevant for your strategy and risk management reporting.

Exhibit 8: Climate Value-at-Risk at the sector level for the REMIND NGFS 2°C Orderly scenario and average physical risk scenario



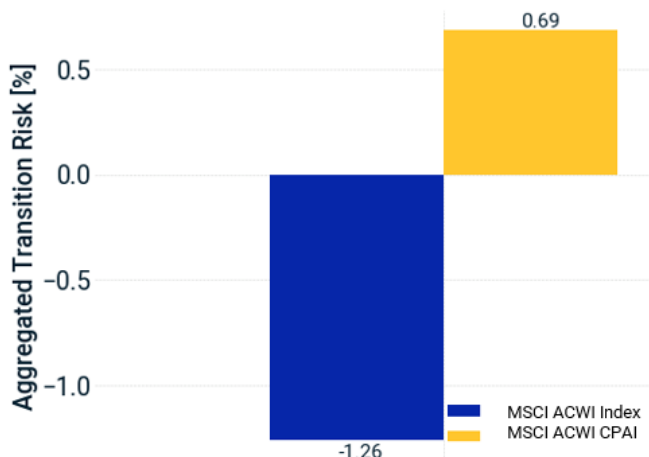
Source: MSCI ESG Research as of May 2022. Exhibit shows the weighted average Climate Value-at-Risk across GICS Sectors. The scenarios chosen are the REMIND NGFS Orderly 2°C for transition risk and the average scenario for physical risk.

Transition risk: policy costs and clean technology opportunities

Transition risk encompasses two main drivers of financial risk: policy risk and technology opportunities. Reporting on them shows the downside risk a portfolio may face from regulatory efforts and the upside opportunities from expanding market opportunities for climate solutions to mitigate the effects of climate change.

- At a high level, we see in Exhibit 9 that the security-weighted transition risk of the MSCI ACWI Index is near -1.2%. In other words, in a gradual transition toward a low-carbon global economy through the end of the century, the MSCI ACWI Index risks losing 1.2% of its total equity value; on a weighted basis, constituents have more to lose from complying with rising carbon prices than they have to gain from expanding clean tech opportunities.
- The MSCI ACWI Climate Paris Aligned Index, however, saw net upside (0.69%) from the transition.

Exhibit 9: Aggregated transition risk in the REMIND NGFS 2°C Orderly scenario



Data as of May 2022. Source: MSCI ESG Research

For more insight, you can disaggregate the top-level transition-risk estimates from the Climate Value-at-Risk model into its two pillars: policy risks and technology opportunities. TCFD has published a table of how transition risks, including policy risks and technology opportunities, translate to financial risks.¹⁷

¹⁷ Task Force on Climate-related Financial Disclosures. October 2021. [“Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures.”](#) TCFD.

Exhibit 10: Examples of climate-related transition risks and potential financial impacts

Type	Climate-Related Risks ¹³³	Potential Financial Impacts
Transition Risks	Policy and Legal	
	<ul style="list-style-type: none"> Increased pricing of GHG emissions Enhanced emissions-reporting obligations Mandates on and regulation of existing products and services Exposure to litigation 	<ul style="list-style-type: none"> Increased operating costs (e.g., higher compliance costs, increased insurance premiums) Write-offs, asset impairment, and early retirement of existing assets due to policy changes Increased costs and/or reduced demand for products and services resulting from fines and judgments
	Technology	
	<ul style="list-style-type: none"> Substitution of existing products and services with lower emissions options Unsuccessful investment in new technologies Costs to transition to lower emissions technology 	<ul style="list-style-type: none"> Write-offs and early retirement of existing assets Reduced demand for products and services Research and development (R&D) expenditures in new and alternative technologies Capital investments in technology development Costs to adopt/deploy new practices and processes
	Market	
	<ul style="list-style-type: none"> Changing customer behavior Uncertainty in market signals Increased cost of raw materials 	<ul style="list-style-type: none"> Reduced demand for goods and services due to shift in consumer preferences Increased production costs due to changing input prices (e.g., energy, water) and output requirements (e.g., waste treatment) Abrupt and unexpected shifts in energy costs Change in revenue mix and sources, resulting in decreased revenues Re-pricing of assets (e.g., fossil fuel reserves, land valuations, securities valuations)
	Reputation	
	<ul style="list-style-type: none"> Shifts in consumer preferences Stigmatization of sector Increased stakeholder concern or negative stakeholder feedback 	<ul style="list-style-type: none"> Reduced revenue from decreased demand for goods/services Reduced revenue from decreased production capacity (e.g., delayed planning approvals, supply chain interruptions) Reduced revenue from negative impacts on workforce management and planning (e.g., employee attraction and retention) Reduction in capital availability

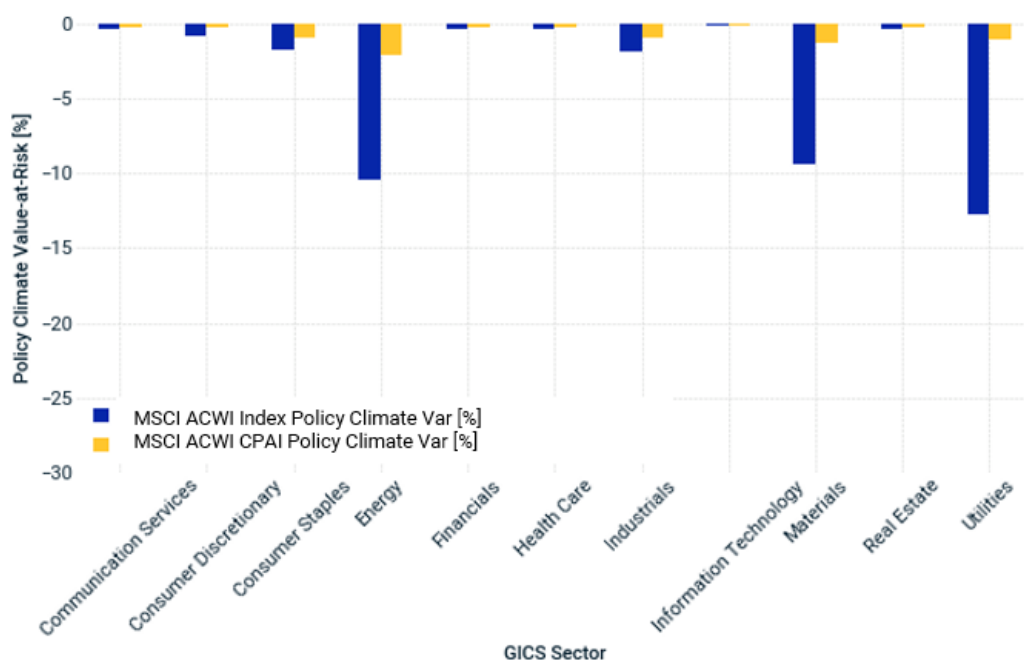
Source: Task Force on Climate-related Financial Disclosures. October 2021. [“Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures.”](#)

A sector-level analysis or even security-level analysis may help identify certain drivers of climate-related risk within the portfolio. In the MSCI ACWI Index, companies in the energy, utilities and materials sectors represent the largest potential losses associated with policy risk. Your organization may choose to incorporate insights from such analysis into your strategy or as part of your risk management process.

Exhibit 11 shows policy risk by sector using the REMIND NGFS 2°C Orderly scenario for the MSCI ACWI Index and MSCI ACWI Climate Paris Aligned Index. The main driver of increased costs over time is carbon prices, which rise steadily in the scenarios, thus penalizing companies with higher operational GHG emissions.

- For less-emissions-intensive sectors (e.g., communication services or health care), the effects were negligible.
- For the constituents of the MSCI ACWI Index in the utilities, energy and materials sectors, however, downside risks rose to more significant levels, ranging toward a median of 13% for utilities.
- For constituents of MSCI ACWI Climate Paris Aligned Index, the effects were less pronounced, even for those sectors, where constituents may be the less-emissions-intensive companies within the sector.

Exhibit 11: Policy risk by sector in the REMIND NGFS 2°C Orderly scenario



Source: MSCI ESG Research as of May 2022.

Climate technology opportunities and low-carbon investments

The climate transition may create financial opportunities in addition to risks. Investors may want to report on their exposure to these opportunities. One way of doing this is to identify the portfolio market value exposed to companies that have the potential to benefit through the growth and demand for low-carbon products and services. These could include companies that offer renewable electricity, electric vehicles or solar cells, for instance.

The MSCI ACWI Climate Paris Aligned Index had 14.2% of its weight exposed to low-carbon solutions, while the MSCI ACWI Index had 9.0% (Exhibit 12).



How are my investments poised to capture climate opportunities?

Low Carbon Transition Score, Patent Data, Green Revenue

Exhibit 12: Low-carbon solutions, MSCI ACWI Climate Paris Aligned Index vs. MSCI ACWI Index



Source: MSCI ESG Research Climate Risk report as of March 2022. Note: This data identifies the market value of hypothetical portfolios replicating the indexes that is exposed to companies that may benefit from the growth and demand for low-carbon products and services.

You might report how these climate-related opportunities can translate into financial impacts. The TCFD provides a framework for this (Exhibit 13), covering resilience, markets, products and services, energy sources and resource efficiency.¹⁸

¹⁸ TCFD. 2021. "Table A1.2: Examples of Climate-Related Opportunities and Potential Financial Impacts."

Exhibit 13: Examples of climate-related transition opportunities and potential financial impacts

Type	Climate-Related Opportunities ¹³⁴	Potential Financial Impacts
Resource Efficiency	<ul style="list-style-type: none"> – Use of more efficient modes of transport – Use of more efficient production and distribution processes – Use of recycling – Move to more efficient buildings – Reduced water usage and consumption 	<ul style="list-style-type: none"> – Reduced operating costs (e.g., through efficiency gains and cost reductions) – Increased production capacity, resulting in increased revenues – Increased value of fixed assets (e.g., highly rated energy-efficient buildings) – Benefits to workforce management and planning (e.g., improved health and safety, employee satisfaction) resulting in lower costs
Energy Source	<ul style="list-style-type: none"> – Use of lower-emission sources of energy – Use of supportive policy incentives – Use of new technologies – Participation in carbon market – Shift toward decentralized energy generation 	<ul style="list-style-type: none"> – Reduced operational costs (e.g., through use of lowest cost abatement) – Reduced exposure to future fossil fuel price increases – Reduced exposure to GHG emissions and therefore less sensitivity to changes in cost of carbon – Returns on investment in low-emission technology – Increased capital availability (e.g., as more investors favor lower-emissions producers) – Reputational benefits resulting in increased demand for goods/services
Products and Services	<ul style="list-style-type: none"> – Development and/or expansion of low emission goods and services – Development of climate adaptation and insurance risk solutions – Development of new products or services through R&D and innovation – Ability to diversify business activities – Shift in consumer preferences 	<ul style="list-style-type: none"> – Increased revenue through demand for lower emissions products and services – Increased revenue through new solutions to adaptation needs (e.g., insurance risk transfer products and services) – Better competitive position to reflect shifting consumer preferences, resulting in increased revenues
Markets	<ul style="list-style-type: none"> – Access to new markets – Use of public-sector incentives – Access to new assets and locations needing insurance coverage 	<ul style="list-style-type: none"> – Increased revenues through access to new and emerging markets (e.g., partnerships with governments, development banks) – Increased diversification of financial assets (e.g., green bonds and infrastructure)
Resilience	<ul style="list-style-type: none"> – Participation in renewable energy programs and adoption of energy-efficiency measures – Resource substitutes/diversification 	<ul style="list-style-type: none"> – Increased market valuation through resilience planning (e.g., infrastructure, land, buildings) – Increased reliability of supply chain and ability to operate under various conditions – Increased revenue through new products and services related to ensuring resiliency

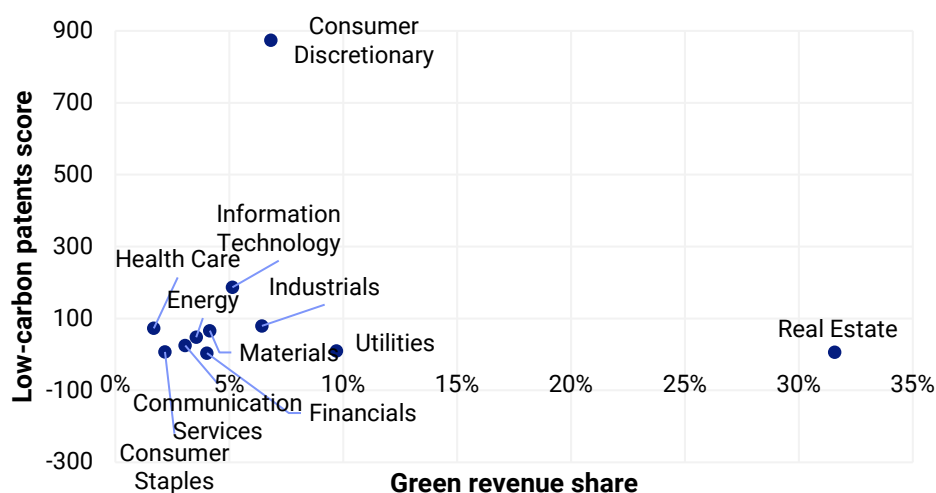
Source: Task Force on Climate-related Financial Disclosures. October 2021. [“Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures.”](#)

In addition to low-carbon solutions, reporting climate-related opportunities may include disclosing relevant patents that portfolio companies hold or the share of “green” revenue for those companies.

Exhibit 14 shows sector medians of low-carbon patent scores (a measure of the value of the company’s patents relevant to low-carbon technologies) and the share of total revenue generated from green sources (i.e., from alternative energy, energy efficiency, green buildings, pollution prevention and sustainable water) for constituents of the MSCI ACWI Index.

- There were two outlier sectors: consumer discretionary – several automobile and electronics manufacturers stood out for high patent scores – and real estate – a small number of issuers (four) had data for green buildings revenue, and two had particularly high green buildings revenue rates (48% and 84%, respectively).
- The information technology, industrials, materials, utilities and energy sectors stood out with higher values in both low-carbon patents and green revenue share (outlying sectors notwithstanding), relative to other sectors.
- Communication services, consumer staples and financials had lower rates of climate innovation (as measured by their low-carbon patents score) and shares of revenue from climate solutions (i.e., green revenue share), relative to other sectors.

Exhibit 14: Green revenue share vs. low-carbon patent score per sector



Source: MSCI ESG Research as of April 28, 2022. MSCI ACWI Index constituents numbered 454 from the as of that date, where data were available. The green revenue share (%) represents the median percentage of revenue related to alternative energy, green buildings, energy efficiency, pollution prevention or sustainable water, as defined in the MSCI ESG Research Sustainable Impact Metrics methodology. The low-carbon patents score represents the median such score, as defined by MSCI ESG Research MSCI Climate VaR methodology.

Physical risks: costs of property damage or business interruption

Physical climate scenarios define possible climate consequences resulting from increased concentration of GHG emissions. They describe changes in global temperatures, precipitation levels, extreme weather events such as storms, snowfall and flooding. Using historical evidence as a baseline, MSCI ESG Research brings future extreme weather trends into perspective through 2100.

We calculate physical risk based on three components: hazard, exposure and vulnerability. We define physical risk exposure as the inventory of elements present in hazard zones that are subject to potential losses.¹⁹

In the physical risk models used to arrive at the physical Climate Value-at-Risk, we consider two types of exposure:²⁰

- exposure to direct loss (asset damage), which is the reinstatement or replacement cost of the asset in question; and
- exposure to indirect loss (business interruption), which is the loss of revenue generated at the location.

The TCFD has published a table describing how physical risks translate into financial risks.

Exhibit 15: Examples of climate-related risks and potential financial impacts

Type	Climate-Related Risks ¹⁹	Potential Financial Impacts
Physical Risks	Acute	<ul style="list-style-type: none"> – Reduced revenue from decreased production capacity (e.g., transport difficulties, supply chain interruptions) – Reduced revenue and higher costs from negative impacts on workforce (e.g., health, safety, absenteeism) – Write-offs and early retirement of existing assets (e.g., damage to property and assets in “high-risk” locations)
	Chronic	<ul style="list-style-type: none"> – Increased operating costs (e.g., inadequate water supply for hydroelectric plants or to cool nuclear and fossil fuel plants) – Increased capital costs (e.g., damage to facilities) – Reduced revenues from lower sales/output – Increased insurance premiums and potential for reduced availability of insurance on assets in “high-risk” locations

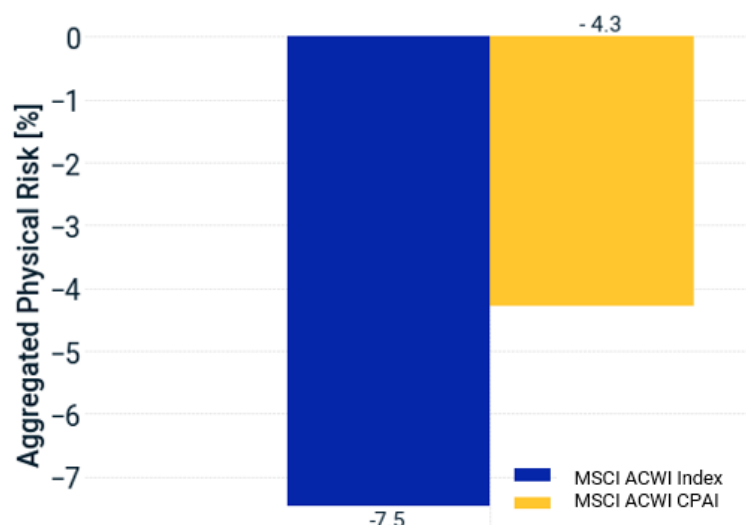
Task Force on Climate-related Financial Disclosures. October 2021. [“Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures.”](#)

An index-level analysis shows that the MSCI ACWI Index was exposed to roughly twice the physical risk of the MSCI ACWI Climate Paris Aligned Index.

¹⁹ United Nations. 2009. “2009 UNISDR Terminology on Disaster Risk Reduction.” United Nations International Strategy for Disaster Reduction.

²⁰ MSCI ESG Research. March 2022. “Exposure Estimation for Physical Risk Models.” MSCI ESG Manager. (Client access only).

Exhibit 16: Physical Climate Value-at-Risk (average scenario)



Source: MSCI ESG Research as of May 2022.

More insight can be provided through a more granular breakdown of physical risk. The following table (Exhibit 17) shows a comparison of potential financial losses (or gains) due to physical risks disaggregated by risk type for two indexes: the MSCI ACWI Index and the MSCI ACWI Climate Paris Aligned Index, as well as the difference between them.

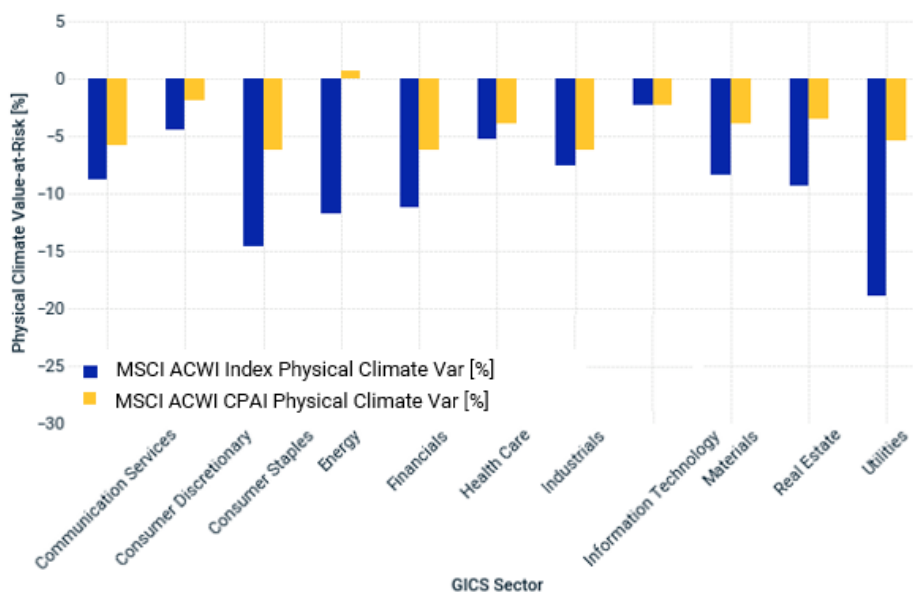
Exhibit 17: Physical Climate Value-at-Risk in detail

Average physical risk scenario				
		MSCI ACWI Climate Paris Aligned Index	MSCI ACWI Index	Active
Chronic risks (0.5° global grid)	Extreme cold	0.30%	0.40%	-0.10%
	Extreme heat	-2.20%	-3.70%	1.70%
	Extreme precipitation	-0.10%	0.10%	0.00%
	Heavy snowfall	0.00%	0.10%	0.00%
	Extreme wind	-0.10%	-0.10%	0.00%
Acute Risks	Coastal flooding	-1.10%	-2.70%	1.60%
	Fluvial flooding	-0.20%	-0.40%	0.20%
	Tropical cyclone	-0.20%	-0.50%	0.30%
	Aggregate Physical Climate VaR	-3.20%	-6.70%	3.50%

Source: MSCI ESG Research Climate Risk report as of March 31, 2022.

Exhibit 18 shows that the MSCI ACWI Climate Paris Aligned Index had a lower physical Climate Value-at-Risk on average when compared with the MSCI ACWI Index across sectors.

Exhibit 18: Physical Climate Value-at-Risk by sector (average scenario)



Source: MSCI ESG Research as of May 2022.

3. Understanding implications of portfolio company climate targets

An assessment of the emissions reduction targets of portfolio companies also can help provide a forward-looking perspective into company behavior.

Some potential questions to answer:

- How many companies have targets, and how comprehensive are they (what emission scopes)?
- How ambitious is the implied rate of emissions reductions?

Targets, including (self-declared) net-zero targets, have increased rapidly in recent years (Exhibit 19).

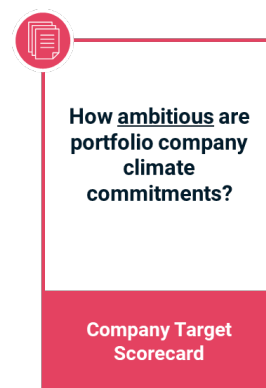
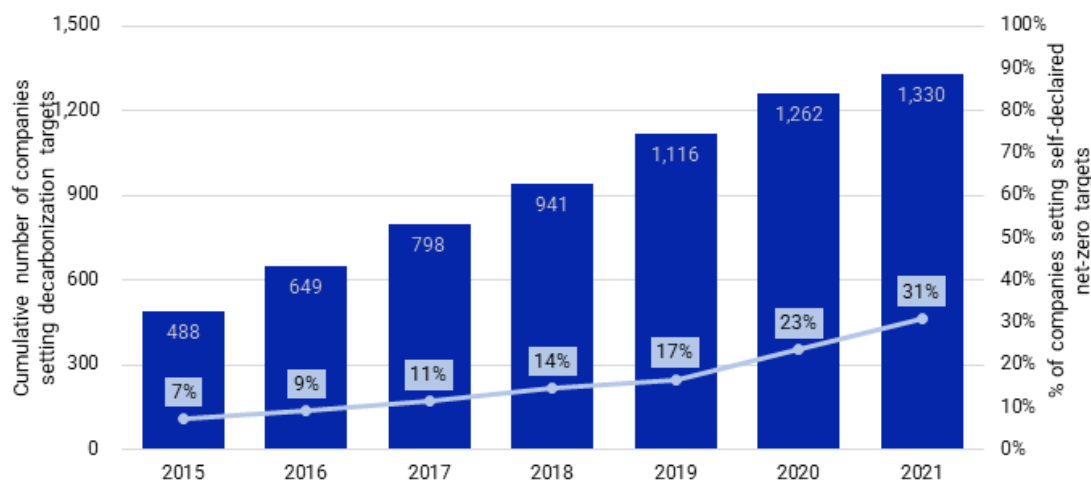


Exhibit 19: Cumulative number of companies that have set decarbonization and self-declared net-zero targets in the MSCI ACWI Index



Source: Wu, Emma and Uddin, Zohir. "As TCFD Comes of Age, Regulators Take a Varied Approach." MSCI ESG Research. April 21, 2022. [As TCFD Comes of Age, Regulators Take a Varied Approach - MSCI](#) Note: When target announcement dates were not disclosed, we assumed targets were set in 2021.

But without a clear, uniformly adopted disclosure standard, the information disclosed by companies is often heterogenous, leading to difficulties in comparing companies' targets. Emerging regulations across several jurisdictions informed by TCFD recommendations may change the picture.²¹ To help organize companies' target information, MSCI ESG Research has developed a Climate Target Scorecard.

²¹ Wu, Emma and Uddin, Zohir. April 21, 2022. "As TCFD Comes of Age, Regulators Take a Varied Approach." MSCI ESG Research.

Exhibit 20: Climate Target Scorecard for Shell PLC

Drivers of Carbon Emissions	
Mega tons of CO ₂ e	
Scope 1 (Reported, 2020)	63.00
Scope 2 (Reported, 2020)	9.00
Scope 3 (Estimated, 2020)	603.60
Scope 3 (Reported, 2020)	1.34K
Est. Ratio of Reported vs Total Estimated Emissions*	209%
Target Scorecard	
COMPREHENSIVENESS	AMBITION
100.00% % of company footprint covered by target	-3.23% p.a. Projected reduction per year to meet stated target**
Comprehensiveness	
Type	ABSOLUTE, INTENSITY
Unit	tCO ₂ e, tCO ₂ e/megajoules (MJ)
Target Scopes	1 2 3
Scope 3 upstream categories	1 2 3 4 5 6 7 8
Scope 3 downstream categories	9 10 11 12 13 14 15
% of Company footprint covered by target	100%
Ambition	
Target Year	2050
Projected reduction per year to meet stated target**	-3.23% p.a.
Intention to use carbon offsets	Yes
Target Calculation date (YYYYMMDD)	20220412

Source: MSCI ESG Research as of April 2022.

Investors can summarize corporate climate target data at a portfolio level by reporting on the number of targets, coverage/comprehensiveness (scopes of emissions under the target), average implied reduction, and which companies intend to use carbon offsets, for example.

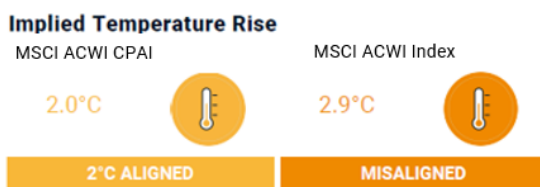
4. Reporting on portfolio temperature alignment

Investors may seek to report how companies' emission trajectories may be aligned or misaligned with the objective of limiting global temperature rise to well below 2°C. MSCI ESG Research developed the Implied Temperature Rise (ITR) metric, which allows investors to align with the TCFD's recommendation.²² ITR shows the warming potential of a financial asset based on its current GHG emissions and projected decarbonization trajectory.²³

A key advantage of this climate metric is that it allows investors to assess their alignment with climate targets, such as companies' emission-reduction commitments to limit global temperature rise to 2°C or 1.5°C. Such climate metrics could be used for asset allocation, risk management, engagement with portfolio companies or communication to investors.

Implied Temperature Rise can also be calculated at the fund level.²⁴ Exhibit 21 compares the Implied Temperature Rise of hypothetical portfolios fully replicating the MSCI ACWI Climate Paris Aligned Index and the MSCI ACWI Index. In this case, the MSCI ACWI Climate Paris Aligned Index had an Implied Temperature Rise of 2.0°C compared with 2.9°C for the MSCI ACWI Index.

Exhibit 21: Implied Temperature Rise of the MSCI ACWI Climate Paris Aligned Index vs the MSCI ACWI Index



Source: MSCI ESG Research.



How will my investments contribute to global warming in the future?

Implied Temperature Rise (1.5°)

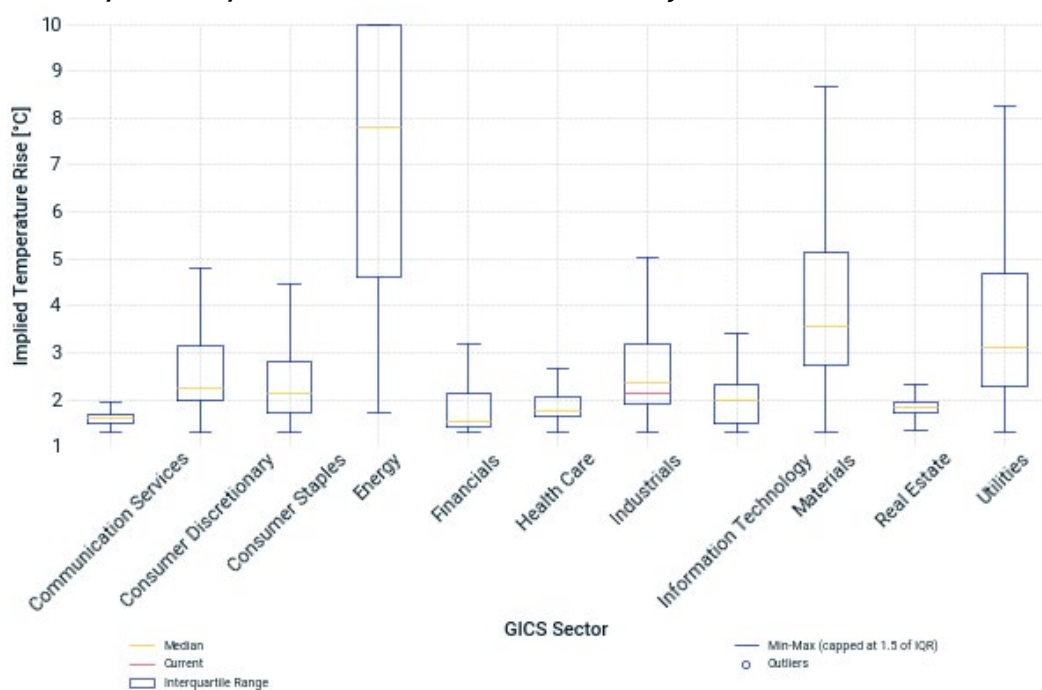
²² Task Force on Climate-related Financial Disclosures. June 2021. [“Technical Supplement: Measuring Portfolio Alignment.”](#) TCFD.

²³ MSCI's Implied Temperature Rise calculation methodology has three steps: First, for each company we estimate a remaining emissions budget that it would have to cover all cumulative future emissions to be aligned with a 2°C target. Next, we estimate cumulative future emissions for each company, based on its current emissions and decarbonization targets. The difference between projected emissions and remaining emission budgets is called the budget overshoot (if positive) or budget undershoot (if negative). The third step calculates the ratio of each company's budget overshoot to the budget. This ratio is then translated into an Implied Temperature Rise, using the TCRE (Transient Climate Response to Cumulative Emissions) calculation metric discussed in the TCFD's June 2021 technical supplement: “Measuring Portfolio Alignment.”

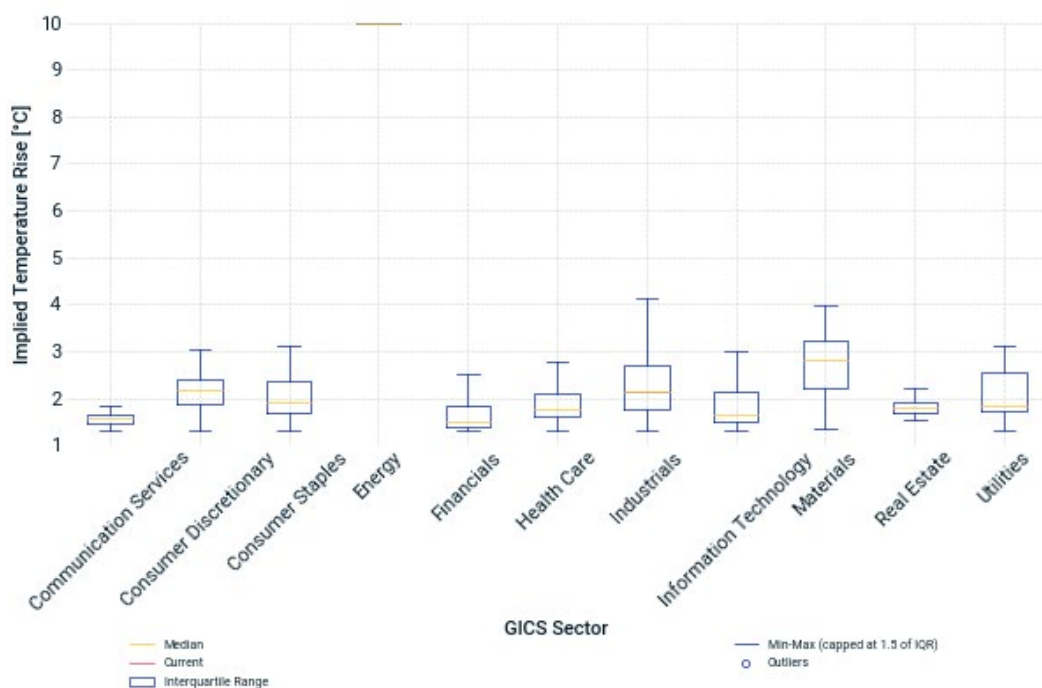
²⁴ Mahmood, Rumi and Droz, Helen. Dec. 6, 2021. [“What Implied Temperature Rise Means for Funds.”](#) MSCI ESG Research..

As with other metrics, more insight may be gained through sector-level disaggregation. As shown in Exhibits 22.1 and 22.2, the largest differences between MSCI ACWI Index and MSCI ACWI Climate Paris Aligned Index are between the energy and utilities sectors, though other sectors, including materials, had lower Implied Temperature Rise in the MSCI ACWI Climate Paris Aligned Index as well. The distribution (inter-quartile range) shown by the boxes illustrates the range of decarbonization paths that companies in each sector are on. Of particular note were the wide distributions in the energy and materials sectors.

Exhibit 22: Implied Temperature Rise distribution by sector
22.1. Implied Temperature Rise of MSCI ACWI Index by sector



22.2. Implied Temperature Rise of MSCI ACWI Climate Paris Aligned Index by sector



Source: MSCI ESG Research as of May 2022. The exhibit shows the Implied Temperature Rise sector distribution. There was only one constituent of the MSCI ACWI Climate Paris Aligned Index in the energy sector.

5. Providing details about other climate metrics

In addition to carbon footprinting, financed emissions, Climate Value-at-Risk and Implied Temperature Rise, investors may wish to report other climate-related metrics about their portfolio, including their current exposure to companies and assets with particular relevance for climate change.²⁵

For example:

- Fossil-fuel-based exposure, such as:
 - conventional oil & gas exposure;
 - unconventional oil & gas exposure (e.g., shale oil or oil sands); or
 - exposure to holdings deriving revenue from fossil fuels.

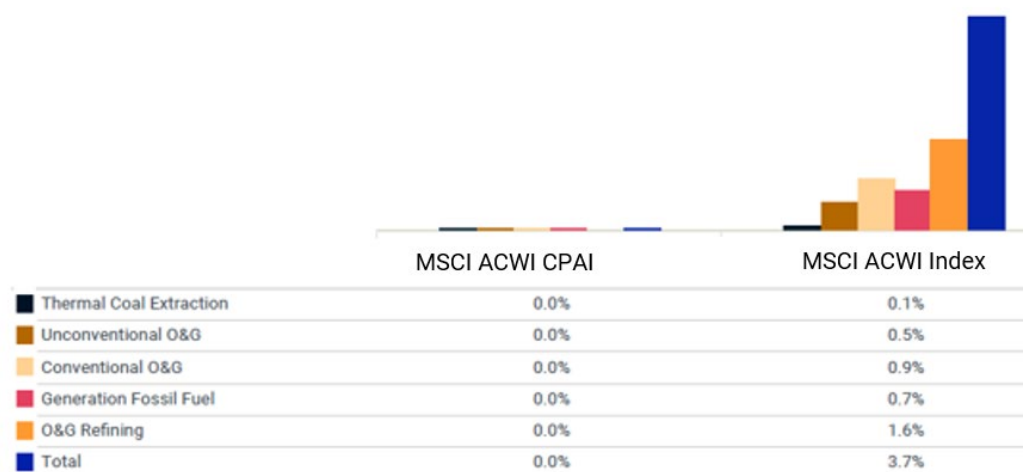
²⁵ A full list of climate change-related metrics and definitions available from MSCI ESG Research can be found in: "MSCI ESG Climate Change Metrics: Methodology and Definitions." September 2021. MSCI ESG Research. (Client access only).

- Green revenue exposure (e.g., revenue from alternative energy, such as solar and wind, or energy efficiency); or
- Adaptive capacity: climate risk management (e.g., companies with industry-leading management practices regarding climate risk).

Fossil-fuel based exposure

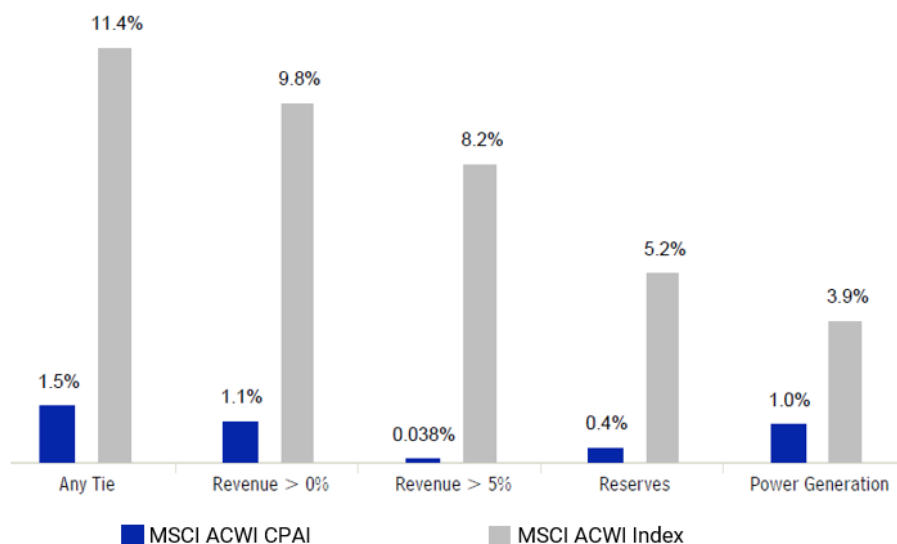
Disclosing your portfolio's exposure to fossil fuels – whether, for example, from coal extraction, oil and gas production, refining or electricity generation – increases transparency and could form the basis of additional analysis related to climate risk, engagement or portfolio construction decisions. Exhibits 23 through 26 below show examples of how MSCI ESG Research data can demonstrate various types of fossil fuel involvement for hypothetical portfolios fully replicating the MSCI ACWI Climate Paris Aligned Index and the MSCI ACWI Index.

Exhibit 23: Weighted average fossil fuel-based revenue, MSCI ACWI Climate Paris Aligned Index vs. MSCI ACWI Index



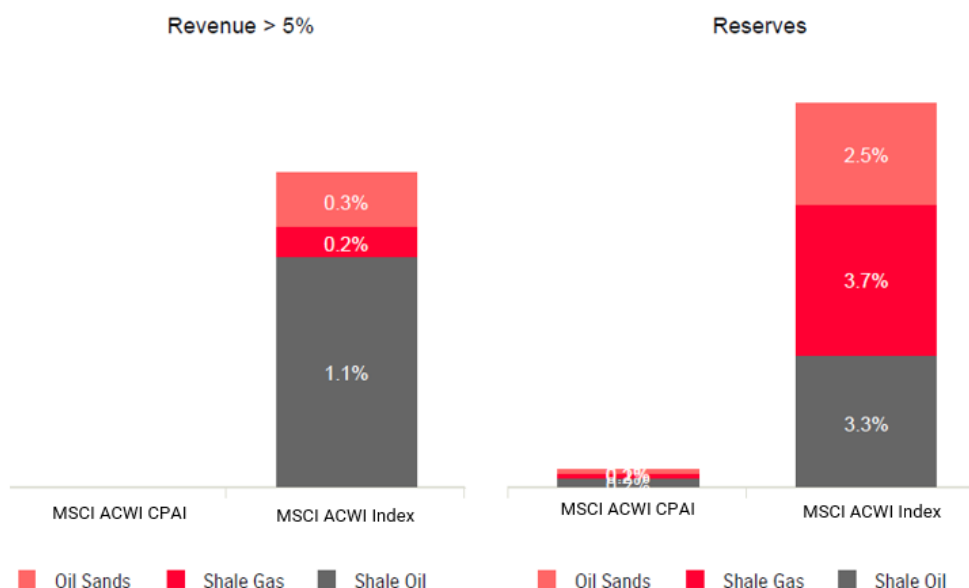
Source: MSCI ESG Research Climate Risk Report as of March 2022.

Exhibit 24: Oil & gas involvement, MSCI ACWI Climate Paris Aligned Index vs. MSCI ACWI Index



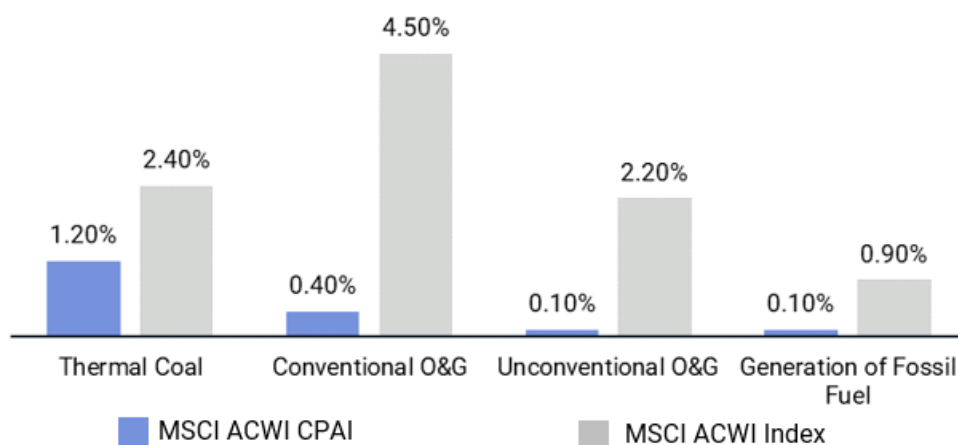
Source: MSCI ESG Research Climate Risk Report as of March 2022.

Exhibit 25: Unconventional oil & gas revenue and reserves, MSCI ACWI Climate Paris Aligned Index vs. MSCI ACWI Index



Source: MSCI ESG Research Climate Risk Report as of March 2022.

Exhibit 26: Companies deriving revenue from fossil fuels, MSCI ACWI Climate Paris Aligned Index vs. MSCI ACWI Index

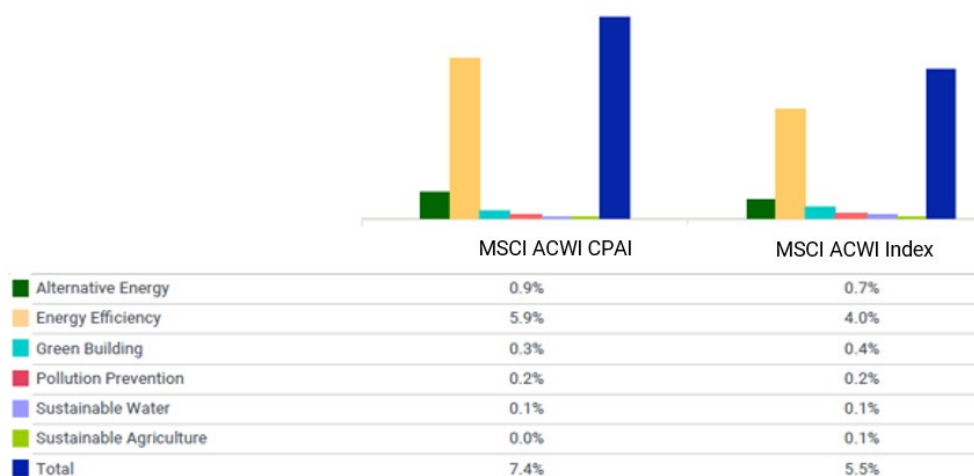


Source: MSCI ESG Research Climate Risk Report as of March 2022.

Green revenue exposure

You may also highlight your portfolio's exposure to "green" revenue – e.g., revenue related to climate solutions, including alternative energy, energy efficiency, green buildings, pollution prevention and sustainable water.

Exhibit 27: Weighted average green revenue, MSCI ACWI Climate Paris Aligned Index vs. MSCI ACWI Index

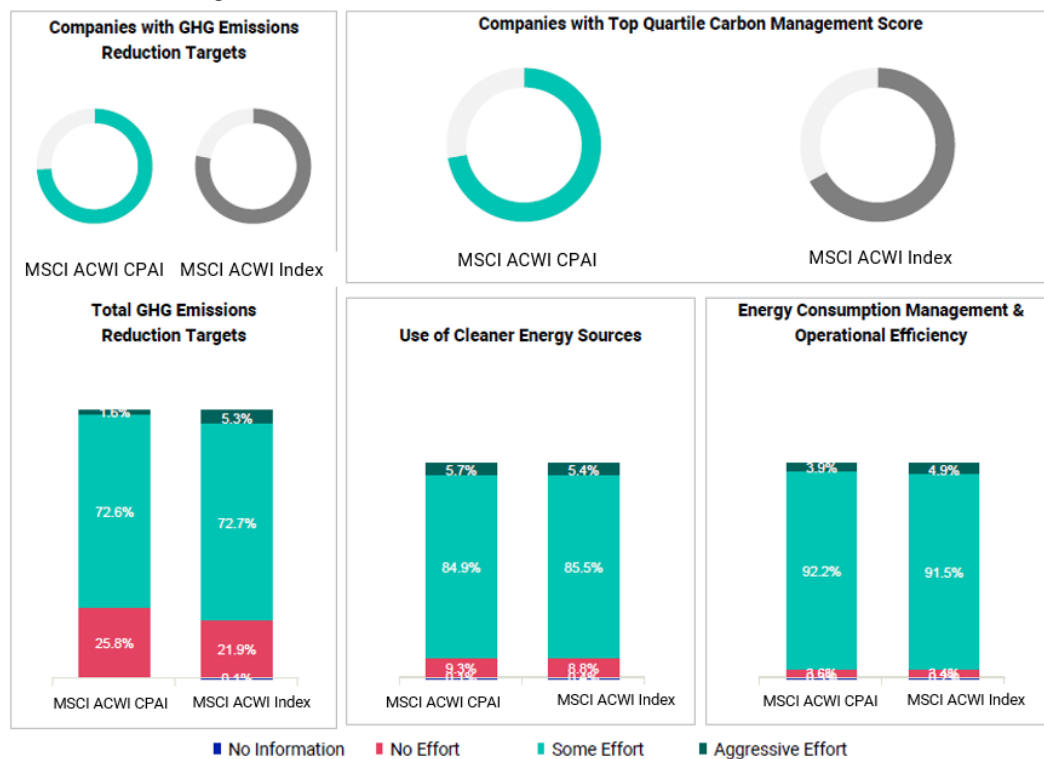


Source: MSCI ESG Research Climate Risk Report as of March 2022.

Adaptive capacity: climate risk management

A final example is highlighting companies with evidence of leading practices for managing climate-related risks.

Exhibit 28: Companies with proactive carbon-risk mitigation initiatives, MSCI ACWI Climate Paris Aligned Index vs. MSCI ACWI Index



Source: MSCI ESG Research Climate Risk Report as of March 2022.

Conclusion

Your organization can use data and metrics from MSCI ESG Research to develop a TCFD-aligned report on climate-related risks and opportunities. In addition to providing the metrics and climate targets themselves, the data may also help inform discussion of relevant governance, strategy and risk management topics.

Some key metrics and data include:

- Carbon footprinting;
- Climate Value-at-Risk for transition risk (policy risk and technology opportunities) and physical risk;
- Portfolio-company climate targets;
- Temperature alignment with Implied Temperature Rise; and
- Exposure metrics, including exposure to fossil fuels, green revenue, low-carbon patents and climate-risk management capacity.

These metrics can be reported at the portfolio level, but also at the sector and company level to provide a detailed picture of climate-related risks and opportunities.

Appendix 1: TCFD recommendations, guidance and status reports

These documents are the most recent official recommendations and guidance published by the TCFD as of this document's publication (June 2022).

- TCFD. [Implementing the Recommendations of the Taskforce on Climate-related Financial Disclosures](#). October 2021.
- TCFD. [Guidance on Metrics, Targets and Transition Plans](#). October 2021.
- TCFD. "[Measuring Portfolio Alignment: Technical Supplement](#)." June 2021.
- TCFD. "[2021 Status Report](#)." October 2021.

More resources are available on the TCFD website.²⁶

²⁶ Task Force on Climate-related Financial Disclosures. "[About](#)." TCFD. Accessed May 20, 2022.

Appendix 2: NGFS climate scenario variables

	1.5°C REMIND NGFS Orderly	1.5°C REMIND NGFS Disorderly	2°C REMIND NGFS Orderly	2°C REMIND NGFS Disorderly	3°C REMIND NGFS
Population					
World population peak	2070	2070	2070	2070	2070
World population in 2100 (million)	9,019	9,019	9,019	9,019	9,019
GDP					
Real GDP growth 2020-2100 (CAGR)	2.0%	2.0%	2.0%	2.0%	2.0%
Electricity generation by fuel source					
2030 fuel mix					
% renewables	72%	71%	58%	41%	46%
% nuclear	6%	6%	6%	6%	5%
% gas	17%	18%	22%	26%	25%
% coal	4%	5%	14%	28%	23%
2050 fuel mix					
% renewables	94%	93%	92%	94%	80%
% nuclear	3%	4%	4%	4%	3%
% gas	3%	3%	5%	3%	16%
% coal	0%	0%	0%	0%	1%
Carbon sequestration (MtCO₂/yr)					
Year Uptake surpasses 5000 Mt/yr	2037	2045	2050	2050	2090
Carbon sequestration peak (Mt/yr)	8,779	7,645	7,498	5,926	5,342
Low carbon fuel sources in transport					
2050 low carbon fuel sources (%)	26%	46%	18%	26%	14%
GHG emissions					
Peak year	2020	2020	2020	2030	2025
90% reduction achieved by	2045	2045	2055	2049	na
Zero emissions achieved by	2055	2055	2100	2060	na
Annual change - 2020-2030 (CAGR)	-7.1%	-7.1%	-3.5%	+0.7%	+0.2%
Annual change - 2020-2050 (CAGR)	-11.7%	-10.6%	-4.7%	-8.1%	-1.2%
Global warming temperature					
Global warming temperature 2100	1.66°C	1.63°C	1.90°C	1.84°C	2.63°C
Carbon Price (US\$2010/tCO₂)					
2020 Carbon Price	2.99	2.99	2.99	2.99	2.99
2030 Carbon Price	184.07	278.40	57.89	2.49	9.97
2050 Carbon Price	672.71	783.16	193.37	621.92	34.05
Annual change – 2020-2030 (CAGR)	51%	57.4%	34.5%	-1.8%	12.8%
Annual change – 2030-2050 (CAGR)	6.7%	5.3%	6.2%	31.8%	6.3%

Source: Faigle, Nathan. "Introduction to Climate Scenarios: Introduction to the Integrated Assessment Models and Shared Socioeconomic Pathways Used in the MSCI Climate Value-at-Risk Models." March 2022. MSCI ESG Research. (Client access only).

Appendix 3: MSCI planned asset-class and data coverage

Asset Class	Emissions Footprinting	Fossil Fuel Exposure	Green Solutions	Physical Risk	Climate Targets	Portfolio Temperature Alignment	Scenario Analysis (Climate VaR)
Listed Equities							
Corporate Bonds (IG, HY, EM)							
Sovereign Bonds							
Commercial Real Estate							
Private Assets							
Corporate Syndicated Loans							
Corporate Direct Lending/ Private Debt							
Local Authorities							
Municipal Bonds (US)							
Mortgage-Backed Securities (RMBS, CMBS)							
ABS							
CLO							
Infrastructure							
Projects							
Commodities							

Source: MSCI ESG Research 2022 Product Road Map.

Appendix 4: Select examples of climate risk reports

Asset Owners

- AIMCO. 2021. [“Responsible Investor Report.”](#)
- AXA. 2020. [“Climate Report: Renewed Action in Time of Crisis.”](#)
- CalPERS. 2019. [“Addressing Climate Change Risk: CalPERS’ First Response to Senate Bill 964.”](#)
- Giese, Guido, Nagy, Zoltan and Srivastav, Abhishek. 2022. [“Report for the Norwegian Ministry of Finance.”](#)
- GPIF. 2021. [“Supplementary Guide to GPIF ESG Report 2020: Analysis of Climate Change-related Risks and Opportunities in the GPIF Portfolio.”](#)
- UC Investments. 2021. [“Managing Climate Change Risks.”](#)

Asset Managers

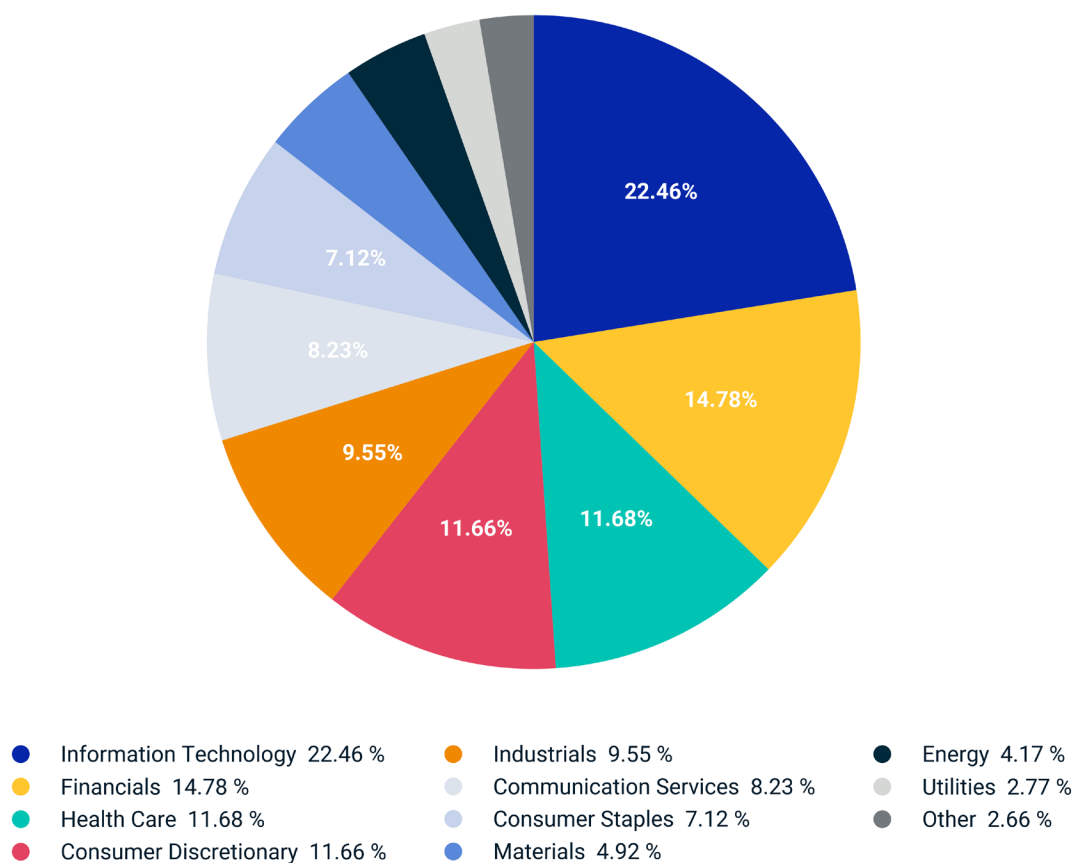
- PIMCO. 2021. [“Bonds for Change: ESG Investing Report.”](#)
- RBC Global Asset Management. 2021. [“Task Force on Climate-related Financial Disclosures: 2021 Report.”](#)
- Garcia-Manas, Carlota. 2021. [“Climate Disclosure – Quality Must Beat Quantity.”](#) Royal London Asset Management.

Insurance

- Aviva PLC. 2021. [“Climate-related Financial Disclosure 2021.”](#)
- Nippon Life Insurance Co. 2021. [“ESG Report 2021.”](#)

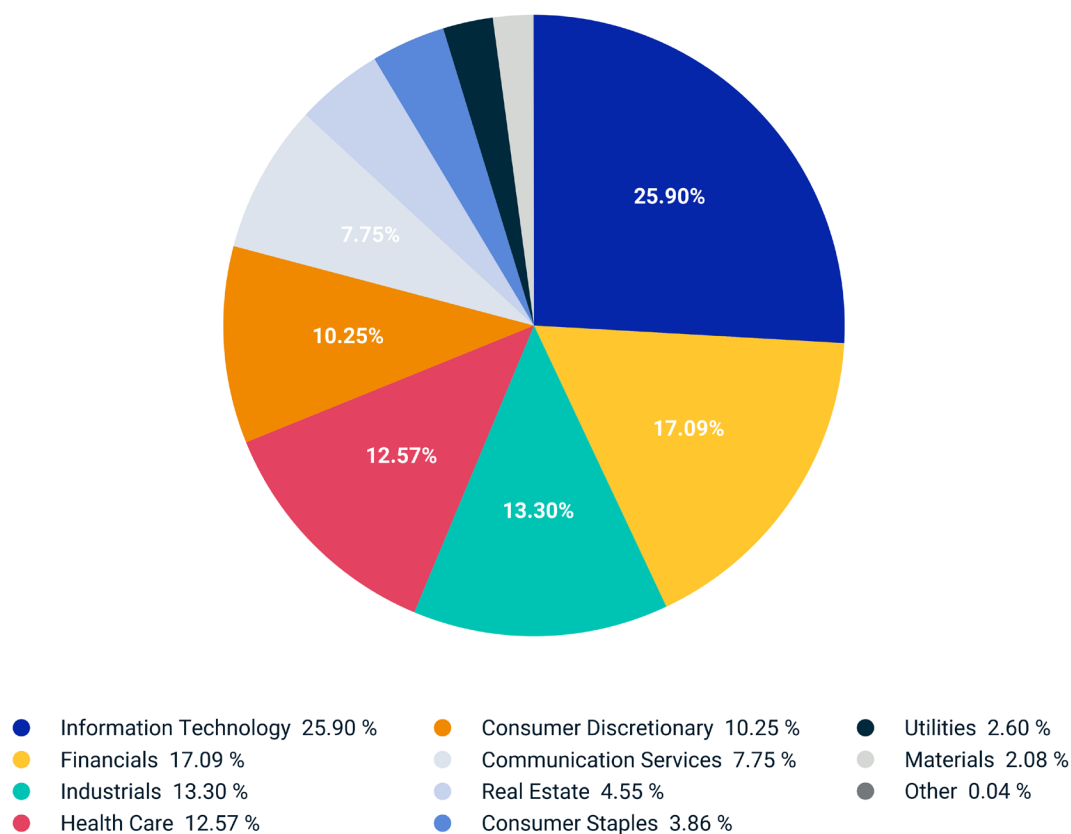
Appendix 5: Sector split of constituents of indexes used

Exhibit 32: Sector split of MSCI ACWI Index



Source: MSCI ESG Research as of May 2022.

Exhibit 33: Sector split of MSCI ACWI Climate Paris Aligned Index



Source: MSCI ESG Research as of May 2022.

Data used for this report

ESG factor name in ESG Manager (Client access only)	Short name	Exhibits
CARBON_EMISSIONS_SCOPE_12_INTEN	Carbon Emissions – Scope 1 + 2 Intensity (t/USD million sales)	4, 5
CARBON_EMISSIONS_EVIC_SCOPE_12_INTEN	Carbon Emissions – Scope 1+2 Intensity (t/USD million EVIC)	4, 5
VAR_EXW_EQUITY	Aggregated Extreme Weather Equity Climate VaR (Average Scenario) [%]	7, 16, 17
VAR_TEC2_REMIND_NGFS_ORDERLY_EQUITY	2°C Technology Opportunity Equity Climate VaR (REMIND NGFS ORDERLY) [%]	7
VAR_AGG_REG2_REMIND_NGFS_ORDERLY_EQUITY	2°C Aggregated Policy Risk Equity Climate VaR (REMIND NGFS ORDERLY) [%]	7
VAR_EXW_CF_EQUITY	Coastal Flooding Equity Climate VaR (Average Scenario) [%]	17
VAR_EXW_COLD_EQUITY	Extreme Cold Equity Climate VaR (Average Scenario) [%]	17
VAR_EXW_HEAT_EQUITY	Extreme Heat Equity Climate VaR (Average Scenario) [%]	17
VAR_EXW_PRECIP_EQUITY	Extreme Precipitation Equity Climate VaR (Average Scenario) [%]	17
VAR_EXW_WIND_EQUITY	Extreme Wind Equity Climate VaR (Average Scenario) [%]	17
VAR_EXW_FF_EQUITY	Fluvial Flooding Equity Climate VaR (Average Scenario) [%]	17
VAR_EXW_LF_EQUITY	River Low Flow Equity Climate VaR (Average Scenario) [%]	17

ESG factor name in ESG Manager (Client access only)	Short name	Exhibits
VAR_EXW_SNOW_EQUITY	Heavy Snowfall Equity Climate VaR (Average Scenario) [%]	17
VAR_EXW_CYC_EQUITY	Tropical Cyclones Equity Climate VaR (Average Scenario) [%]	17
VAR_EXW_WF_EQUITY	Wildfire Equity Climate VaR (Average Scenario) [%]	17
CT_TOTAL_MAX_REV	Environmental Impact Solutions – Maximum Percentage of Revenue	14, 27
GREEN_PAT_VAL	Low-Carbon Patents Score	14
ITR	Implied Temperature Rise	21, 22
CBN_LCT_SCORE	Low-Carbon Transition Score	12
TARGET_SUMMARY_EFFECTIVE_COVERAGE	Estimated proportion of company's total emissions covered by targets (%)	19
TARGET_CARBON_EVIDENCE_NET_ZERO	Targets net-zero emissions	19
CARBON_EMISSIONS_SCOPE_1_FY20	Carbon Emissions Timeseries – Scope 1 (metric tons) FY2020	20
CARBON_EMISSIONS_SCOPE_2_FY20	Carbon Emissions Timeseries – Scope 2 (metric tons) FY2020	20
CARBON_EMISSIONS_SCOPE_3_FY20	Carbon Emissions Timeseries – Scope 3 (metric tons) FY2020	20
CARBON_EMISSIONS_SCOPE_3_TOTAL	Scope 3 – Total Emissions Estimated	20
TARGET_SUMMARY_TYPES	GHG emissions reduction types covered by targets	20
TARGET_SUMMARY_SCOPES	GHG emissions reduction scopes covered by targets	20
TARGET_SUMMARY_UNITS	Emissions reduction target units	20

ESG factor name in ESG Manager (Client access only)	Short name	Exhibits
TARGET_SUMMARY_EFFECTIVE_COVERAGE	Estimated proportion of company's total emissions covered by targets (%)	20
TARGET_SUMMARY_END_YEAR	Ultimate emissions-reduction target year	20
TARGET_SUMMARY_ANNUAL_REDUCTION	Projected remaining annual emissions reduction (%)	20
TARGET_SUMMARY_CALCULATION_DATE	Target Score Card – Calculation Date	20
TARGET_SUMMARY_USE_OF_OFFSETS	Company intends to use carbon offset to meet targets	20
THERMAL_COAL_MAX_REV_PCT	Thermal Coal – Maximum Percentage of Revenue	23, 26
UNCONV_OIL_GAS_MAX_REV_PCT	Unconventional O&G – Maximum Percentage of Revenue	23, 26
CONV_OIL_GAS_MAX_REV_PCT	Conventional O&G – Maximum Percentage of Revenue	23, 26
GENERAT_MAX_REV_FOSSIL_FUELS	Generation Fossil Fuels – Maximum Percentage of Revenue	23, 24, 26
O&G_REV_REFINING	O&G – Refining – Maximum Percentage of Revenue	23
FOSSIL_FUELS_ANY_TIE	Fossil Fuels – Any Tie	24
GENERAT_FOSSIL_FUELS_PCT	Generation Fossil Fuels (%)	24
OIL_NAT_GAS_RESERVES	Evidence of Total Oil & Gas Reserves	24
SHALE_OIL_MAX_REV_PCT	Shale Oil – Maximum Percentage of Revenue	25
SHALE_GAS_MAX_REV_PCT	Shale Gas – Maximum Percentage of Revenue	25
OIL_SANDS_MAX_REV_PCT	Oil Sands – Maximum Percentage of Revenue	25
SHALE_OIL_RESERVES	Evidence of Shale Oil Reserves	25
SHALE_GAS_RESERVES	Evidence of Shale Gas Reserves	25

ESG Factor name in ESG Manager (Client access only)	Short name	Exhibits
OIL_SANDS_RESERVES	Evidence of Oil Shale & Tar Sands Reserves	25
CT_ALT_ENERGY_MAX_REV	Alternative Energy – Maximum Percentage of Revenue	27
CT_ENERGY_EFF_MAX_REV	Energy Efficiency – Maximum Percentage of Revenue	27
CT_GREEN_BLDG_MAX_REV	Green Building – Maximum Percentage of Revenue	27
CT_POLL_PREV_MAX_REV	Pollution Prevention – Maximum Percentage of Revenue	27
CT_SUST_WATER_MAX_REV	Sustainable Water – Maximum Percentage of Revenue	27
CT_SUST_AG_MAX_REV	Sustainable Agriculture – Maximum Percentage of Revenue	27
CARBON_EMISSIONS_REDUCT_TARGET	Carbon Emissions Reduction Targets	28
CARBON_EMISSIONS_MGMT_SCORE	Carbon Emissions Management Score	28
CARBON_EMISSIONS_CLEANER_ENERGY_SOURCES	Use of Cleaner Sources of Energy	28
CARBON_EMISSIONS_ENERGY_MGMT_EFFICIENCY	Energy Consumption Management & Operational Efficiency	28

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