TEMPERATURE SCORING | DRAFT METHODOLOGY FOR CONSULTATION

CDP and WWF International

April 30, 2020

This call for comments will allow all interested parties to review and express views on a new temperature scoring methodology being developed by CDP and WWF in collaboration with Science Based Targets initiative (SBTi). The methodology will be an open source framework to enable the translation of corporate GHG emission reduction targets into temperature scores at a company and a portfolio level. This document represents a draft that is being presented for a public consultation. This document is accompanied by a survey which enables the collection of feedback on specific methodological questions. The request for comment will remain open to May 22nd, 2020.

The content received will be used to revise and update the methodology in anticipation of publishing the first version of the temperature scoring in Q2 of 2020. Any additional information to justify or support comments is also welcomed. All input received will be kept confidential and internal, unless consent is given by the respondent.

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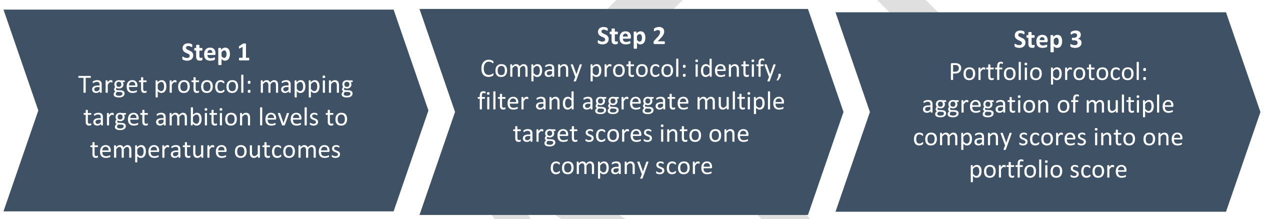
Methodological Overview

Through the Science Based Targets initiative (SBTi), a large number of companies have been able to set approved science-based targets since 2015. Building on the work of the SBTi, the temperature scoring methodology presented in this document expands the temperature assessment of short- and medium-term corporate ambition against a wide range of end of century (2100) temperature outcomes, between 1.5-5°C. It therefore aims to translate reported corporate targets into long-term temperature trajectories. Assessing the ambition of corporate targets has traditionally been very complex, as targets can be expressed with different units, over multiple timeframes covering various types of scopes. The goal of a temperature rating is to translate targets into a single common and intuitive metric that is linked to the long-term temperature outcomes associated with the ambition of the target.

The methodology is composed of three distinct steps:



The target protocol represents the first step of the process, which is to convert individual targets of various formats into temperature scores. This is achieved by generating simple regression models for estimated warming in 2100 from climate scenarios with short, medium, and long-term trends in metrics like absolute emissions or emissions intensities. Regression models are generated based on scenarios in the IPCC Special Report on 1.5C scenario database. In addition to defining methods for disclosed targets, this step outlines the methodology used to define a default score to be applied to all non-disclosing companies.

Since companies have multiple climate targets, covering different scopes and timeframes, a protocol is then used to aggregate all target data into scores at a company level (step 2). This protocol defines the minimum quality criteria for determining the acceptability of a target to be scored and the steps required to identify and aggregate multiple targets to produce an overall company score.

The final step is used to weight company scores when assessing an index or portfolio of companies, such as in the context of financial portfolios. Figure 1 presents an overview of how the three protocols fit together to form the temperature scoring methodology.

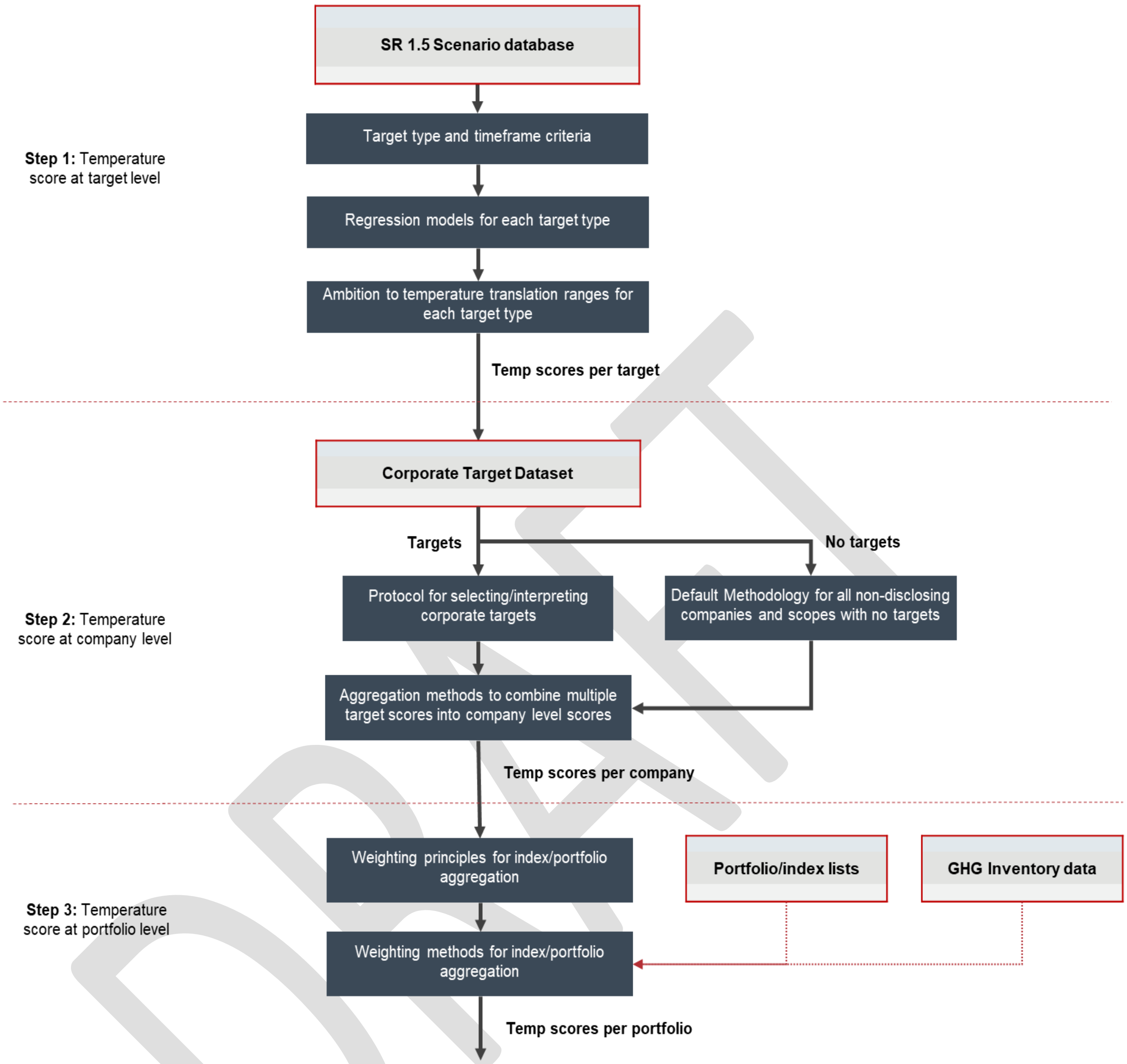


Figure 1. Temperature scoring methodology overview

1. Target protocol

1.1. Introduction

Companies are directly responsible for a significant portion of global GHG emissions and bear substantial influence over energy and land-use systems that will need to transform to meet the goals of the Paris Agreement. In 2019, more than four thousand companies covering seven GT CO2e emissions, publicly reported emissions targets through CDP. Emissions targets are a partial, but relatively crucial and forward-looking marker of a company's ambition to mitigate its climate impact. In this document, a protocol for expressing ('scoring') individual climate targets as temperature outcomes (warming in 2100) is presented.

1.2. Overview of methodology

In support of the IPCC's Special Report on Global Warming of 1.5°C, the Integrated Assessment Modelling Consortium (IAMC) compiled a database of over 400 scenarios produced by models across different experimental frameworks (Huppman et al., 2018). The scenarios cover a wide range of temperature outcomes, which may be classified based on global warming in 2100 compared to pre-industrial temperatures. Our method assumes that there is a linear relationship between the change (slope) in common target metrics (e.g., absolute emissions; emissions intensity of revenue or sold product) over specific timeframes relevant to corporate target setting horizons (e.g., 2020-2035) and the resulting global warming in 2100. The concept builds on descriptive statistical summaries of the IAMC SR1.5 database (Huppman et al., 2018; Rogelj et al., 2018) and the simple analysis presented in Weber et al. (2018) relevant to corporate targets and scenario variables. See for instance Figure 2 (b), which shows the 20 year slope in relevant scenario variables for different end of century temperature outcomes (<1.5°C to 4°C) from the Shared Socioeconomic Pathways (SSP) database.

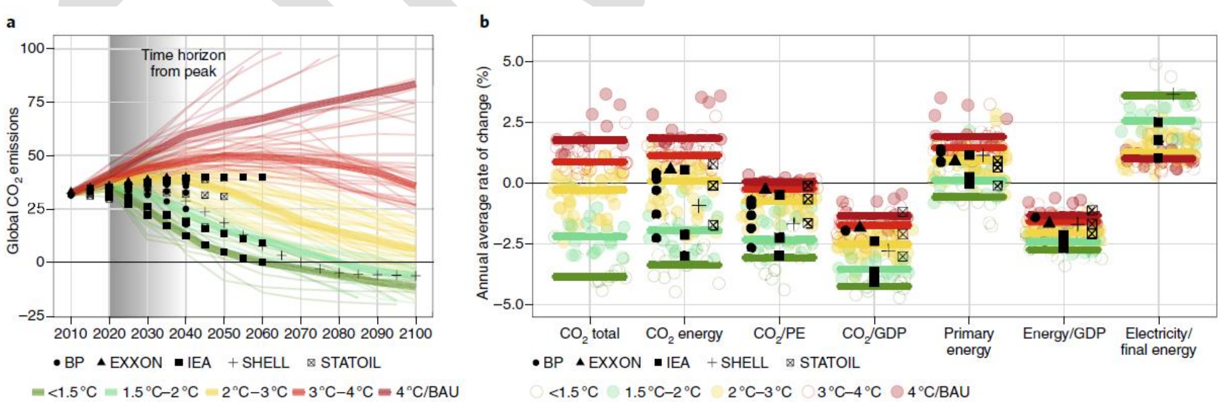


Figure 2. Illustration of underlying scientific scenarios and corporate and industry scenarios (black markers) for one global control variable (CO2 emissions; panel a) and summaries of the 20 year slope of such variables vs. end of century temperature outcomes (b)

Traditionally, scenario databases are analysed using a variety of descriptive statistical approaches. In the SR1.5 for instance, scenarios were binned according to their end of century temperature outcome and level of overshoot (Below 1.5C, 1.5C low overshoot, etc.; see Figure 3 below). While valuable to describe the range of uncertainty and variability between scenarios, such an approach has several main drawbacks for the intended use here:

1) In order to apply a ‘score’ to targets, a method must return a single unambiguous score, which is not possible using descriptive binning approaches
2) the IPCC tends to be very inclusive of any scenario meeting certain minimum quality criteria, but there are normative reasons to prefer certain scenarios given both the potential climate impacts of overshoot (e.g. Anderson et al., 2019) and concerns over the feasibility of large scale CO_2 removal (Fuss et al., 2018; Andersen et al., 2019) especially in the context of “delay” scenarios that do not begin aggressive mitigation until later years, e.g. 2030. (Strefler et al., 2018).
3) Results can be difficult to understand for non-experts, since bins tend to have overlapping ranges (see Fig 3)

For these reasons we instead apply a simple two step approach to temperature scoring: first, the creation of a scenario set that matches a normative precautionary preference in regard to overshoot and CDR; and second, develop best-fitting linear regression models to describe the relationship between scenario variables (matching the general structure of corporate GHG targets) and end of century temperature outcomes. As described below, the two steps were further applied iteratively to test different normative choices surrounding CDR and overshoot and the resulting regression fits for select scenario metrics.

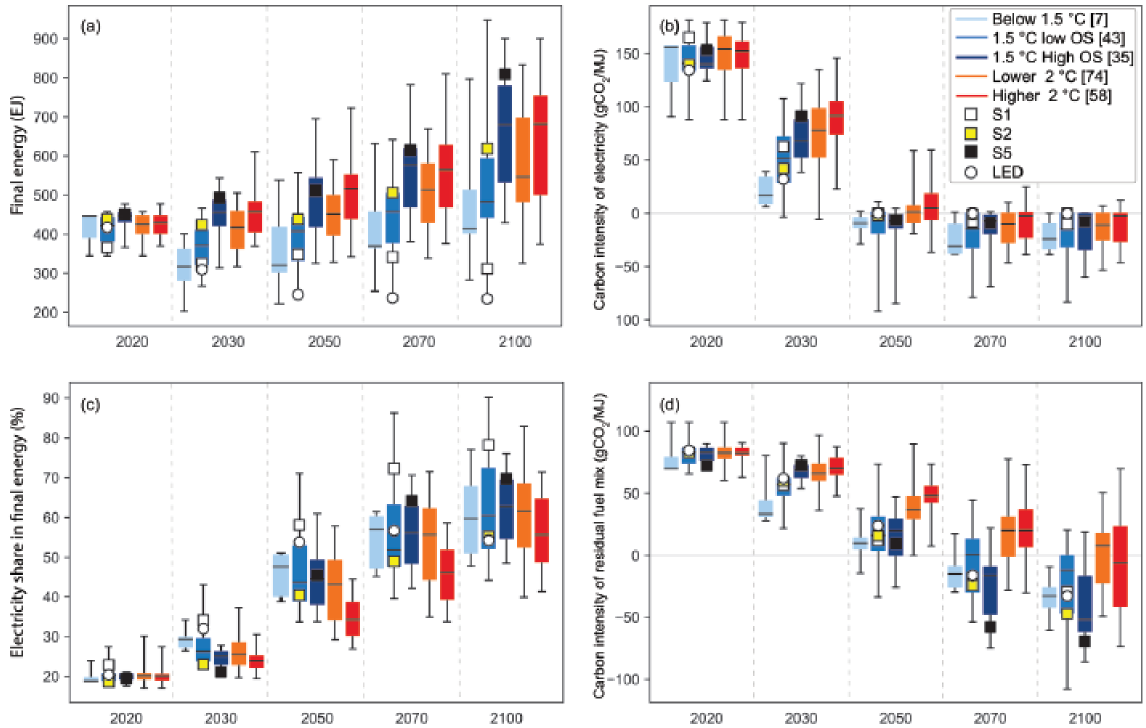


Figure 2.14 | Decomposition of transformation pathways into (a) energy demand, (b) carbon intensity of electricity, (c) the electricity share in final energy, and (d) the carbon intensity of the residual (non-electricity) fuel mix. Box plots show median, interquartile range and full range of pathways. Pathway temperature classes (Table 2.1) and illustrative pathway archetypes are indicated in the legend. Values following the class labels give the number of available pathways in each class.

Figure 3: SR1.5 analysis of scenarios using descriptive binning, here analyzing decomposition of energy system CO2 emissions

The methodology is subject to notable limitations that reflect trade-offs between specificity and applicability. First, any generalized metric is inherently a summary of sub-metrics that are potentially diverse (e.g., global GHG emissions pathways are the sum of all regional or country-level pathways, which can also be subdivided into emissions associated with different physical processes). Many companies operate across a diverse range of geographies and/or activities, but in some cases, using a generalized metric that is not consistent with the company's geographies or activities might lead to biased results. Sensitivity analyses have been included, where possible, to assess the significance of such potential biases. Second, in cases where the metric is appropriate, the assessment of one target is still an incomplete picture of the company's alignment with long-term or structural changes needed to meet the goals of the Paris Agreement. For example, two approaches to reducing power-related emissions by 30% in ten years (e.g., 2018-2028) may correspond to very different outlooks for the subsequent ten years (e.g., 2028-2038) based on the lifespan of assets, etc., which are not captured by emissions targets. This uncertainty can be reduced by assessing the temperature alignment of both short/mid-term targets and long-term targets for a single company, in cases where both have been reported.

Third, there are inherent issues with the use of linear regression of a scenario set, since scenarios are by their nature not a random statistical sample—one of the inherent assumptions of a regression. We contend this general limitation would be true of nearly any reasonable approach that ‘scores’ GHG targets, since benchmarks for scoring short-term targets must either be based on a single scenario or some statistical averaging of scenario results.

Fourth, rating companies based on stated targets assumes inherently that the targets will be met—if targets are missed, companies may be given unfairly low temperature scores. Of course, the converse is also true—if companies exceed GHG reduction targets, their scores are biased high.

Finally, and perhaps most importantly, the approach only scores companies based on their forward-looking ambition (as indicated by GHG targets) rather than based on prior actions the company has taken to reduce emissions. This naturally penalizes those companies that have already reduced emissions considerably, since generally the cost of emissions reductions for most companies will increase as low-cost/high-return options are exhausted.

There are approaches that could be used to ameliorate the fourth (assumption of target compliance) and final (disregard for past action) weaknesses—for instance, rating approaches can use a combination of forward-looking and backward-looking indicators, including cross-sectional comparisons to competitors. Further iterations of this method will test such approaches, but this initial version should be understood in the context of these limitations.

In the next section of this methodology, regression models for absolute emissions reduction targets and intensity targets are introduced.

1.3. Assigning a temperature score to disclosed targets

The first step in assigning temperature scores to disclosed targets was to assess which types of corporate GHG targets (absolute GHG reductions and GHG intensity reductions, following CDP 2018 Climate Change questionnaire) can be adequately matched to scenario variables (e.g. global GHG emissions) or benchmarks constructed using scenario variables (e.g. global GHG intensity, GHG/GDP). Using GHG targets disclosed to CDP in 2018, common target types were identified and mapped to scenario variables or derived benchmarks. Annex 1 shows the results of this mapping, but some of the most common scenario benchmarks are shown in Table 1.

Table 1: Target typology and matched scenario benchmark

<table>
<tr><th>Target Class</th><th>Example Target wording</th><th>SR1.5 Scenario variable/ benchmark</th></tr>
<tr><td>Absolute GHG reduction</td><td>Company X commits to reduce absolute scope 1 and 2 emissions 30% by 2030 from a 2018 base year</td><td>Emissions|Kyoto Gases (AR5-GWP100)</td></tr>
<tr><td>GHG Economic Intensity</td><td>Company X commits to reduce scope 1 and 2 emissions 30% per unit of added value by 2030 from a 2018 base year</td><td>Emissions|Kyoto Gases (AR5-GWP100)/ GDP|PPP</td></tr>
<tr><td>GHG Physical Intensity, cement</td><td>Company X commits to reduce scope 1 emissions 30% per tonne of cement by 2030 from a 2018 base year</td><td>Emissions|CO2|Energy|Demand|Industry Materials production|Cement</td></tr>
<tr><td>GHG Physical Intensity, steel</td><td>Company X commits to reduce scope 1 emissions 30% per tonne of steel by 2030 from a 2018 base year</td><td>Emissions|CO2|Energy|Demand|Industry Materials production|Crude steel</td></tr>
<tr><td>GHG Physical Intensity, power generation</td><td>Company X commits to reduce scope 1 emissions 30% per MWh by 2030 from a 2018 base year</td><td>Emissions|CO2|Energy|Supply|Electricity</td></tr>
</table>

In order to assess the temperature alignment of targets, each class of target needs to be mapped to an SR15 variable (or quotient of two SR15 variables, in the case of intensity targets). Each target "class" is a combination of a CDP- Industry classification, target type (including denominator for intensity targets), and scope(s) covered. In Annex1, relevant target classes are mapped to SR15 variables.

The second step was identifying potential scenario subsets from the entire SR1.5 database to be included in subsequent regressions. This step was treated iteratively, through code that subsetted the entire database using different combinations of three key variables that collectively describe the normative scenario types SBTi aligns itself with (those most likely to result in long term temperature target given potential limits to late century CDR, see The SBTi Foundations of target setting paper, SBTi, 2019). Specifically, scenarios were filtered using combinations of the following variables:

- Peak emissions year (using values of 2020, 2025, 2030, and 2100), applied to both CO2 from energy/industry and Kyoto GHGs from mitigation scenarios
- Maximum annual CDR (10, 15, or 20 Gt CO2/year, as well as no constraint (1000 Gt CO2/yr)

The combinations of these variables resulted in 192 different scenario sets, though with many duplicates (for instance, because peak year 2020 and peak year 2025 filters removed the same scenarios). In total 56 unique scenario sets resulted after deduplication, summarized in Annex 2. The scenario sets ranged from a minimum of 213 to a maximum of 416 scenarios after filters were applied. These numbers were further reduced by removing baseline scenarios from each set (as defined by SR1.5 metadata field “baseline scenario”, i.e. scenarios where no deliberate mitigation action is taken), as baseline scenarios are not appropriate benchmarks for corporate mitigation actions (though these were utilized in the development of the default score, as described below in Section 1.4).

Regression models were then developed for each unique combination of key scenario variables or benchmarks, each unique scenario set (56 unique sets, Annex 2) and developed for six key time horizons relevant to corporate targets, ranging from 5 years to 30 years, starting from base year 2020 (the most common mitigation start year for mitigation scenarios in the SR1.5 database). Thus a total of 2016 regression models were constructed. Here we focus especially on results for “medium term” targets (15 years, 2020-2035 slopes) and “long term” targets (30 years, 2020-2050., though results for each time horizon will also be made available upon publication.

Code written in R to process the SR1.5 scenario data into the distinct scenario subsets and run and visualize the regressions will also be freely available online upon publication.

Sample results are shown for the most common scenario benchmark (global GHGs) over the six time horizons and one scenario set (4) in Figure 4. Results for each scenario set and variable followed a similar logical pattern, with fits increasing and slopes of the regression lines increasing over longer time horizons (slope –0.23, R2 0.64 for 5 year; slope –0.52, R2 0.93 for 30 year). This is logical, since the required ambition over a longer time horizon will be smaller, since it averages over more years, and the degree of variability between scenarios decreases over longer horizons as more of the scenario is ‘baked in’ by 2050 than by 2030.

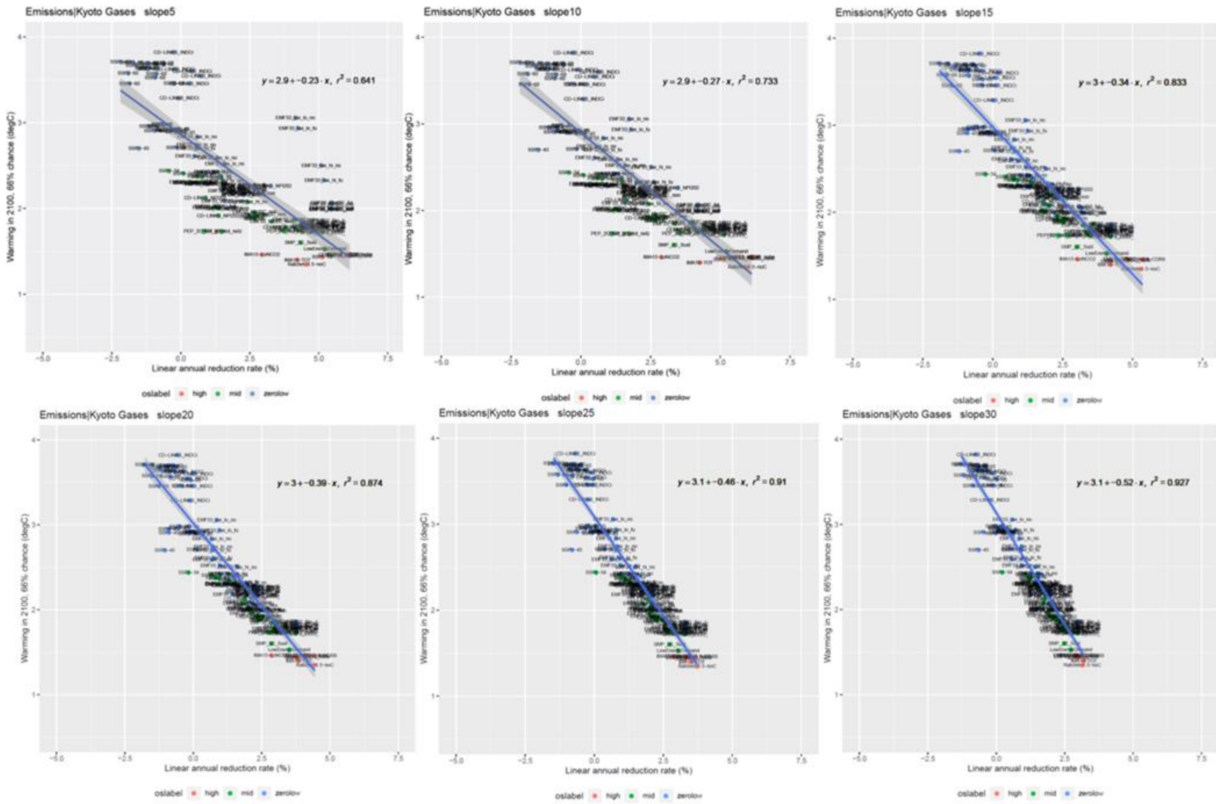


Figure 4: Scatter plots with linear fit for global GHG variable ('Emissions|Kyoto Gases') over six time horizons for Scenario set 4

Following the development of regression models, the final input scenario set (and thus regression results) was chosen based on a combination of two factors: first, best fit over medium and long term horizons (15 and 30 year); and second, consistency with SBTi's scenario preferences for lower-risk (low overshoot/low CDR) scenarios (see SBTi, 2019). Common regression diagnostics (leverage, Cook's D) were also consulted.

Fortunately these factors pointed in similar directions, as generally the scenarios sets that were more constrained for peak year and particularly for CDR tended to find better regression fits—this is shown in Annex 2, which sorts the scenario sets by average R^2 values for the three most common target variables (GHGs, GHG/GDP, and CO2/MWh from power) over 15 and 30 year horizons. Comparing the number of scenarios in each set with average fits shows a high degree of correlation, as shown in Figure 5. This is logical, as most scenarios that represent outliers between near term scenario variables and end of century warming are those that delay ambition and make up for it through later CDR (Rogelj et al., 2018). This trend is further shown in Figure 5, which shows the relationship between the sample size and resulting fit for the 56 scenarios sets, coloured by each scenario variable. (NB: sample sizes in this graphic are different from those shown in Annex 2 because not all scenarios contain every variable).

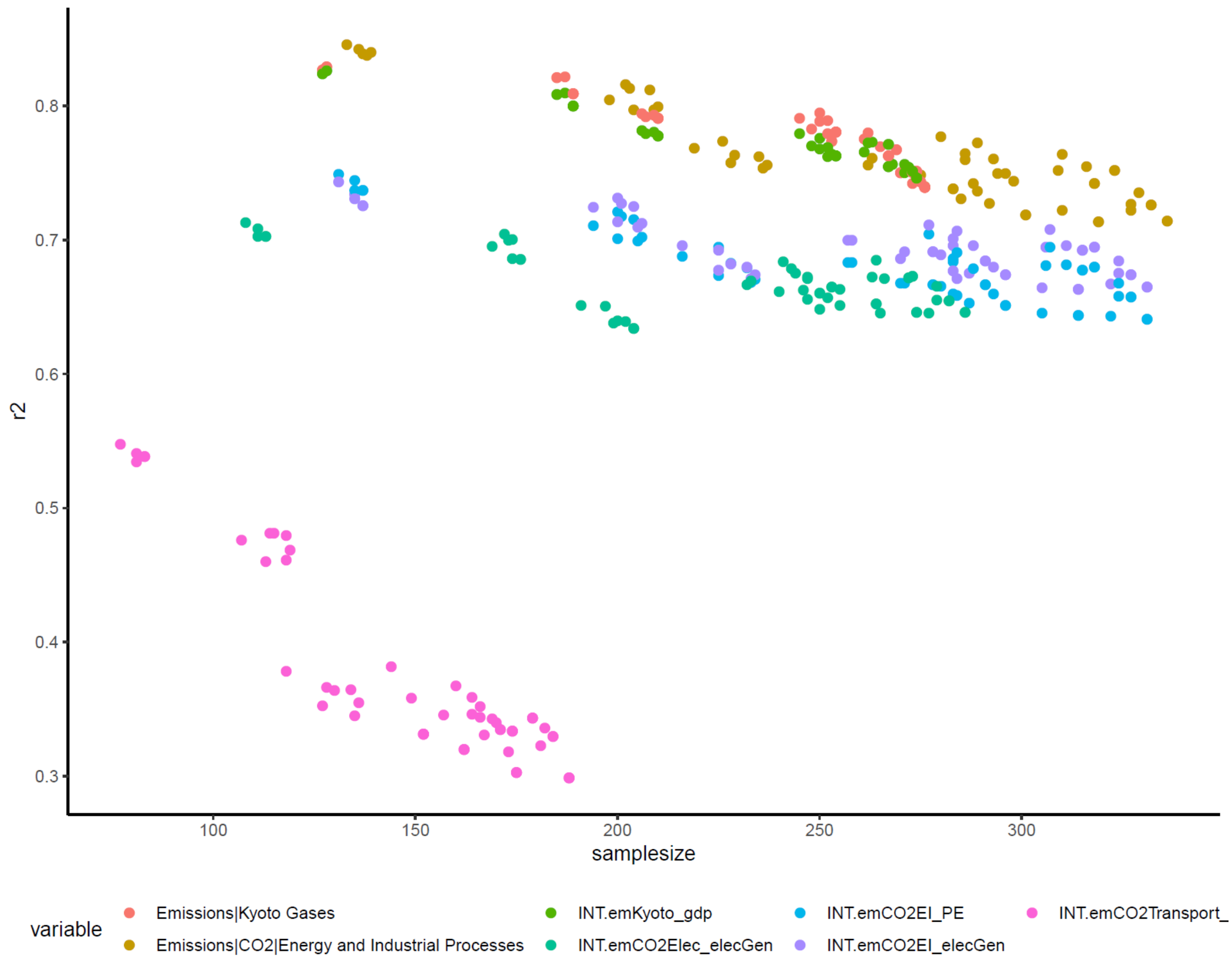


Figure 5: Regression fit (R2) as a function of sample size of regression, by scenario variable/benchmark.

The chosen scenario set (104) is constrained to a peak year of 2020 for maximum CO2 emissions from energy and industry, and a maximum CDR of 10 Gt/yr. Regression results for the chosen scenario subset are shown in Table 2.

Table 2: Regression results for Scenario set 4

	15 year horizon (targets < 15 year)			30 year horizon (targets < 30 year)		
Variable	Intercept	Slope	R2	Intercept	Slope	R2
GHG	3.0	-0.34	0.84	3.1	-0.52	0.93
CO2 (En/Ind)	2.9	-0.34	0.85	3.0	-0.48	0.90
GHG/GDP	4.5	-0.58	0.83	5.4	-1.2	0.90
CO2/MWH	3.7	-0.36	0.72	4.1	-0.52	0.72
CO2/PE	3.3	-0.56	0.76	3.5	-0.71	0.84
CO2 transport/GDP	3.4	-0.41	0.56	4	00.85	0.72

1.4. Default temperature score for companies without disclosed targets

1.4.1. Default score approaches

Companies without any relevant, publicly disclosed targets, or without targets covering an important GHG emissions scope, are still assigned a temperature score ("default temperature score") to enable the useful comparison of portfolios that may differ in terms of target coverage, in addition to company-by-company comparison.

Two options are proposed for consideration, which vary substantially in terms of methodological approach, assumptions needed, and diversity of resulting scores:

Option 1: Uniform default score. A default score is applied uniformly to all companies, regardless of sector. Using the climate action trackers 2100 warming projections, the default score would be 3.2°C[1]. Current policies presently in place around the world are projected to reduce baseline emissions and result in about 3.0°C warming above pre-industrial levels. Hence for companies with no forward-looking targets, it is expected that they will decarbonise along a 3.2°C pathway, consistent with global policies implemented to ensure reduction of emissions at this rate.

Option 2: Sector-specific score. Sector-specific default temperature scores are essentially the downscaled warming estimates of stated policy scenarios like the IEA WEO Stated Policies scenario and the Climate Action Tracker "Current Policies" estimate. Downscaling is conducted by assessing the difference in each industry's emissions in mitigation scenarios compared to stated policy scenarios; where the difference in emissions is large, the industry's default score is higher, and where the difference in emissions is low, the industry's default score is lower.

1.4.2. Default score implications

Default scores can be used at two stages, 1) when producing company level score, 2) when producing portfolio level scores by aggregating and weighting company level scores. The choice of default scoring approach therefore can have a significant influence on the final scores generated. For example, the default score of a company that has no public targets may significantly influence a portfolio score if that company is weighted heavily in the portfolio. Step 3 of this methodology highlights the weighting approaches that can be applied at the portfolio stage.

Appendix 4 highlights the importance of the default score when assessing large samples of companies. Taking the S&P 500 and FTSE 250 samples as an example, companies reporting GHG emissions targets to CDP are responsible for only 48% of estimated scope 1+2 emissions in the S&P 500 sample, and only 25% of estimated scope 1+2 emissions in the FTSE 250 sample.

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[1] Based on a likely (≥66%) probability that if the projected emissions are accurate, warming would not exceed 3.2°C, which is consistent with the scenario temperature classifications used throughout.

For these samples a significant portion of the emissions would have to be covered by a default score.

A uniform approach applied at the company level (Option 1) would apply the same default score to each company, regardless of its sector or current performance. This value would not represent the actual business as usual temperature trajectory of the company, rather it simply reveals that we do not know that the ambition of the company and they need to set a target in order to be scored. Option A can work in with the portfolio weighting steps in Section 3, where the default score of the company is effectively weighted against the emissions and invested value of the company compared to the others in the portfolio.

Option 2 would produce a more granular default score, that would reflect the current business as usual trajectories by sector. This approach is currently outside the scope of this work but would enable the generation of sector default scores. These scores could be used as stand along scores at a company level, while also being used during the portfolio aggregation steps.

2. Company protocol

The company protocol enables the generation of a company level temperature score based on the temperature scores of the company's targets. Targets are usually expressed using different units, can cover various types of GHG emission scope, and can be set over multiple timeframes. Hence, this protocol is used to select and aggregate different target scores in order to produce consistent and comparable score at a company level.

A set of quality criteria is first established to identify the target types and target formulations that can be scored. This is followed by a series of classification and aggregation steps based to produce the finals scores per company.

2.1. Target quality criteria

Targets can be classified in terms of five key attributes, presented in Table 3.

Table 3. Target criteria

Criteria	Description
Target Type	Defines whether the target ambition is based on an absolute, intensity, or other format e.g. % procurement
Target scope coverage	Targets can be set across individual or combined GHG emission scopes (as defined in the GHG protocol) e.g. scope 1, scope 1+2, scope 1+2+3.
Boundary coverage	Within a given emissions scope, companies define how much of that scope will be included in the boundary of the target e.g. 50% of scope 1 is covered by the target, or 95% of scope 1+2 is covered by the target
Target timeframe	Targets can be reported across timeframes ranging from the reporting year up to 2100
Target progress	Describes the rate of achievement of the target that may also be disclosed by companies e.g. 30% of the target has been achieved by the current reporting year

2.1.1. Target types

Only GHG emission reduction targets are currently acceptable for scoring. All procurement, engagement, or renewable electricity targets are currently not accepted. Long-term ambitious or aspirational targets that are not quantitative (e.g. climate neutral/net-zero in 2050) are not scored at this time. Valid target types include both absolute and intensity GHG emission reduction targets emissions.

All types of absolute targets based on GHG emissions and intensity targets based on GHG reductions per unit of X, such as

- Physical intensity pathways of SDA sectors: Cement, Power Generation, Iron and Steel, Aluminium, Chemicals, Oil and Gas, Real Estate
- Economic intensity targets: based on GEVA or Revenue.
- Any intensity targets where the conversion to absolute emissions is disclosed

2.1.2. Scope coverage

Scope 1+2 and scope 3 will be assessed and scored separately as outlined in Section 1. Temperature scores will be produced for each company by either scoring the targets or using a default score in the absence of a valid target.

Scope 3 targets will be scored using the same approach as scope 1 and 2 targets. The SBTi target classification approaches currently apply only to scope 1 and 2 targets. Future target classifications approaches developed by the SBTi can be incorporated into this methodology to ensure alignment.

If a company's relevant and mandatory scope 3 emissions are 40% or more of total scope 1, 2, and 3 emissions, a scope 3 target is required. For companies whose scope 3 emissions represent less than 40% of total emissions, scores will be based only on scope 1+2 ambition. If no scope 3 target is disclosed, or the target is deemed insufficient from a coverage or timeframe perspective, a default score is provided.

The individual scores for scope 1+2 and scope 3 can be aggregated to produce an overall scope 1+2+3 score. This is completed with GHG inventory data. The following equation highlights the weighting approach to produce scope 1+2+3 scores, where TS is temperature score:

$$\frac{(Scope\ 1+2\ \ TS) \times (Scope\ 1+2\ GHG\ emissions) + (Scope\ 3\ TS) \times (Scope\ 3\ GHG\ emissions)}{Scope\ 1+2+3\ GHG\ emissions}$$

2.1.3. Boundary coverage

The boundary coverage criterion defines the minimum acceptable coverage of emissions in scopes covered by targets. For scope 1 and 2 targets, three options are proposed for consultation:

Option 1: Minimum coverage threshold

Minimum coverage of 95% of scope 1+2 and 67% of scope 3 emissions covered by targets for them to be considered valid. If these coverage thresholds are not met, the default score will be applied. This option aligns directly with SBTi's target boundary coverage criteria.

Option 2: Weighted coverage

All targets are scored, regardless of boundary coverage. The % reduction is weighted relative to the % boundary coverage of the target. For all scope 1+2 targets under 95% coverage, and scope

3 targets under 67% coverage, the ambition of the target is therefore linked to the coverage. This means an ambitious target covering only a small portion of the scope emissions would be weighted lower as a result of the low coverage. The temperature score for the scope is computed using the following equation:

$$Scope\ TS = (\%\ emissions\ in\ scope\ covered\ by\ target) \times (target\ TS)$$

Option 3: Default coverage
This option assumes that the uncovered portion of the scope receives the default score. The target score and the default score are then weighted based on the amount of emissions covered by both options. The temperature score for the scope is computed using the following equation:

$$\frac{(emissions\ covered\ by\ target) \times (target\ TS) + (emissions\ not\ covered\ by\ target) \times (default\ TS)}{total\ emissions\ in\ scope}$$

Coverage can be noted alongside the temperature scores for further transparency, e.g. Company X has a temperature score of 2.1°C, based on 75% coverage of its GHG emissions.

2.1.4. Target timeframe

The timeframe criterion defines the range of acceptable target timeframes. Targets up to and including the current reporting year are not forward-looking and hence are not considered valid. The regression models outlined in Section 1 highlight that a 15 year regression time horizon is used for all targets with target years less than 15 years in the future. A 30 year time horizon is used for all targets with target years more than 15 years in the future. The 15 year time horizon can be further split into short term and mid-term timeframes.

Target timeframes are divided into the following three categories:

- Short-term: target years up to 4 years from the reporting year e.g. 2021-2024
- Mid-term: target years between 5-15 years from the reporting year e.g. 2025-2035
- Long-term: target years greater than 15 years from the reporting year e.g. 2036-2050

Two timeframe options are proposed for consultation:

Option 1: targets are only scored for the mid-term and long-term timeframes

Option 2: targets are scored over the 3 timeframes, short, mid, and long-term.

2.1.5. Target progress

Scores will be based on the ambition over the timeframe of the target (base year to target year), and not just on the forward-looking portion (current year to target year). Therefore, companies reporting some progress towards achieving their targets (as long as it is not 100% achieved) will not be penalised for early action. Target must not already have already been completed i.e. a 2025 target that has already been achieved would not be acceptable for scoring.

2.2. Target aggregation

The target aggregation process describes the steps taken to classify and score targets to generate one company score per scope and timeframe. The following steps are conducted to arrive at the final scores:

1) Classify companies in terms of scope 1+2 and scope 3. For combined targets (scope 1+2+3) where the underlying composition is not clear, the ambition is applied only to the scope 1+2 portion, and the if no details on scope 3 coverage are provided, the scope 3 portion would receive the default score.

2) Group the targets into timeframes: short-term (2021-2024), mid-term (2025-2035), and long-term (2036-2050).

3) Assess coverage of the targets and apply the relevant boundary coverage criteria as outlined in Section 2.1.3.

4) Filtering multiple targets. Many companies report multiple targets within the same scope and timeframe. e.g. two midterm targets covering scope 1+2. In these cases, multiple scores per category would be produced. To generate just one representative score per category, a series of filtering steps is performed to arrive at a single score for each timeframe/scope category:

    4.1. Boundary coverage – select the target with the highest boundary coverage.
    4.2. Timeframes – If the boundary coverage is the same, later target years within the timeframes are given precedence. Longer-term perspectives are preferred as it means that targets are more forward-looking e.g. in a case where a company has a valid 2030 and 2035 targets covering scope 1+2, the 2035 temperature score would be used to represent the company's midterm score. In cases where target years are the same, but the additional target uses a different base year, the target with the later base year is given precedence.
    4.3. Target type – in cases where both timeframe and boundary coverage are the same, absolute targets are given precedence over intensity targets

Figure 4 displays a summary of the protocol steps:

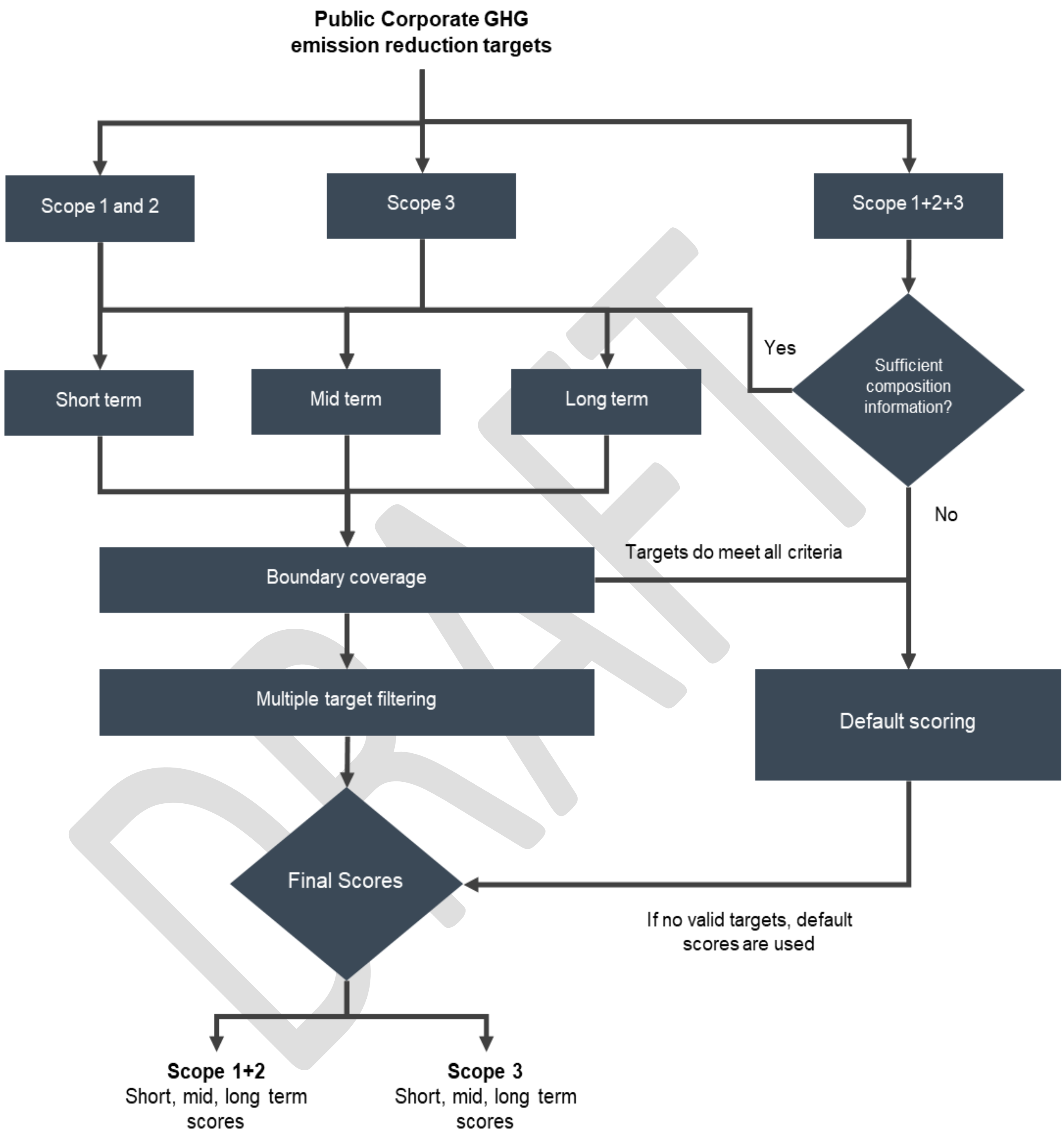

Figure 4. protocol steps to generate temperature scores at a company level, based on either valid, publicly disclosed targets or a default approach for n companies with no valid targets.

2.3. Using temperature scores

Depending on the option chosen for timeframe coverage, up to six temperature scores can be produced per company based on target timeframe and GHG emission scope coverage. Table 4 presents the six categories that can be scored at the company level.

Table 4. Six categories for each company based on GHG emission scope coverage and target timeframe.

	Short-term 2021-2024	Mid-term 2025-2035	Long-term 2035-2050
Scope 1+2	Temp score	Temp score	Temp score
Scope 3	Temp score	Temp score	Temp score

The scope 1+2 temperature scores can then be combined with the scope 3 temperature scores to generate a scope 1+2+3 score. Table 5 illustrates how these scores would be presented for one example company. In this case, the company has only publicly disclosed valid targets covering scope 1+2 for the mid-term and long-term timeframes. The company has not disclosed any short-term targets or any scope 3 targets.

The mid-term timeframe is considered the key timeframe as it currently represents the main time period for corporate ambition and aligns with the SBTi's target setting criteria of between 5-15 years from the reporting year. The short and long-term scores can be used to better understand if companies have more immediate and longer-term goals in place.

Table 5. Example output of temperature scores at the company level

	Short-term 2021-2024	Mid-term 2025-2035	Long-term 2035-2050
Scope 1+2 GHG: 450,000t	No target/default score: 3.2°C	1.8°C	1.9°C
Scope 3 GHG: 2,100,000t	No target/default score: 3.2°C	No target/default score: 3.2°C	No target/default score: 3.2°C
Scope 1+2+3 GHG: 2,550,000t	No target/default score: 3.2°C	GHG weighting applied to produce a composite score: $\frac{(450{,}000 * 1.8°C) + (2{,}100{,}000 * 3.2°C)}{450{,}000 + 2{,}100{,}000} = 2.95°C$	GHG weighting applied to produce a composite score: $\frac{(450{,}000 * 1.9°C) + (2{,}100{,}000 * 3.2°C)}{450{,}000 + 2{,}100{,}000} = 2.97°C$

3. Portfolio protocol

The final step of the temperature scoring method describes the different options for aggregating temperature scores of companies at an index or portfolio level. It makes a recommendation for a default approach to be applied by investors and other users in the portfolio assessment and alignment process.

3.1. Weighting objectives and principles

Table 6 presents the three key objectives that any weighting method should adhere to:

Table 6. Default weighting method objectives

Objective	Description
Enable Net-zero / Paris alignment	The method should emphasize climate impact and support investors in accurately assessing the °C warming potential of an index or a portfolio and to align their investments with a 1.5° pathway.
Support better disclosure of GHG emissions by corporations	The method should foster more and higher quality disclosure of GHG emissions along the entire value chain (Scope 1+2+3) by global corporations.
Support standardisation of methods	The method should be aligned with existing portfolio GHG accounting methods.

In addition to meeting these objectives, the default weighting method should best adhere to a set of weighting principles, presented in Table 7.

Table 7. Default weighting principles

Principle	Description
Comparability	Results should be comparable across different asset classes and investment products.
Applicability	Investors should be able to perform the aggregation at a reasonable cost with public/accessible data.
Reliability	The method should produce results which are reliable and verifiable.
Clarity	The method should be understandable and practical to implement.
Timeliness	The method should produce results that are timely and current.
Completeness	The method should allow for complete portfolio assessments.

3.2. Weighting Options

Six potential options for aggregating individual company temperature scores at the index/portfolio are presented for consultation. These include:

- Option 1: Weighted average temperature score (WATS)
- Option 2: Total emissions[1] weighted temperature score (TETS)
- Option 3: Market Owned[2] emissions weighted temperature score (MOTS)
- Option 4: Enterprise Owned[3] emissions weighted temperature score (EOTS).
- Option 5: EV + Cash emissions weighted temperature score (ECOTS)
- Option 6: Total Assets emissions weighted temperature score (AOTS)

Table 8 provides a description and formula for calculating the portfolio temperature scores using each of these options.

[1] Reported and modelled GHG emissions of the latest reporting period.
[2] Based on a company's market capitalisation, i.e. the total euro market value of a company's outstanding shares of stock. Commonly referred to as "market cap," it is calculated by multiplying the total number of a company's outstanding shares by the current market price of one share.
[3] Based on Enterprise value (EV). EV is a measure of a company's total value and includes in its calculation the market capitalisation of a company but also short-term and long-term debt.

Table 8: Details of portfolio aggregation methods

Option	Method	Temperature score formula (where TS = Company temperature score)
Weighted average temperature score (WATS)	Temperature scores are allocated based on portfolio weights.	$\sum_{n}^{i}(Portfolio\ weight_i \times TS_i)$
Total emissions weighted temperature score (TETS)	Temperature scores are allocated based on historical emission weights using total company emissions.	$\sum_{n}^{i}\left(\frac{Company\ emissions_i}{Portfolio\ emissions} \times TS_i\right)$
Market Owned emissions weighted temperature score (MOTS)	Temperature scores are allocated based on an equity ownership approach.	$\sum_{n}^{i}\left(\left(\frac{\frac{Investment\ value_i}{Company\ market\ cap} \times Company\ emissions_i}{Portfolio\ market\ value\ owned\ emissions}\right) \times TS_i\right)$
Enterprise Owned emissions weighted temperature score (EOTS)	Temperature scores are allocated based on an enterprise ownership approach	$\sum_{n}^{i}\left(\left(\frac{\frac{Investment\ value_i}{Company\ enterprise\ value} \times Company\ emissions_i}{Total\ enterprise\ owned\ emissions}\right) \times TS_i\right)$
Enterprise Value + Cash emissions weighted temperature score (ECOTS)	Temperature scores are allocated based on an enterprise value (EV) plus cash & equivalents ownership approach	$\sum_{n}^{i}\left(\left(\frac{\frac{Investment\ value_i}{Company\ EV + Cash} \times Company\ emissions_i}{Total\ EV + Cash\ owned\ emissions}\right) \times TS_i\right)$
Total Assets emissions weighted temperature score (AOTS)	Temperature scores are allocated based on a total assets ownership approach	$\sum_{n}^{i}\left(\left(\frac{\frac{Investment\ value_i}{Company\ Total\ Assets} \times Company\ emissions_i}{Total\ Assets\ owned\ emissions}\right) \times TS_i\right)$

The denominators in the formulas presented in Table 8 are defined as follows:

TETS: portfolio emissions are the sum of the portfolio company emissions

MOTS: Portfolio market value owned emissions is the sum of portfolio company owned emissions weighted on the market cap of investee companies.

EOTS: Total enterprise owned emissions is the sum of portfolio company owned emissions weighted on the enterprise value of investee companies.

ECOTS: Total EV + Cash owned emissions is the sum of portfolio company owned emissions weighted on the enterprise value + cash of investee companies.

AOTS: Total Assets owned emissions is the sum of portfolio company owned emissions weighted on the total assets of investee companies.

3.3. Sample portfolios & temperature scores

To assess the various weighting approaches, each option was applied to three sample portfolios using actual company data and temperature scores as shown in Annex 3. The three types of portfolios differ in terms of the current GHG emissions of companies included (high impact composed of 10 companies with high current Scope 1+2+3 emissions, medium impact composed of 10 companies with medium Scope 1+2+3 emissions, low impact composed of ten companies with low Scope 1+2+3 emissions). Separate results for Scope 1+2 and Scope 1+2+3 temperature scores are shown in Table 9.

Table 9: Temperature score results (in °Celsius)

	WATS		TETS		MOTS		EOTS/ ECOTS/ AOTS	
	Scope 1+2	Scope 1+2+3	Scope 1+2	Scope 1+2+3	Scope 1+2	Scope 1+2+3	Scope 1+2	Scope 1+2+3
High impact portfolio	2.76	3.05	2.94	3.13	3.07	3.17	3.00	3.18
Medium impact portfolio	2.20	2.94	2.06	3.01	1.95	3.09	1.96	3.09
Low impact portfolio	1.93	2.56	1.64	2.34	1.69	2.19	1.72	2.13

3.4. Discussion and recommended method

The temperature scores of the high impact portfolio are higher across all options. This may reflect that it is generally easier for medium and low impact companies to set ambitious targets, and the fact that high impact companies have set fewer targets and thus were assigned the higher default score of 3.2°C.

The differences between MOTS and EOTS/ECOTS/AOTS are not significant. Variations between TETS and MOTS/EOTS are partly significant. Whilst TETS results are heavily influenced by emissions outliers, MOTS/EOTS scores are also driven by variations in market cap and enterprise value owned emissions. This analysis is only for illustrative purposes and assumes that the sample portfolios are equal weighted. In reality, portfolio weights vary which would strongly impact the WATS, MOTS and EOTS/ECOTS/AOTS scores.

The results could be interpreted as follows for the scope 1+2+3 scores:

- WATS: The weighted average rate at which portfolio companies intend to reduce their emissions is consistent with a global warming potential of 2.94°C by 2100 compared to pre-industrial levels.
- TETS: The weighted average rate at which the total emissions of portfolio companies may decrease is consistent with a global warming potential of 3.01°C by 2100 compared to pre-industrial levels.
- MOTS / EOTS/ ECOTS/ AOTS: The weighted average rate at which the investor's owned emissions may decrease is consistent with a global warming potential of 3.09°C by 2100 compared to pre-industrial levels.

Table 10 provides an assessment of each option against the objectives outlined above.

Table 10: Assessment of options against weighting objectives

Objective	WATS	TETS	MOTS	EOTS	ECOTS	AOTS	Comment
Enable Net-zero / Paris alignment	✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	Exposure to high impact companies best reflected under TETS; exposure under MOTS/EOTS could be masked by high market cap/EV of these companies.
Support better disclosure of GHG emissions by corporations	✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	WATS does not take current GHG emissions into account, therefore the incentive for companies to report is lower.
Support standardisation of methods	✓✓✓	✓	✓✓	✓✓✓	✓✓✓	✓✓✓	WATS aligned to TCFD's[4] main recommended WACI method for measuring the carbon intensity of a portfolio. MOTS aligned to TCFD's approach for carbon footprinting. EOTS aligned to PCAF[5] method for carbon footprinting of listed equities and corporate debt.

[4] TCFD (Task Force on Climate-related Financial Disclosures, 2017): Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures

[5] PCAF (Partnership for Carbon Accounting Financials, 2019): Accounting GHG emissions and taking action: harmonised approach for the financial sector in the Netherlands

Table 11 provides an assessment of each option against the principles outlined above.

Table 11: Assessment of options against weighting principles

Objective	WATS	TETS	MOTS	EOTS	ECOTS	AOTS	Comment
Comparability	✓✓✓	✓✓✓	✓	✓✓✓	✓✓✓	✓✓✓	MOTS cannot be applied to corporate bonds
Applicability	✓✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	TETS requires GHG data, MOTS/EOTS require GHG and additionally MC/EV data.
Reliability	✓✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	TETS/MOTS/EOTS based on self-reported and modelled GHG data.
Clarity	✓✓✓	✓✓✓	✓✓	✓✓	✓✓	✓✓	Ownership based methods reduces transparency / results are somewhat less intuitive.
Timeliness	✓✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	TETS/MOTS/EOTS dependent on timely GHG data
Completeness	✓✓✓	✓✓	✓	✓	✓	✓	TETS dependent on GHG data for all portfolio companies; MOTS/EOTS required MC/EV data in addition.

The EOTS/ECOTS/AOTS method best supports the stated objectives whereas WATS is the least supportive method. In contrast, WATS is significantly better aligned to the principles compared to EOTS. Yet, some of the principles related disadvantages of EOTS/ECOTS/AOTS would be less significant if corporate reporting of GHG emission inventories were better. As better disclosure is generally supported through these approaches, an enterprise ownership approach using either ECOTS or AOTS is recommended to be applied in the temperature scoring of portfolios.

3.5. Additional notes on the portfolio protocol

Double counting: In the absence of an appropriate accounting standard, double counting of GHG emissions and their respective targets shall not be considered at this stage.

Comparison of temperature scores across portfolios: When comparing temperature scores across portfolios, the same invested value should be applied.

Avoided emissions: as with the temperature scores at the company level, avoided emissions from low-carbon products or services shall not be considered.

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Annex 1: Target class to SR15 variable mapping

Target class			SR15 variable match
CDP-ACS Industry	**Target type**	**Scope**	
All industries except Fossil Fuels, Cement & Concrete, Steel & Iron, Aluminum, Power, and Transportation Services (below)	Absolute	Scope 1	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 1+2	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 1+2+3	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 3 (upstream)	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 3 (downstream)	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 3 (upstream and downstream)	Emissions|Kyoto Gases (AR5-GWP100)
	Intensity (per unit revenue or unit of product)	Scope 1	Emissions|Kyoto Gases (AR5-GWP100)/ GDP|PPP
		Scope 1+2	Emissions|Kyoto Gases (AR5-GWP100)/ GDP|PPP
		Scope 1+2+3	Emissions|Kyoto Gases (AR5-GWP100)/ GDP|PPP
		Scope 3 (upstream)	Emissions|Kyoto Gases (AR5-GWP100)/ GDP|PPP
		Scope 3 (downstream)	Emissions|Kyoto Gases (AR5-GWP100)/ GDP|PPP
		Scope 3 (upstream and downstream)	Emissions|Kyoto Gases (AR5-GWP100)/ GDP|PPP
Fossil Fuels	Absolute	Scope 1	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 1+2	Emissions|Kyoto Gases (AR5-GWP100)

		Scope 1+2+3	Emissions|CO2|Energy & Industrial Processes
		Scope 3 (upstream)	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 3 (downstream)	Emissions|CO2|Energy & Industrial Processes
		Scope 3 (upstream and downstream)	Emissions|CO2|Energy & Industrial Processes
	Intensity (per unit of energy)	Scope 1	Emissions|Kyoto Gases (AR5-GWP100)/Primary Energy
		Scope 1+2	Emissions|Kyoto Gases (AR5-GWP100) /Primary Energy
		Scope 1+2+3	Emissions|CO2|Energy & Industrial Processes/Primary Energy
		Scope 3 (upstream)	Emissions|Kyoto Gases (AR5-GWP100) /Primary Energy
		Scope 3 (downstream)	Emissions|CO2|Energy & Industrial Processes/Primary Energy
		Scope 3 (upstream and downstream)	Emissions|CO2|Energy & Industrial Processes/Primary Energy
Materials| Cement & Concrete	Absolute	Scope 1	Emissions|CO2|Energy|Demand|Industry
		Scope 1+2	Emissions|CO2|Energy|Demand|Industry
		Scope 1+2+3	Emissions|CO2|Energy|Demand|Industry
		Scope 3 (upstream)	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 3 (downstream)	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 3 (upstream and downstream)	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 1	Emissions|CO2|Energy|Demand|Industry/

	Intensity (per unit of cement or revenue)		*Materials production|Cement*
		Scope 1+2	Emissions|CO2|Energy|Demand|Industry/ *Materials production|Cement*
		Scope 1+2+3	Emissions|CO2|Energy|Demand|Industry/ *Materials production|Cement*
		Scope 3 (upstream)	Emissions|Kyoto Gases (AR5-GWP100)/ *Materials production|Cement*
		Scope 3 (downstream)	Emissions|Kyoto Gases (AR5-GWP100)/ *Materials production|Cement*
		Scope 3 (upstream and downstream)	Emissions|Kyoto Gases (AR5-GWP100)/ *Materials production|Cement*
Materials| Metal smelting, refining & forming| Iron & steel	Absolute	Scope 1	Emissions|CO2|Energy|Demand|Industry or
		Scope 1+2	Emissions|CO2|Energy|Demand|Industry
		Scope 1+2+3	Emissions|CO2|Energy|Demand|Industry
		Scope 3 (upstream)	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 3 (downstream)	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 3 (upstream and downstream)	Emissions|Kyoto Gases (AR5-GWP100)
	Intensity (per unit of iron,	Scope 1	Emissions|CO2|Energy|Demand|Industry/ *Materials production|Crude steel*

	steel or revenue)	Scope 1+2	Emissions|CO2|Energy|Demand|Industry/ *Materials production*|*Crude steel*
		Scope 1+2+3	Emissions|CO2|Energy|Demand|Industry/ *Materials production*|*Crude steel*
		Scope 3 (upstream)	Emissions|Kyoto Gases (AR5-GWP100)/ *Materials production*|*Crude steel*
		Scope 3 (downstream)	Emissions|Kyoto Gases (AR5-GWP100)/ *Materials production*|*Crude steel*
		Scope 3 (upstream and downstream)	Emissions|Kyoto Gases (AR5-GWP100)/ *Materials production*|*Crude steel*
Materials| Metal smelting, refining & forming| Aluminum	Absolute	Scope 1	Emissions|CO2|Energy|Demand|Industry
		Scope 1+2	Emissions|CO2|Energy|Demand|Industry
		Scope 1+2+3	Emissions|CO2|Energy|Demand|Industry
		Scope 3 (upstream)	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 3 (downstream)	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 3 (upstream and downstream)	Emissions|Kyoto Gases (AR5-GWP100)
	Intensity (per unit of aluminium or revenue)	Scope 1	Emissions|CO2|Energy|Demand|Industry/ *Materials production*|*Total aluminum*
		Scope 1+2	Emissions|CO2|Energy|Demand|Industry/ *Materials production*|*Total aluminum*

		Scope 1+2+3	Emissions|CO2|Energy|Demand|Industry/ *Materials production*|*Total aluminum*
		Scope 3 (upstream)	Emissions|Kyoto Gases (AR5-GWP100)/ *Materials production*|*Total aluminum*
		Scope 3 (downstream)	Emissions|Kyoto Gases (AR5-GWP100)/ *Materials production*|*Total aluminum*
		Scope 3 (upstream and downstream)	Emissions|Kyoto Gases (AR5-GWP100)/ *Materials production*|*Total aluminum*
Power	Absolute	Scope 1	Emissions|CO2|Energy|Supply|Electricity
		Scope 1+2	Emissions|CO2|Energy|Supply|Electricity
		Scope 1+2+3	Emissions|CO2|Energy|Supply|Electricity
		Scope 3 (upstream)	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 3 (downstream)	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 3 (upstream and downstream)	Emissions|Kyoto Gases (AR5-GWP100)
	Intensity (per unit of electricity)	Scope 1	Emissions|CO2|Energy|Supply|Electricity / Secondary Energy|Electricity
		Scope 1+2	Emissions|CO2|Energy|Supply|Electricity / Secondary Energy|Electricity
		Scope 1+2+3	Emissions|CO2|Energy|Supply|Electricity / Secondary Energy|Electricity

		Scope 3 (upstream)	Emissions|Kyoto Gases (AR5-GWP100) / Secondary Energy|Electricity
		Scope 3 (downstream)	Emissions|Kyoto Gases (AR5-GWP100) / Secondary Energy|Electricity
		Scope 3 (upstream and downstream)	Emissions|Kyoto Gases (AR5-GWP100) / Secondary Energy|Electricity
Transportation services	Absolute	Scope 1	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 1+2	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 1+2+3	Emissions|CO2|Energy|Demand|Transportation
		Scope 3 (upstream)	Emissions|Kyoto Gases (AR5-GWP100)
		Scope 3 (downstream)	Emissions|CO2|Energy|Demand|Transportation
		Scope 3 (upstream and downstream)	Emissions|CO2|Energy|Demand|Transportation
	Intensity (per unit of revenue)	Scope 1	Emissions|Kyoto Gases (AR5-GWP100)/ GDP|PPP
		Scope 1+2	Emissions|Kyoto Gases (AR5-GWP100)/ GDP|PPP
		Scope 1+2+3	Emissions|CO2|Energy|Demand|Transportation/ GDP|PPP
		Scope 3 (upstream)	Emissions|Kyoto Gases (AR5-GWP100) / GDP|PPP
		Scope 3 (downstream)	Emissions|CO2|Energy|Demand|Transportation/ GDP|PPP
		Scope 3 (upstream and downstream)	Emissions|CO2|Energy|Demand|Transportation/ GDP|PPP

Annex 2: Scenario sets used for regression models

Scenario Set	Average R2, 15 year	Rank R2, 15 year	Average R2, 30 year	Rank R2, 30 year	Peak Emissions year	Peak Emissions variable	Peak filter applied to	CDR filter variable	CDR Limit (Gt CO2/yr)	Number scenarios in set
4	0.799879	1	0.903919	1	2100	Year of max Kyoto emissions	1.5C and 2C	cdr|max	-10	213
104	0.795081	3	0.903357	2	2020	Year of max EI CO2 emissions	1.5C and 2C	cdr|max	-10	216
20	0.795777	2	0.902727	4	2100	Year of max Kyoto emissions	1.5C and lower 2C	cdr|max	-10	217
136	0.792082	5	0.902217	5	2020	Year of max EI CO2 emissions	1.5C	cdr|max	-10	218
36	0.793902	4	0.903104	3	2100	Year of max Kyoto emissions	1.5C	cdr|max	-10	219
3	0.777904	9	0.880951	11	2100	Year of max Kyoto emissions	1.5C and 2C	cdr|max	-15	278
103	0.787263	6	0.887937	6	2020	Year of max EI CO2 emissions	1.5C and 2C	cdr|max	-15	282
119	0.786006	7	0.88724	8	2020	Year of max EI CO2 emissions	1.5C and lower 2C	cdr|max	-15	283
19	0.77443	10	0.879555	19	2100	Year of max Kyoto emissions	1.5C and lower 2C	cdr|max	-15	284
107	0.785552	8	0.887556	7	2025	Year of max EI CO2 emissions	1.5C and 2C	cdr|max	-15	288
35	0.77296	12	0.879204	20	2100	Year of max Kyoto emissions	1.5C	cdr|max	-15	289
99	0.773886	11	0.879661	18	2100	Year of max EI CO2 emissions	1.5C and 2C	cdr|max	-15	290
52	0.754887	16	0.872668	39	2100	Year of max Kyoto emissions	1.5C and 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-10	297
152	0.756133	15	0.871872	45	2020	Year of max EI CO2 emissions	1.5C and 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-10	304
68	0.748917	24	0.870096	53	2100	Year of max Kyoto emissions	1.5C and lower 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-10	306

168	0.751037	20	0.869931	54	2020	Year of max EI CO2 emissions	1.5C and lower 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-10	307
156	0.751247	19	0.87071	50	2025	Year of max EI CO2 emissions	1.5C and 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-10	313
84	0.746734	27	0.869693	56	2100	Year of max Kyoto emissions	1.5C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-10	314
148	0.747671	26	0.870142	52	2100	Year of max EI CO2 emissions	1.5C and 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-10	315
51	0.745919	28	0.873163	38	2100	Year of max Kyoto emissions	1.5C and 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-15	340
2	0.747949	25	0.876861	25	2100	Year of max Kyoto emissions	1.5C and 2C	cdr|max	-20	343
50	0.73639	38	0.875866	27	2100	Year of max Kyoto emissions	1.5C and 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-20	354
18	0.743356	32	0.875174	30	2100	Year of max Kyoto emissions	1.5C and lower 2C	cdr|max	-20	355
151	0.760699	13	0.879948	15	2020	Year of max EI CO2 emissions	1.5C and 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-15	358
53	0.732392	41	0.875519	28	2020	Year of max Kyoto emissions	1.5C and 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-1000	361
5	0.732392	42	0.875519	29	2020	Year of max Kyoto emissions	1.5C and 2C	cdr|max	-1000	363
167	0.749913	22	0.876825	26	2020	Year of max EI CO2 emissions	1.5C and lower 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-15	364
1	0.725108	47	0.87488	32	2100	Year of max Kyoto emissions	1.5C and 2C	cdr|max	-1000	365
118	0.752599	17	0.880982	10	2020	Year of max EI CO2 emissions	1.5C and lower 2C	cdr|max	-20	366
83	0.736425	37	0.869926	55	2100	Year of max Kyoto emissions	1.5C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-15	367
34	0.740188	36	0.874516	34	2100	Year of max Kyoto emissions	1.5C	cdr|max	-20	368

106	0.75928	14	0.882794	9	2025	Year of max EI CO2 emissions	1.5C and 2C	cdr|max	-20	369
66	0.731086	43	0.873351	37	2100	Year of max Kyoto emissions	1.5C and lower 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-20	370
122	0.751381	18	0.880862	13	2025	Year of max EI CO2 emissions	1.5C and lower 2C	cdr|max	-20	373
134	0.742193	34	0.874171	35	2020	Year of max EI CO2 emissions	1.5C	cdr|max	-20	374
138	0.74275	33	0.874797	33	2025	Year of max EI CO2 emissions	1.5C	cdr|max	-20	376
98	0.741272	35	0.874971	31	2100	Year of max EI CO2 emissions	1.5C and 2C	cdr|max	-20	378
65	0.720008	51	0.872412	40	2100	Year of max Kyoto emissions	1.5C and lower 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-1000	379
17	0.720008	52	0.872412	41	2100	Year of max Kyoto emissions	1.5C and lower 2C	cdr|max	-1000	381
166	0.745421	29	0.878488	21	2020	Year of max EI CO2 emissions	1.5C and lower 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-20	387
82	0.727532	46	0.872221	44	2100	Year of max Kyoto emissions	1.5C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-20	388
101	0.75022	21	0.880894	12	2020	Year of max EI CO2 emissions	1.5C and 2C	cdr|max	-1000	390
154	0.749474	23	0.880441	14	2025	Year of max EI CO2 emissions	1.5C and 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-20	394
165	0.73327	39	0.877332	23	2020	Year of max EI CO2 emissions	1.5C and lower 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-1000	396
81	0.716454	55	0.87124	48	2100	Year of max Kyoto emissions	1.5C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-1000	397
117	0.73327	40	0.877332	24	2020	Year of max EI CO2 emissions	1.5C and lower 2C	cdr|max	-1000	398
33	0.716454	56	0.87124	49	2100	Year of max Kyoto emissions	1.5C	cdr|max	-1000	399
153	0.744722	30	0.879869	16	2025	Year of max EI CO2 emissions	1.5C and 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-1000	401
105	0.744722	31	0.879869	17	2025	Year of max EI CO2 emissions	1.5C and 2C	cdr|max	-1000	403

146	0.728335	45	0.873519	36	2100	Year of max EI CO2 emissions	1.5C and 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-20	405
133	0.722674	50	0.870676	51	2020	Year of max EI CO2 emissions	1.5C	cdr|max	-1000	407
121	0.730413	44	0.877402	22	2025	Year of max EI CO2 emissions	1.5C and lower 2C	cdr|max	-1000	409
185	0.722961	48	0.871709	46	2025	Year of max EI CO2 emissions	1.5C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-1000	410
137	0.722961	49	0.871709	47	2025	Year of max EI CO2 emissions	1.5C	cdr|max	-1000	412
145	0.717115	53	0.872394	42	2100	Year of max EI CO2 emissions	1.5C and 2C	minimum.net. CO2.emissions .(Gt.CO2/yr)	-1000	414
97	0.717115	54	0.872394	43	2100	Year of max EI CO2 emissions	1.5C and 2C	cdr|max	-1000	416

Annex 3: Sample portfolios used for testing different aggregation methods

High impact portfolio

Company	CDP Activity	Portfolio weight	Investment value (€m)	Market owned emissions Scope 1+2 (tCO_2e)	Market owned emissions Scope 1+2+3 (tCO_2e)	Enterprise owned emissions Scope 1+2 (tCO_2e)	Enterprise owned emissions Scope 1+2+3 (tCO_2e)	Temperature score Scope 1+2 (°C)	Temperature score Scope 1+2+3 (°C)	Scope 1+2 emissions (tCO_2e)	Scope 1+2+3 emissions (tCO_2e)
Air Liquide	Inorganic base chemicals	10%	1.00					1.85	3.20		
BHP	Iron ore mining	10%	1.00					3.20	3.20		
CEMEX	Cement	10%	1.00					2.80	3.20		
Daimler AG	Automobiles	10%	1.00					1.50	1.70		
Air France - KLM	Passenger airlines	10%	1.00					3.20	3.20		
Norsk Hydro	Aluminum	10%	1.00					3.20	3.20		
Royal Dutch Shell	Oil & gas refining	10%	1.00					3.20	3.20		
Tata Power Co	Coal generation	10%	1.00					3.20	3.20		
Voestalpine AG	Iron & steel	10%	1.00					2.80	3.20		
LG Chem Ltd	Other base chemicals	10%	1.00					2.60	3.20		
Totals		100%	10.00	58,085	132,565	11,169	32,327			276,339,388	1,996,688,772

Medium impact portfolio

Company	CDP Activity	Portfolio weight	Investment value (€m)	Market owned emissions Scope 1+2 (tCO_2e)	Market owned emissions Scope 1+2+3 (tCO_2e)	Enterprise owned emissions Scope 1+2 (tCO_2e)	Enterprise owned emissions Scope 1+2+3 (tCO_2e)	Temperature score Scope 1+2 (°C)	Temperature score Scope 1+2+3 (°C)	Scope 1+2 emissions (tCO_2e)	Scope 1+2+3 emissions (tCO_2e)
3M Company	Specialty chemicals	10%	1.00					1.85	3.20		
ASML Holding	Electronic components	10%	1.00					3.20	3.20		
Bayer AG	Pharmaceuticals	10%	1.00					3.20	3.20		
Carrefour	Supermarkets, food & drugstores	10%	1.00					1.70	3.20		
Kone Oyj	Electrical equipment	10%	1.00					1.65	3.20		
LG Electronics	Household appliances	10%	1.00					1.60	3.20		
McDonalds Corporation	Fast food	10%	1.00					1.75	1.75		
OMRON Corporation	Industrial machinery	10%	1.00					1.80	3.20		
Saint-Gobain	Glass products	10%	1.00					2.00	2.00		
Atlas Copco	Industrial machinery	10%	1.00					3.20	3.20		
Totals		100%	10.00	1,120	16,280	637	9,888			25,271,661	284,071,011

Low impact portfolio

Company	CDP Activity	Portfolio weight	Investment value (€m)	Market owned emissions Scope 1+2 (tCO_2e)	Market owned emissions Scope 1+2+3 (tCO_2e)	Enterprise owned emissions Scope 1+2 (tCO_2e)	Enterprise owned emissions Scope 1+2+3 (tCO_2e)	Temperature score Scope 1+2 (°C)	Temperature score Scope 1+2+3 (°C)	Scope 1+2 emissions (tCO_2e)	Scope 1+2+3 emissions (tCO_2e)
Adobe, Inc	Software	10%	1.00					1.70	2.00		
Burberry Group	Apparel & footwear	10%	1.00					1.50	1.80		
Asahi Group Holdings, Ltd	Alcoholic beverages	10%	1.00					1.85	1.85		
Kellogg Company	Baked goods & cereals	10%	1.00					1.65	1.95		
Celgene Corporation	Biotechnology	10%	1.00					3.20	3.20		
Microsoft Corp	Software	10%	1.00					1.50	2.00		
Vivendi SA	Media	10%	1.00					3.20	3.20		
Danske Bank A/S	Banks	10%	1.00					1.60	3.20		
AXA Group	Insurance	10%	1.00					1.60	3.20		
Vodafone Group	Telecommunications services	10%	1.00					1.50	3.20		
Totals		100%	10.00	162	1,688	108	1,165			4,448,951	52,869,388

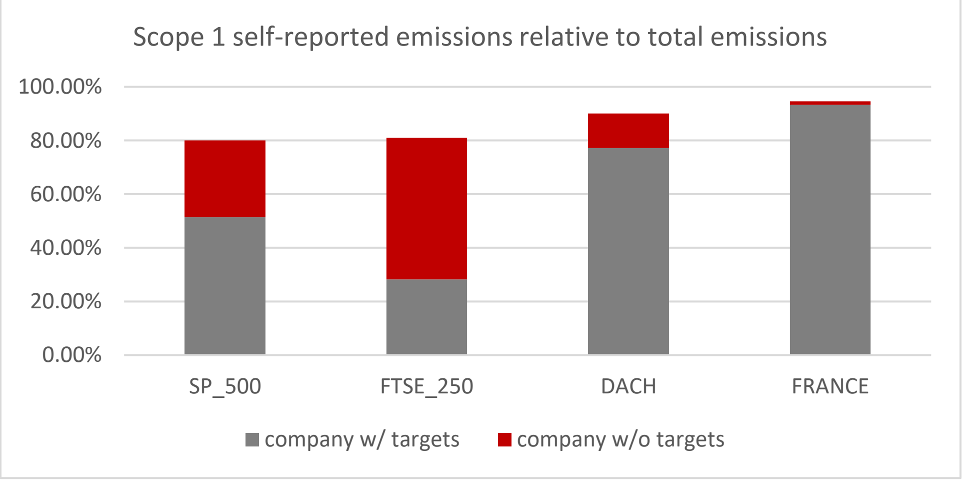
Annex 4: Coverage of sample indexes by companies with GHG emissions targets

In this annex, the percentage of companies with publicly reported GHG emissions targets and the percentage of companies with publicly reported GHG emissions inventories are examined in detail. The former is a partial indication of the direct applicability of the temperature scoring method to companies before assigning default scores, whereas the latter may be used for company score weighting in a portfolio and the calculation of default scores. It is only a partial indication of the direct applicability of the temperature scoring method because targets should also be applied to the most relevant emissions categories with a usable target class.

Four samples are assessed: the S&P 500, FTSE 250, CDP's "DACH" sample (proxy for DAX), and CDP's France sample (proxy for CAC). S&P 500 is associated with by far the greatest volume of emissions, as calculated from self-reported and estimated data (2,300 MT CO2e), while DACH and France are estimated at about 800 MT CO2e, each, and FTSE 250 is estimated at about 80 MT CO2e. In the following section, coverage is assessed based on CDP self-reported data, and in the subsequent section, an examination of non-responding companies in included.

Coverage assessment based on CDP Data

Figure 5 shows that at least 80% of total scope 1 emissions and 30-70% of total scope 2 emissions are self-reported, per sample. In the S&P 500, DACH, and France samples, target-setting companies are representative of the majority of total scope 1 emissions; while in the FTSE 250 sample, only around 30% of total scope 1 emissions are represented by target-setting companies. Total scope 2 emissions coverage by target-setting companies varies similarly by sample.



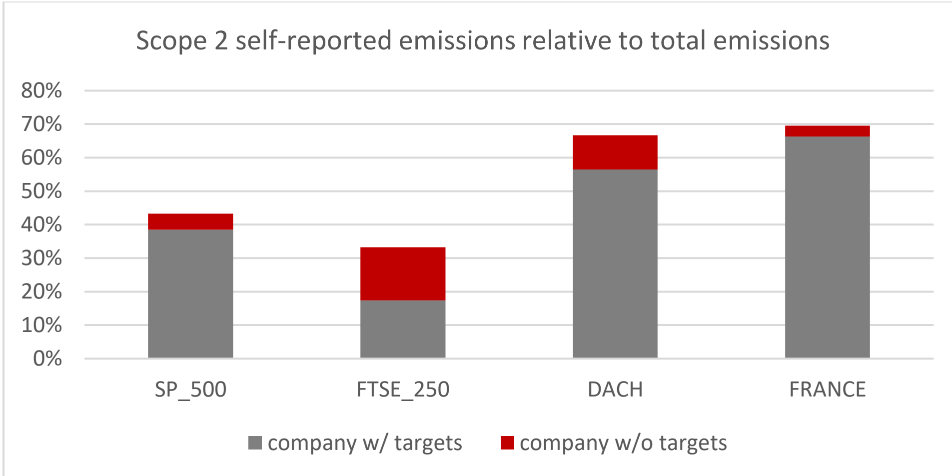


Figure 5: Percentage of emissions per sample that are self-reported to CDP (whole bar), relative to total sample emissions including estimates for scope 1 (top) and scope 2 (bottom). Each bar is broken down into companies with targets on any scope (blue) and targets without targets on any scope (orange).

Figure 6 shows that the unweighted proportion of companies in the S&P 500 sample with any target is similar to its share of total scope 1 emissions; however, for all other samples, the unweighted proportion of companies with any target is substantially lower than their share of total scope 1 emissions. In other words, although a small proportion of companies in the DACH and France samples have publicly reported targets, those that do represent an outsized fraction of total emissions. Total coverage may increase if previous years' data are also included.

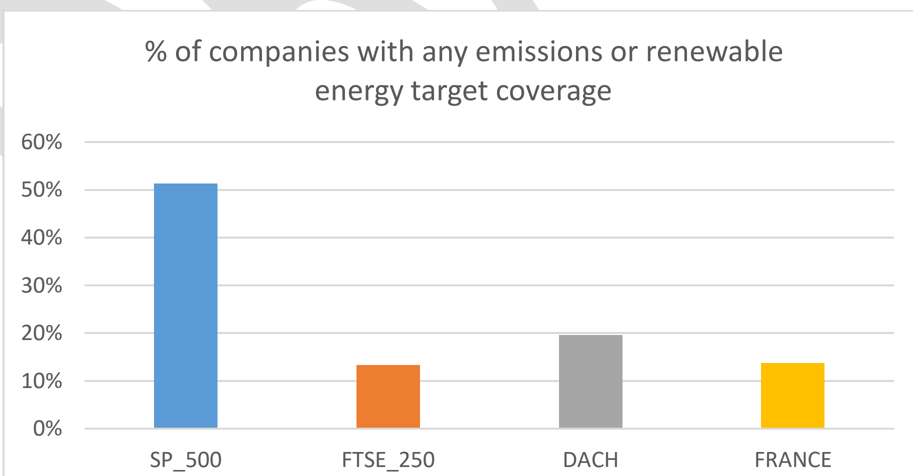


Figure 6: Percentage of companies with any emissions or renewable energy target in each index.

As expected, Figure 7 shows that scope 1 and scope 2 are well-covered by companies setting any targets, while scope 3 and RE targets are not reported as frequently. Interestingly, scope 3 targets are much more common (in relative terms) among companies in the DACH and FRANCE samples than the S&P 500 or FTSE 250 samples.

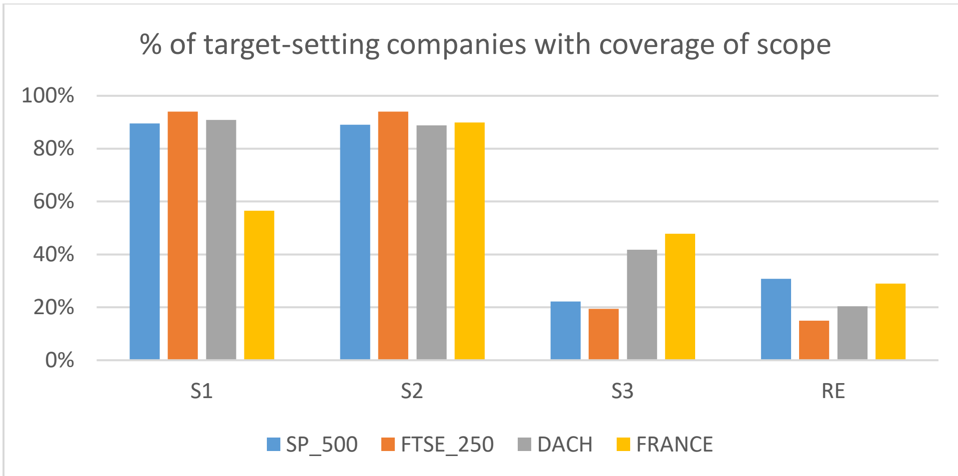


Figure 7: Percentage of companies with at least one target covering scopes 1, 2, 3, or RE, relative to companies in each sample that have reported at least one target.

Assessment of non-responding companies

Companies reporting GHG emissions targets to CDP are responsible for 48% of estimated scope 1+2 emissions in the S&P 500 sample, 25% of estimated scope 1+2 emissions in the FTSE 250 sample, 73% of estimated scope 1+2 emissions in the DACH sample, and 90% of estimated scope 1+2 emissions in the France sample. It is useful to examine how coverage would increase if companies without targets are included – either by assigning a default score or by including publicly available targets that may not have been reported to CDP.

For the S&P 500 sample, adding the top 10 highest emitting companies would increase emissions coverage to 80%. To surpass 90% coverage, the top 26 companies need to be added (Figure). Similarly for FTSE 250, adding the top 10 companies would increase emissions coverage to 81% and to surpass 90% coverage, the top 20 companies need to be added.

Only one company needs to be added for the DACH sample to surpass 80% coverage. Adding 10 companies would increase total coverage to 91%. Adding 10 companies to the France sample would increase total coverage to 97%.

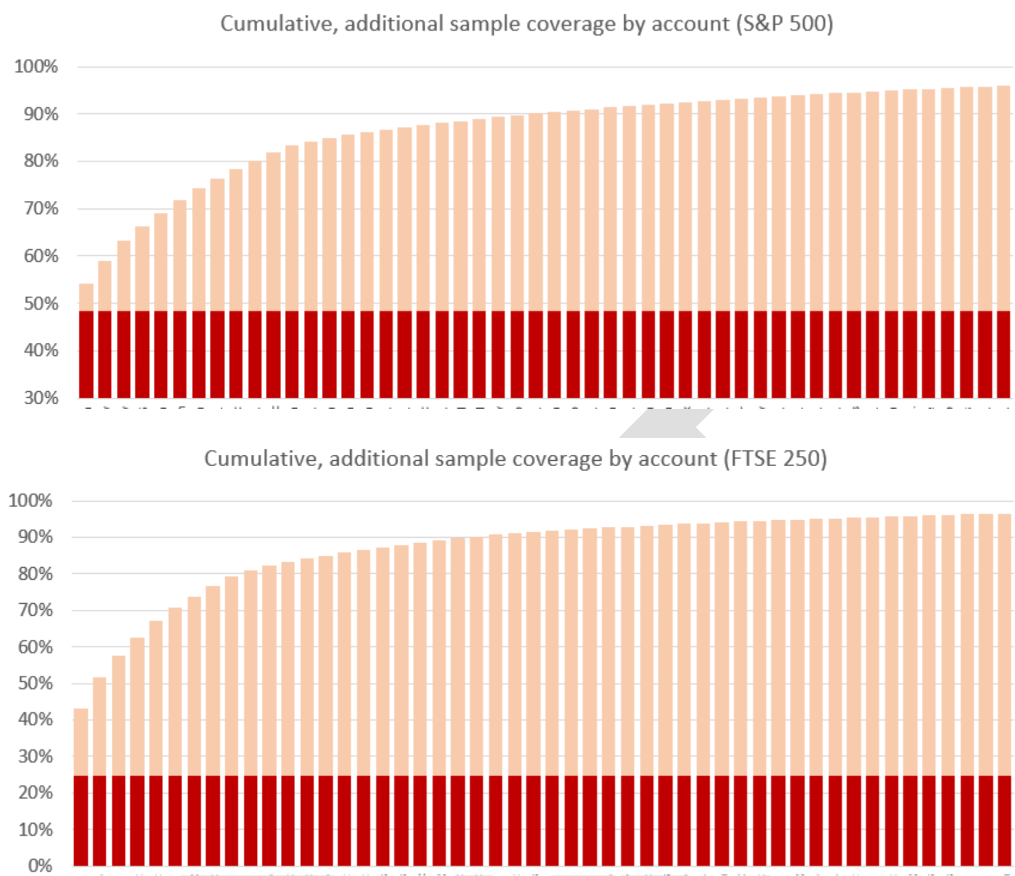


Figure 8: Additional coverage that could be achieved by including CDP target non-disclosing companies. Dark red bars show percentage of total estimated scope 1+2 emissions in the sample covered by CDP target-disclosing companies, while light red bars show the cumulative, additional coverage if target information for the highest emitting companies (left to right) were added or if they are assigned a default score.