Implied Temperature Rise Methodology Summary

MSCI ESG Research

September 2022

Executive summary

Background

The Implied Temperature Rise metric provides an indication of how companies and investment portfolios align to global climate targets. Some institutional investors would like to understand if their portfolios are 2°C-aligned, referring to the Paris Agreement goal of limiting to below 2°C the global mean temperature increase in the year 2100, compared with pre-industrial levels. Another important target is the 1.5°C limit, the maximal objective of the Paris Agreement. This limit has been advocated strongly by small island states, which are most threatened by sea-level rise in a world with temperatures exceeding a rise of 1.5°C.

Key to understanding the Implied Temperature Rise (ITR) is the concept of a carbon budget, i.e., how much the world can emit so that global warming doesn't exceed 2°C by 2100 and, by analogy, how much a company can emit for its fair share of global decarbonization. Indeed, Implied Temperature Rise is about extrapolating the global implied temperature rise (at horizon 2100) *as if* the whole economy "overshot/undershot" its budget in the same way as the given company (or portfolio) overshoots/undershoot its specific company-specific carbon budget.

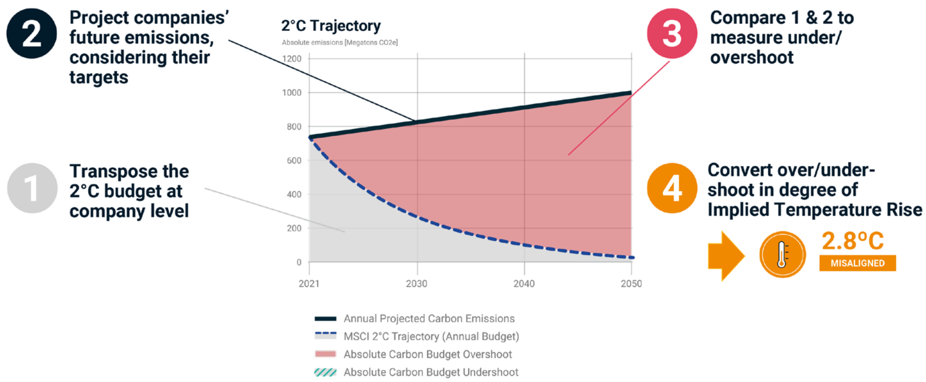
A company whose projected emissions are below budget can be said to "undershoot" while those whose projected emissions exceed the budget "overshoot."

We use Intergovernmental Panel on Climate Change (IPCC) guidance to understand how much global carbon budget is left. The next step is to derive company-level carbon budgets consistent with this. Then we calculate companies' projected emissions out over the next five decades based on their emissions track record, stated reduction targets and other data.

Company Implied Temperature Rise

The calculation of the company-level Implied Temperature Rise involves four key steps:

Exhibit 1. Modeling steps to compute a company's Implied Temperature Rise.



Source: MSCI ESG Research

1. **Transpose a 2°C carbon budget at company level**
   Each year, we calculate a global 2°C carbon budget based on the global remaining carbon budget available to limit warming to 2°C, obtained from the IPCC.[1] Consistent with this global budget, we derive decarbonization pathways and company-specific carbon budgets expressed in absolute terms.. We account for sector, country and business activities in determining a company's "fair share."

2. **Project companies' future emissions, considering their targets**
   Using companies' current emissions and reported emissions reduction targets, we project an absolute emissions timeseries for each company until 2070 for Scopes 1, 2 and 3 emissions.

3. **Calculate the companies' over/undershoot of their carbon budgets**
   We compute each company's carbon budget over-/undershoot by calculating the difference between each company's projected carbon emissions and its allocated 2°C budget. We then express this as a relative over-/undershoot of the 2°C budget of the company (X% of the budget has been over-/undershot).

[1] The IPPC Special Report on 1.5 °C provides the remaining global carbon budget for different temperature rises and probabilities (https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15_Chapter2_Low_Res.pdf (in Table 2.2).

4. **Convert the relative over/undershoot to a degree of temperature rise**
   We apply the relative emissions over-/undershoot to the global budget and convert the impact in degrees of warming (Celsius) using the science-based Transient Climate Response to Cumulative Emissions (TCRE) approach:
   Implied Temperature Rise = 2°C + company level relative over/undershoot × Global 2°C Budget × TCRE Factor.

We perform this analysis on each scope of emissions (Scopes 1, 2 and 3) to capture both direct and indirect contributions to global warming. Additionally, we provide both the Implied Temperature Rise on each scope and an aggregated Implied Temperature Rise for each company. This allows users to understand the contribution of each scope.

Portfolio Implied Temperature Rise

A portfolio's Implied Temperature Rise measures, in aggregate, a portfolio's temperature alignment (in °C) to keeping the world's temperature rise to 2°C by 2100. The calculation uses an aggregated budget approach that compares the sum of financed emission budget overshoot against the sum of financed carbon emission budgets for the underlying portfolio holdings. The total portfolio carbon emission over/undershoot is then converted to a degree of temperature rise using the science-based ratio approach of TCRE.

Transient Climate Response to Cumulative Carbon Emissions

The Transient Climate Response to Cumulative Carbon Emissions (TCRE) was established by the IPCC and provides a relationship that links each additional unit of emissions emitted beyond the available remaining global 2°C carbon budget to degrees of additional warming. We use a TCRE factor of 0.000545°C warming per Gt CO_2.[2] In other words, for each GtCO_2 exceeding the global 2°C carbon budget, we can expect an additional ~0.000545°C warming over 2°C.

This relationship is used in the Implied Temperature Rise methodology to convert a company's or portfolio's allocated carbon budget over-/undershoot into a degree of warming.[3] The Implied Temperature Rise estimates an answer to the following question: What is the additional warming if the whole economy over/-undershoots the global 2°C carbon budget at the same proportion as the company or portfolio analyzed? As described in the 2021 Measuring Portfolio Alignment report, the relationship from above can be used to derive following formula:

Additional Warming = Relative company-level over/undershoot × Global 2°C Budget × TCRE Factor

[2] The 2020 Measuring Portfolio Alignment Report recommends a TCRE factor of 0.000545°C warming per Gt CO2 which is based on IPCC 2013 The Physical Science Basis report (https://www.tcfdhub.org/wp-content/uploads/2020/10/PAT-Report-20201109-Final.pdf). This TCRE value is based on IPCC 2018 Global Warming of 1.5°C report (https://www.ipcc.ch/sr15/).

[3] Based on the relationship presented in the 2021 Portfolio Alignment Team's report, "Measuring Portfolio Alignment: Technical Considerations." (https://www.tcfdhub.org/wp-content/uploads/2021/10/PAT_Measuring_Portfolio_Alignment_Technical_Considerations.pdf)

To then calculate the Implied Temperature Rise, we need to add the additional warming to the base temperature of 2°C:

Implied Temperature Rise = 2°C + Relative company-level over/undershoot × Global 2°C Budget × TCRE Factor

To illustrate, consider a hypothetical company overshooting its allocated carbon budget by 50%, and subsequently assume the whole economy overshoots at the same rate. Using the above formula, a TCRE factor of 0.000545°C/Gt CO_2 and a global 2°C budget of 1491Gt CO_2e[4], we estimate the Implied Temperature Rise to be 2.42°C (2°C + 50%×1491 Gt CO_2e×0.000545°C/Gt CO_2 = 2.4°C).

Incorporating a company's emission-reduction targets into the Implied Temperature Rise model

MSCI ESG Research has developed an approach to analyze and compare emission-reduction targets reported by companies, despite differences in target metrics and time frames. The methodology provides an assessment by scope and allows us to project the absolute emissions of a company, assuming its targets are fully met.

[4] Please see the section Global2°Ccarbon budget for more details.

Implied Temperature Rise Bands

The *Implied Temperature Rise* output is a continuous variable. For ease of comparison among various Implied Temperature Rises, MSCI uses *Implied Temperature Rise Bands* that encompass temperate ranges with clear alignment labels, from “1.5°C aligned” to “Strongly Misaligned.”

Alignment is defined by the two temperature thresholds set by the Paris Agreement climate objectives (+1.5°C, +2°C global mean temperature compared with pre-industrial levels).[5] Misalignment, consequently, corresponds to any Implied Temperature Rise output exceeding those thresholds. We distinguish two categories of misalignment:

- **Misaligned**, defined by a business-as-usual emissions profile; and
- **Strongly Misaligned**, for outputs that fall short even of today’s insufficient country policies.

The NGFS REMIND “Current Policies” scenario that corresponds to the first category of misalignment yields a (rounded) 3.2°C temperature at horizon 2100, which helps us draw the line with the second category.[6]

The table below describes the Implied Temperature Rise Bands as well as what they mean.

Exhibit 26. Overview of Implied Temperature Rise Bands

	ITR Band	Range (°C)	Comment
MISALIGNED	**Strongly Misaligned**	> 3.2	This company/portfolio is misaligned even by business-as-usual standards. Its contribution to catastrophic climate change is higher than most companies’/portfolios’.
MISALIGNED	**Misaligned**	> 2.0 – 3.2	This company/portfolio does not comply with the Paris Agreement goals. Its pace of decarbonization is too slow to mitigate catastrophic climate change. The threshold is determined by the NGFS REMIND “Current policies" scenario yielding an estimated 3.24°C at the 2100 horizon (rounded 3.2°C).

[5] See Article 2 of the Paris Agreement (https://unfccc.int/sites/default/files/english_paris_agreement.pdf)

[6] NGFS Climate Scenario Database. Technical Documentation (2020). (https://www.ngfs.net/sites/default/files/ngfs_climate_scenario_technical_documentation_final.pdf)

ALIGNED	**2°C Aligned**	> 1.5 – 2.0	This company/portfolio meets the Paris Agreement's minimum objective[7] of +2°C global mean temperature compared with pre-industrial levels. It is engaged in the low-carbon transition.
	1.5°C Aligned	<=1.5	This company/portfolio is in line with the Paris Agreement's maximal objective of keeping global mean temperature to +1.5°C compared with pre-industrial levels. It is a transition leader, significantly contributing to mitigating catastrophic climate change.

Source: MSCI ESG Research.

Implied Temperature Rise data updates

To best reflect the current state of the world, Implied Temperature Rise scores may evolve as new data becomes available. For instance, when a company sets a new decarbonization target, we take that into account and recalculate the company's projected emissions, which will, in turn, change the company's Implied Temperature Rise.

We run a regular update cycle: biweekly for targets inputs and quarterly for the rest of the data inputs. However, the total cycle from the moment primary data is available (e.g., the company has announced a new target) to the moment the Implied Temperature Rise integration is finalized can take more time.

[7] See article 2 of the Paris Agreement (https://unfccc.int/sites/default/files/english_paris_agreement.pdf)

Contact us

esgclientservice@msci.com

AMERICAS

Americas	1 888 588 4567 *
Atlanta	+ 1 404 551 3212
Boston	+ 1 617 532 0920
Chicago	+ 1 312 675 0545
Monterrey	+ 52 81 1253 4020
New York	+ 1 212 804 3901
San Francisco	+ 1 415 836 8800
São Paulo	+ 55 11 3706 1360
Toronto	+ 1 416 628 1007

EUROPE, MIDDLE EAST & AFRICA

Cape Town	+ 27 21 673 0100
Frankfurt	+ 49 69 133 859 00
Geneva	+ 41 22 817 9777
London	+ 44 20 7618 2222
Milan	+ 39 02 5849 0415
Paris	0800 91 59 17 *

ASIA PACIFIC

China North	10800 852 1032 *
China South	10800 152 1032 *
Hong Kong	+ 852 2844 9333
Mumbai	+ 91 22 6784 9160
Seoul	00798 8521 3392 *
Singapore	800 852 3749 *
Sydney	+ 61 2 9033 9333
Taipei	008 0112 7513 *
Thailand	0018 0015 6207 7181 *
Tokyo	+ 81 3 5290 1555

* = toll free

About MSCI

MSCI is a leading provider of critical decision support tools and services for the global investment community. With over 50 years of expertise in research, data and technology, we power better investment decisions by enabling clients to understand and analyze key drivers of risk and return and confidently build more effective portfolios. We create industry-leading research-enhanced solutions that clients use to gain insight into and improve transparency across the investment process.

About MSCI ESG Research Products and Services

MSCI ESG Research products and services are provided by MSCI ESG Research LLC, and are designed to provide in-depth research, ratings and analysis of environmental, social and governance-related business practices to companies worldwide. ESG ratings, data and analysis from MSCI ESG Research LLC. are also used in the construction of the MSCI ESG Indexes. MSCI ESG Research LLC is a Registered Investment Adviser under the Investment Advisers Act of 1940 and a subsidiary of MSCI Inc.

To learn more, please visit www.msci.com.

Notice and disclaimer

This document and all of the information contained in it, including without limitation all text, data, graphs, charts (collectively, the "Information") is the property of MSCI Inc. or its subsidiaries (collectively, "MSCI"), or MSCI's licensors, direct or indirect suppliers or any third party involved in making or compiling any Information (collectively, with MSCI, the "Information Providers") and is provided for informational purposes only. The Information may not be modified, reverse-engineered, reproduced or redisseminated in whole or in part without prior written permission from MSCI. All rights in the Information are reserved by MSCI and/or its Information Providers.

The Information may not be used to create derivative works or to verify or correct other data or information. For example (but without limitation), the Information may not be used to create indexes, databases, risk models, analytics, software, or in connection with the issuing, offering, sponsoring, managing or marketing of any securities, portfolios, financial products or other investment vehicles utilizing or based on, linked to, tracking or otherwise derived from the Information or any other MSCI data, information, products or services.

The user of the Information assumes the entire risk of any use it may make or permit to be made of the Information. NONE OF THE INFORMATION PROVIDERS MAKES ANY EXPRESS OR IMPLIED WARRANTIES OR REPRESENTATIONS WITH RESPECT TO THE INFORMATION (OR THE RESULTS TO BE OBTAINED BY THE USE THEREOF), AND TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, EACH INFORMATION PROVIDER EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES (INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF ORIGINALITY, ACCURACY, TIMELINESS, NON-INFRINGEMENT, COMPLETENESS, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY OF THE INFORMATION.

Without limiting any of the foregoing and to the maximum extent permitted by applicable law, in no event shall any Information Provider have any liability regarding any of the Information for any direct, indirect, special, punitive, consequential (including lost profits) or any other damages even if notified of the possibility of such damages. The foregoing shall not exclude or limit any liability that may not by applicable law be excluded or limited, including without limitation (as applicable), any liability for death or personal injury to the extent that such injury results from the negligence or willful default of itself, its servants, agents or sub-contractors.

Information containing any historical information, data or analysis should not be taken as an indication or guarantee of any future performance, analysis, forecast or prediction. Past performance does not guarantee future results.

The Information should not be relied on and is not a substitute for the skill, judgment and experience of the user, its management, employees, advisors and/or clients when making investment and other business decisions. All Information is impersonal and not tailored to the needs of any person, entity or group of persons.

None of the Information constitutes an offer to sell (or a solicitation of an offer to buy), any security, financial product or other investment vehicle or any trading strategy.

It is not possible to invest directly in an index. Exposure to an asset class or trading strategy or other category represented by an index is only available through third party investable instruments (if any) based on that index. MSCI does not issue, sponsor, endorse, market, offer, review or otherwise express any opinion regarding any fund, ETF, derivative or other security, investment, financial product or trading strategy that is based on, linked to or seeks to provide an investment return related to the performance of any MSCI index (collectively, "Index Linked Investments"). MSCI makes no assurance that any Index Linked Investments will accurately track index performance or provide positive investment returns. MSCI Inc. is not an investment adviser or fiduciary and MSCI makes no representation regarding the advisability of investing in any Index Linked Investments.

Index returns do not represent the results of actual trading of investible assets/securities. MSCI maintains and calculates indexes, but does not manage actual assets. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the index or Index Linked Investments. The imposition of these fees and charges would cause the performance of an Index Linked Investment to be different than the MSCI index performance.

The Information may contain back tested data. Back-tested performance is not actual performance, but is hypothetical. There are frequently material differences between back tested performance results and actual results subsequently achieved by any investment strategy.

Constituents of MSCI equity indexes are listed companies, which are included in or excluded from the indexes according to the application of the relevant index methodologies. Accordingly, constituents in MSCI equity indexes may include MSCI Inc., clients of MSCI or suppliers to MSCI. Inclusion of a security within an MSCI index is not a recommendation by MSCI to buy, sell, or hold such security, nor is it considered to be investment advice.

Data and information produced by various affiliates of MSCI Inc., including MSCI ESG Research LLC and Barra LLC, may be used in calculating certain MSCI indexes. More information can be found in the relevant index methodologies on www.msci.com.

MSCI receives compensation in connection with licensing its indexes to third parties. MSCI Inc.'s revenue includes fees based on assets in Index Linked Investments. Information can be found in MSCI Inc.'s company filings on the Investor Relations section of www.msci.com.

MSCI ESG Research LLC is a Registered Investment Adviser under the Investment Advisers Act of 1940 and a subsidiary of MSCI Inc. Except with respect to any applicable products or services from MSCI ESG Research, neither MSCI nor any of its products or services recommends, endorses, approves or otherwise expresses any opinion regarding any issuer, securities, financial products or instruments or trading strategies and MSCI's products or services are not intended to constitute investment advice or a recommendation to make (or refrain from making) any kind of investment decision and may not be relied on as such. Issuers mentioned or included in any MSCI ESG Research materials may include MSCI Inc., clients of MSCI or suppliers to MSCI, and may also purchase research or other products or services from MSCI ESG Research. MSCI ESG Research materials, including materials utilized in any MSCI ESG Indexes or other products, have not been submitted to, nor received approval from, the United States Securities and Exchange Commission or any other regulatory body.

Any use of or access to products, services or information of MSCI requires a license from MSCI. MSCI, Barra, RiskMetrics, IPD and other MSCI brands and product names are the trademarks, service marks, or registered trademarks of MSCI or its subsidiaries in the United States and other jurisdictions. The Global Industry Classification Standard (GICS) was developed by and is the exclusive property of MSCI and Standard & Poor's. "Global Industry Classification Standard (GICS)" is a service mark of MSCI and Standard & Poor's.

MIFID2/MIFIR notice: MSCI ESG Research LLC does not distribute or act as an intermediary for financial instruments or structured deposits, nor does it deal on its own account, provide execution services for others or manage client accounts. No MSCI ESG Research product or service supports, promotes or is intended to support or promote any such activity. MSCI ESG Research is an independent provider of ESG data, reports and ratings based on published methodologies and available to clients on a subscription basis. We do not provide custom or one-off ratings or recommendations of securities or other financial instruments upon request.

Privacy notice: For information about how MSCI collects and uses personal data, please refer to our Privacy Notice at https://www.msci.com/privacy-pledge