Sustainability

Scenario Alignment

Methodology & Research Process

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METHODOLOGY AND RESEARCH PROCESS

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Introduction

ISS STOXX Enhances Its Scenario Alignment Analysis Approach

This paper presents the significant methodological enhancements to ISS STOXX's Scenario Alignment Solution in response to developments in best practice for climate scenario alignment modelling. The updated methodology was launched in March 2024.

The former methodology drew on the three climate scenarios provided by the International Energy Agency (IEA) World Energy Outlook 2021 (WEO2021), now discontinued. The solution has enabled investors to assess how their portfolios are aligned with climate scenarios and objectives.

Since 2020, new science-based scenarios have emerged and gained recognition in the financial industry, including within the IEA WEO scenario offering. Furthermore, market initiatives to standardize scenario alignment assessments have continued to develop. First initiated by TCFD's Portfolio Alignment Team in 2020, the Glasgow Financial Alliance for Net Zero (GFANZ) continued efforts (see section Context - GFANZ below). Consequently, in March 2024, ISS STOXX launched a suite of enhancements that constitute a change in the breadth and depth of scenario alignment, giving more comprehensive, granular, and flexible outputs.

This new methodology is referred to as ISS STOXX's Scenario Alignment and is described in this document.

The purpose of this Scenario Alignment is to measure the alignment of an issuer's or portfolio's future emissions against a specific emissions pathway or set of pathways. Pathways in this context are defined as the scenario-related emissions trajectories (on an aggregate, sectoral, or regional basis). The new Scenario Alignment enables assessments at a higher level of granularity per scenario and allows for tracking of issuers' realized emissions against industry average projected emissions and an issuer's own target projections.

It incorporates major enhancements, including:

- Choice of three main sources of science-based scenarios, including the IEA, the One Earth Climate Model (OECM), and the Network for Greening the Financial System (NGFS)
- Additional Net Zero Aligned scenarios with a total of more than 20 scenarios
- Inclusion of all 3 emissions scopes, providing a holistic view of alignment at issuer level
- A cumulative emission approach as opposed to a point-in-time analysis of a company's emissions alignment, providing a more accountable approach to emissions projections
- Three types of projected emissions per company, allowing for an assessment based on either historical growth rate, industry average (policies), and target-based projections
- Greater regional and sectoral granularity

Underlying Concepts / Frameworks

Context - GFANZ

GFANZ conducted a survey of market participants, including ISS STOXX, in Q1 2022, with the aim of establishing best practice for scenario alignment and implied temperature scores. Following the survey, GFANZ[1] published a public consultation in the summer of 2022, presenting 9 key judgements to be considered when undertaking scenario alignment, in which ISS STOXX also participated.

ISS STOXX's current approach is well aligned with 7 of these key judgements (please refer to Appendix 1: GFANZ Key Judgements for further information).

Process Structure

The Scenario Alignment data production process follows a series of steps as laid out below:

1) The Collection phase: where the data requirements from scenario providers, models, and issuer data are harvested for treatment in the subsequent steps.
    - Scenario data entails various scenario providers, models, and a range of scenarios that are ingested and evaluated.
    - Issuer data entails collecting historical emissions, production data, or revenues.
2) The Mapping phase: a substantial exercise that is necessary to provide the level of detail needed for the calculation of carbon budgets, an issuer's projected emissions, the resulting alignment, and other metrics provided. It includes:
    - Mapping scenario sectors to a classification framework of economic activities (NACE)
    - Expanding scenario data at sectoral and regional level
    - Mapping company scope emissions to the scenario industry emissions pathways
3) The Projection phase: leveraging the extended scenarios and mapping between the scenario sectors and NACE activities. It involves:
    - Calculating the carbon budget, which is allocated to a company using the 'fair-share' principle. It also takes into consideration past emission performance of an issuer to adjust their carbon budget profile.
    - Projecting the issuer's future emissions in three different trajectories independently of the carbon budget calculations. Projected emissions will be derived based on historic trends, industry average growth rate, or company specific targets.

[1] GFANZ Measuring Portfolio Alignment (November 2022) Measuring-Portfolio-Alignment-Enhancement-Convergence-and-Adoption-November-2022.pdf (bbhub.io)

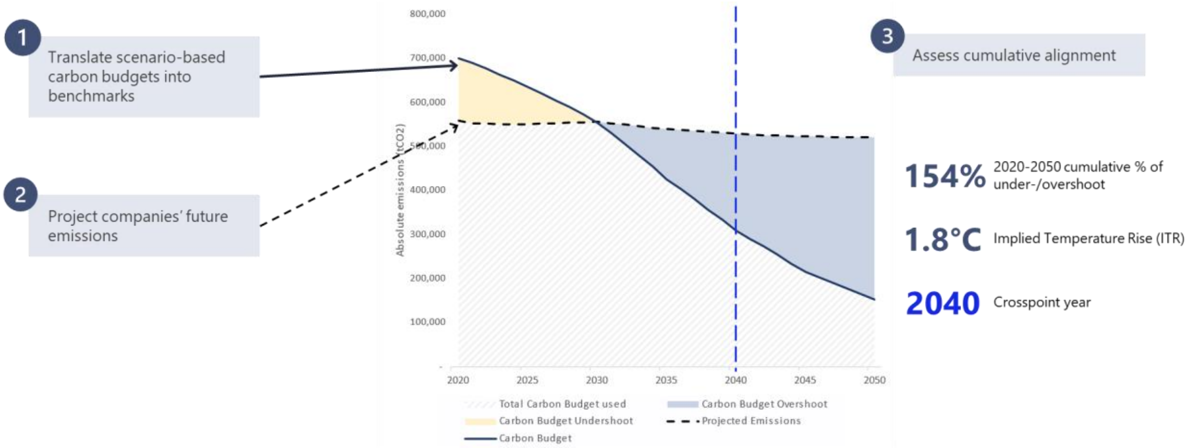
4) The Output phase: calculating the result of the projected emissions against the various scenarios' allocated carbon budgets. The key result factors are:
   - Cumulative alignment
   - Implied temperature rise
   - Crosspoint year

Methodology Summary

The purpose of the model is to measure the alignment of an issuer's or portfolio's future emissions against a specific emissions pathway or set of pathways. The methodology to calculate alignment of an issuer to a scenario can be summarized in 3 steps as defined below.

Absolute emissions are compared to an allocated carbon budget based on a mapping using NACE and region information. The alignment is measured as a relative value (%), an Implied Temperature Score (ITR), as well as a crosspoint year and can be done for two distinct combinations: Scope 1 & 2 and for Scope 1, 2 & 3.

Figure 1: Modelling Steps to Assess Company or Portfolio Alignment



Source: ISS STOXX

- The first step consists of translating science-based carbon budgets into benchmarks for an issuer or portfolio. Scenario Alignment leverages sectoral and regional emissions pathways from various climate models (IEA, NGFS & OECM) to derive company-specific carbon budgets expressed in absolute terms. The Scenario Alignment solution covers 25 scenarios, assessing a wide range of possible futures in terms of socio-economic and technological developments, and projected temperature rise ranging from 1.5°C to 3°C.

  ISS STOXX has developed a framework to harmonize the number of sectors used in the scenarios provided by IEA, NGFS, and OECM, which vary from model to model. This enables comparison across scenarios and budgets. Carbon budgets are allocated to companies according to their sector and geographical footprint based on a 'fair-share'2 basis. The 'fair-share' approach compares the current emissions intensity of a company to the sector average intensity and allocates carbon budget accordingly. The intensity can be calculated based on an economic or production denominator. The comparison is also calculated for each year of available realized emission data in order to re-calibrate the 'share'.

- The second step is to project companies' emissions up to 2050, using one of three approaches: historical, policies or target. For each company, the user can contextualize past trends in historical emissions (historical approach), integrate a forward-looking view of the sector's emissions (policies approach), or account for any potential GHG reduction target (target based).
- Finally, alignment is measured by comparing future emissions with scenario budgets on a cumulative basis. The Intergovernmental Panel on Climate Change (IPCC) shows that the rise in Earth's temperatures is proportional to cumulative absolute emissions.

The alignment of an issuer depends on (1) the scenario selected (e.g., IEA Net Zero, NGFS REMIND Current Policies) and (2) the projection methodology used to forecast the issuer's future emissions (i.e., historical, policies, or target). The results of the analysis are:

- A percentage of cumulative alignment, where undershoot is less than 100% and overshoot more than 100%, is calculated at short-term (2030) and longer-term time-horizons (2050). This is the factor root name denominated as ***ClimateCuAlign***[3]
- A crosspoint year which indicates when the cumulative projected emissions surpass the overall Net Zero cumulative budget. This is the factor root name denominated as ***ClimateCrsptYr***
- An implied temperature rise (ITR) metric which is obtained by linearly applying the transient climate response to cumulative emissions of carbon dioxide (TCRE) to the cumulative alignment score as described above. This is the factor root name denominated as *ClimateITR*

Sources / Inputs

Scenarios

The first step to scenario alignment is choosing the correct scenario, and therefore the Scenario Alignment solution allows for the selection of a range of various scenarios, each not only different in its implied temperature trajectory but in its underlying assumptions. The 25 scenarios used in the solution are based on five distinct Integrated Assessment Models (IAM) from three internationally recognised providers. These scenarios cover a range of implied temperature rises from 1.5 degrees Celsius to beyond 3 degrees Celsius.

[2] Using the term 'fair-share' as defined by GFANZ. Does not reflect ISS's value judgement on the notion of a fair allocation of carbon emissions.
[3] Note
Please note that throughout the methodology where a factor included in the dataset is refered in its factor name it will be displayed as FactorName

For ease of reference, below are the links to the following sections defining commonly used terms throughout the methodology:
An overview of factors: Issuer-Level Factors: Navigating the Combination of Results
A glossary of terms which are used throughout the document: Glossary

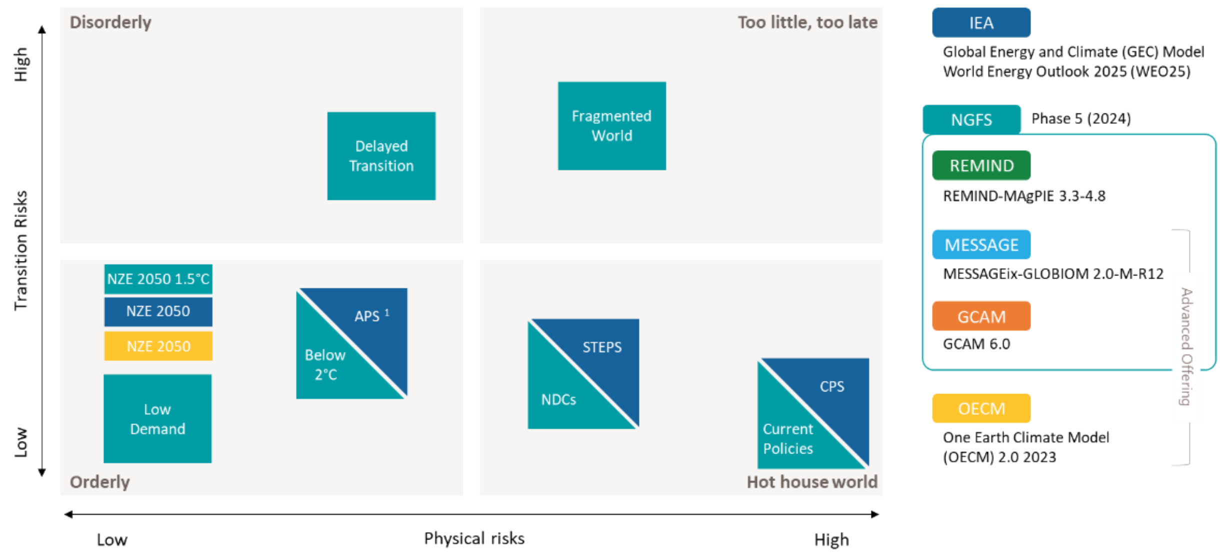
The process of selection and evaluation of the scenarios from each model has been described in detail in ISS STOXX's thought leadership piece on scenario analysis A Guide to Climate Scenario Analysis: A Framework of Guiding Principles.

Diversity of models equates to a diverse range of assumptions and resulting scenario emissions pathways. This is to be expected based on the goal that each model was set to fulfill and the type of assumptions such as underlying Socio-economic paths and technological developments. These are detailed in *Appendix 2: Scenario Descriptions*.

Scenario Overview

The public scenarios discussed here were selected for their widespread use by financial institutions (FI) and their publicly available data and documentation. Sources include the International Energy Agency (IEA) World Energy Outlook (WEO) 2025, the Phase V of the Network for Greening the Financial System (NGFS), and the One Earth Climate Model (OECM). In Figure 2, the IEA, OECM, and NGFS pathways are positioned according to their relative climate-related transition risks and physical risks, although physical risks are not explicitly modelled in IEA and OECM.

Figure 2: Selected Scenarios Pathways4



Notes: NZE = Net Zero Emissions, APS = Announced Pledges Scenario, STEPS = Stated Policies Scenario, CPS = Current Policies Scenario, NDCs = Nationally Determined Contributions. Yellow = OECM; blue = IEA; green = NGFS. Quadrants "disorderly, orderly, too little too late and hot house world" are NGFS' definition for groups of scenarios.
[1] APS was last updated in World Energy Outlook 2024 by the IEA
Source: ISS STOXX Research, adapted from NGFS for illustrative purposes only.

[4] This mapping reflects ISS STOXX's interpretation of the NGFS scenario quadrant framework and has been done in an effort to extend the framework to other scenarios.

There are, in total, 25 scenarios based on five different Integrated Assessment Models (IAMs), including seven NGFS pathways run on three IAMs (GCAM, MESSAGEix-GLOBIOM, and REMIND-MAgPIE). IEA and NGFS models can be used to assess the impact of various levels of transition risks, which are linked to the stringency and coordination of climate actions.

International Energy Agency (IEA)

The International Energy Agency (IEA) is an autonomous intergovernmental organization created in 1974 to provide a collective response to disruptions in the supply of oil. It now provides research, statistics, analysis, and recommendations on energy policy, market trends, and future scenarios.

The IEA's flagship World Energy Outlook (WEO) provides global energy analysis using a scenario-based framework. Updated annually, it assesses the full energy system and shows how future outcomes vary with changes in technologies, markets, and government policies. The WEO includes both *exploratory scenarios* based on current and evolving policy assumptions and *normative scenarios* that map pathways to achieving specific energy and emissions goals. This multi-scenario approach highlights the choices, uncertainties, and implications that shape possible energy futures.

Table 1: IEA World Energy Outlook Scenarios

SA2.0 VERSION	MODEL	SCENARIO	ASSOCIATED TEMPERATURE (in 2100, with 50% chance)
2024	WEO 2022	Net Zero by 2050	1.5°C
		Announced Pledges Scenario (APS)	1.9°C – 2.3°C
		Stated Policies Scenario (STEPS)	2.4°C – 2.8°C
2025	WEO 2024[5]	Net Zero by 2050	< 1.5°C
		Announced Pledges Scenario (APS)	1.7°C
		Stated Policies Scenario (STEPS)	2.4°C
2026	WEO 2024	Announced Pledges Scenario (APS)	1.7°C
	WEO 2025[6]	Net Zero by 2050	< 1.5°C *(peak at c.1.65 °C in 2050)*
		Stated Policies Scenario (STEPS)	2.5°C
		Current Policies Scenario (CPS)	2.9°C

Network for Greening the Financial System (NGFS)[7]

The Network for Greening the Financial System (NGFS) is a group of central banks and supervisors, these scenarios are instrumental in assessing climate-related risks and opportunities for financial stability and economic growth.

[5] IEA (2024), World Energy Outlook 2024, IEA, Paris , Licence: CC BY 4.0 (report); CC BY NC SA 4.0 (Annex A)
[6] IEA (2025), World Energy Outlook 2025, IEA, Paris https://www.iea.org/reports/world-energy-outlook-2025, Licence: CC BY 4.0 (report); CC BY NC SA 4.0 (Annex A)
[7] ISS STOXX's data incorporates data obtained from the Network for Greening the Financial System ("NGFS"). The NGFS material is subject to a public license. The NGFS material is available at the following URL: https://data.ene.iiasa.ac.at/ngfs and NGFS Climate Scenarios for central banks and supervisors - Phase V | Network for Greening the Financial System

There are three different models under NGFS, each containing the same set of seven scenarios. Note that the Divergent Net Zero scenario from Phase III has been discontinued, but two new scenarios were added: Low Demand and Fragmented World.

Table 2: NGFS Scenarios

SA2.0 VERSION	MODEL	SCENARIO	ASSOCIATED TEMPERATURE (in 2100, with 50% chance)
2024	• REMIND-MAgPIE 3.0-4.4 • MESSAGEix-GLOBIOM 1.1-M-R12 • GCAM 5.3+ NGFS	Net Zero 2050	1.5°C
		Divergent Net Zero	1.5°C
		Below 2°C	1.6°C - 2°C (67% chance)
		Delayed transition	1.6°C - 2°C (67% chance)
		Nationally Determined Contributions (NDCs)	2.6°C
		Current Policies	3°C +
2025 2026	• REMIND-MAgPIE 3.3-4.8 • MESSAGEix-GLOBIOM 2.0-M-R12-NGFS • GCAM 6.0 NGFS	Low Demand	1.1°C
		Net Zero 2050	1.4°C
		Below 2°C	1.8°C
		Delayed transition	1.7°C
		Nationally Determined Contributions (NDCs)	2.3°C
		Fragmented World	2.4°C
		Current Policies	3°C

The REMIND-MAgPIE goal is to find the optimal mix of investments in the economy and the energy sectors of each of its modelled geographical regions. Population, technology, policy, and climate constraints are accounted for. It also accounts for regional trade characteristics on goods, energy fuels, and emissions allowances.

The MESSAGEix-GLOBIOM model at its core is a technology-detailed energy-engineering optimization model used for energy planning.

GCAM is an integrated, multi-sector model that explores both human and Earth system dynamics. Its role is to provide scientific insights on how multiple human and physical Earth systems interact together.

One Earth Climate Model (OECM)

In 2022, the UN-convened Net Zero Asset Owners Alliance (NZAOA) and the European Climate Foundation (ECF) commissioned the University of Technology Sydney (UTS) to build the One Earth Climate Model (OECM)[8]. The OECM is the result of a two-year collaboration with 17 leading scientists at the University of Technology Sydney (UTS), two institutes at the German Aerospace Center (DLR), and the University of Melbourne's Climate & Energy College.

[8] Teske, S. (2022) et. al., Achieving the Paris Climate Agreement Goals- Part 2: Science-based Target Setting for the Finance industry — Net-Zero Sectoral 1.5˚C Pathways for Real Economy Sectors. Springer, Cham. https://doi.org/10.1007/978-3-030-99177-7

Table 3: OECM Scenario

MODEL	SCENARIO	ASSOCIATED TEMPERATURE (in 2100, with > 50% chance)
OECM	Net Zero by 2050	1.5°C

The 2023 outputs of the OECM[9] now provide granular pathways for more than 20 regions. Note that Net Zero by 2050 scenario now uses a c.50%+ probability of achieving 1.5°C compared to 67% chance in its previous iteration.

Issuer Coverage

This Scenario Alignment solution covers equity and corporate debt entities which are covered by ISS STOXX's emissions database which represent c.30k+ issuers, including reported and modelled emissions.

Please refer to the ISS STOXX Carbon Footprinting Methodology for further details.

The methodology does not include any sovereign nor individual real-estate assets.

Issuer Data Requirements

At baseline, internal solutions as well as third-party vendors' data are leveraged after the collection of scenario data to ingest issuer-level data.

- The solution requires at least one year of emissions and financial data between 2020 and the last published fiscal year[10].
- Emissions used are sourced from ISS STOXX's emissions database. High quality reported data and modelled emissions data are used. *Please see the ISS STOXX Carbon Footprinting Methodology for full detail.*
- Production data or revenue data is required to perform the 'fair-share' carbon budget allocation.
- GHG Reduction targets are used for the issuer projected emissions.

Table 4: Issuer Data Requirements

SOURCE	NAME	USAGE
ISS STOXX	Carbon Footprint	Emissions
ISS STOXX	Energy & Extractives	Fossil Fuels Production and Electricity generation
External	Third-party vendor	Financial Data; Geographic Distribution of Property, Plants and Equipment; Sector Classification
ISS STOXX	Environment & Social raw data	GHG Reduction Target Data

[9] Teske, S., Rispler, J., Niklas, S. et al. Net-zero 1.5 °C sectorial pathways for G20 countries: energy and emissions data to inform science-based decarbonization targets. SN Appl. Sci. 5, 252 (2023). https://doi.org/10.1007/s42452-023-05481-x
[10] The current baseline is set at 2020 as all scenario's remaining carbon budget assumptions are based on 2020-2050. The last published fiscal year will increase every year and is therefore not a static upper year ceiling. It is usually set as Current Year – 2. For example, for a 2026 analysis, FY2024 emissions will be available.

Assessment Process

Mapping Phase: Bridging Scenario Sectors and Issuers Activities

This Scenario Alignment solution provides a consistent framework to map issuers' main activities to the scenario sectoral emissions pathways. The methodology framework is described in subsequent sections and acknowledges:

- Which of the three scopes of emissions are included in the scenario sectoral pathways (see *Sector and Scope Mapping*) and how individual scope of emissions can be mapped to the pathways
- The varying level of sectoral granularity between models (see *Sectoral Granularity)*
- The varying level of regional granularity between models (see *Regional Granularity)*
- The need to expand variables across models to harmonize granularity, sector, and region where possible, between scenarios. This is to ensure that financial institutions have their exposures mapped as accurately and consistently as possible across models. (see *Expansion Degree*)

This methodology for Scenario Alignment therefore relies on an expanded sectoral division, where possible, and a proprietary mapping of issuers' scopes of emissions to the scenario sectors.

Issuers are mapped to their relevant scenario sectoral emissions pathways using their main activity of operations as defined by the Nomenclature of Economic Activities (NACE). NACE is a classification of economic activities developed by the European Union which classifies activities into a 4-level hierarchical structure. NACE comprises highest level categories named Sections, e.g., B – Mining and quarrying, and NACE Classes, at the most granular level, e.g., 05.10 – Mining of hard coal (see *Sector and Scope Mapping*).

Sector and Scope Mapping

Defining Sectoral Emissions Scopes

The disaggregation of corporates emissions data into scope 1, 2, and 3 emissions is a well-established standard, as defined by the GHG Protocol in their Corporate Accounting and Reporting Standard.

The scenario sectoral pathways do not explicitly state which scopes of emissions are embedded therein. Therefore, to map individual emission scopes to sectors it was necessary to develop a framework to bridge the gap between corporate and sectoral scopes of emissions.

Within that scope mapping framework, emission scopes are broken down into distinct categories such as:

- **Scope 1:** Direct emissions from owned or controlled sources.

  Therefore, the scope 1 of an issuer is defined as its sector-specific emissions as opposed to the company-specific scope 1 emissions. For example, the emission of vehicles used by an issuer in the steel sector wouldn't be accounted within their scope 1, only its steel production related direct emissions.

- **Scope 2:** Indirect emissions from the generation of purchased electricity, steam, heat, or cooling consumed.

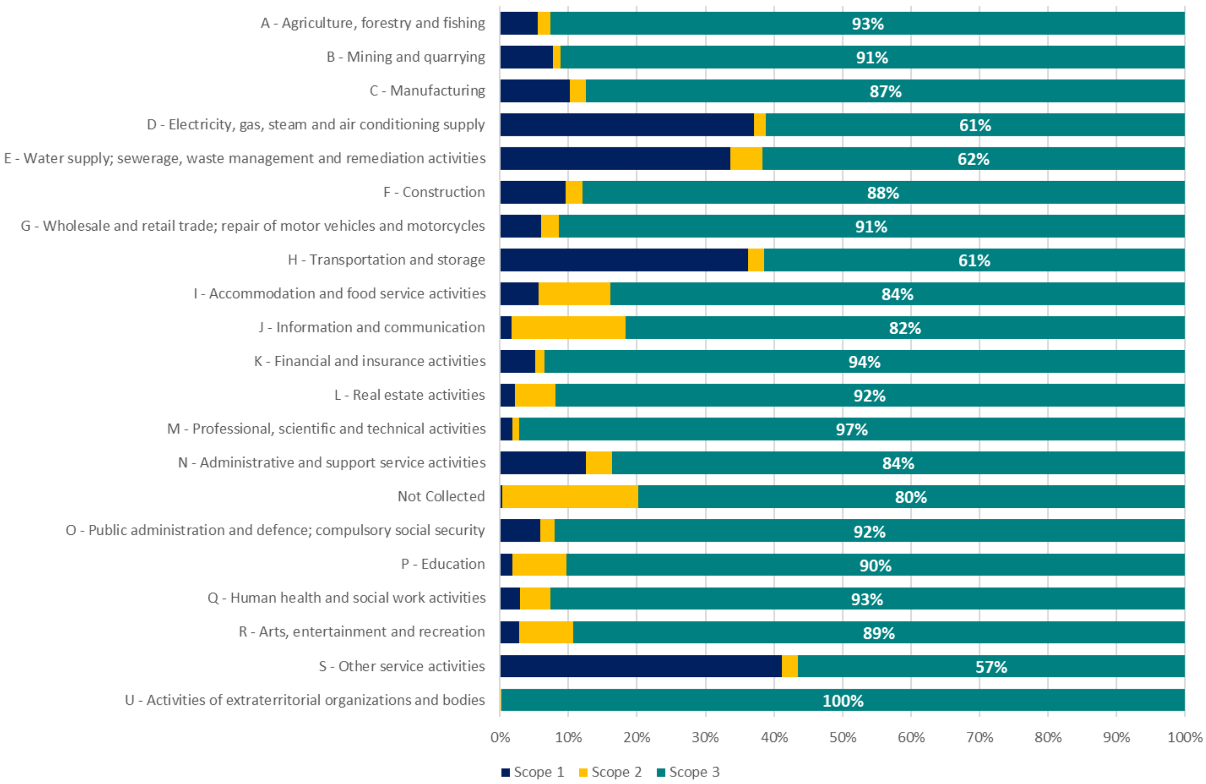
  Due to the lack of available data, the actual electricity demand is not reported for most industry sectors or sub-sectors. Therefore, only **sector-specific electricity consumption is used**, as opposed to company-specific electricity consumption.

  For instance, Scope 2 emissions for industrial sectors focus on the sub-sectors projected future electricity consumptions under the assumed electricity-generation mix (e.g., electricity used in Electric Arc Furnaces for Steel), and electricity used in office buildings for those sectors will be ignored. This approach is conservative from a global carbon budget perspective and the share of those emissions is deemed marginal.

- **Scope 3:** Includes all other indirect emissions and are often the greatest share of the carbon footprint, as shown in Figure 3 where scope 3 represents between 60% to 100% of emissions of corporates that are classified at NACE section level.

  Due to data limitation, not all 15 categories are analysed and allocated carbon budget separately. The dominant scope 3 emission profile is mapped to its most relevant pathway.

Figure 3: Share of Emissions per Scope at NACE Section Level



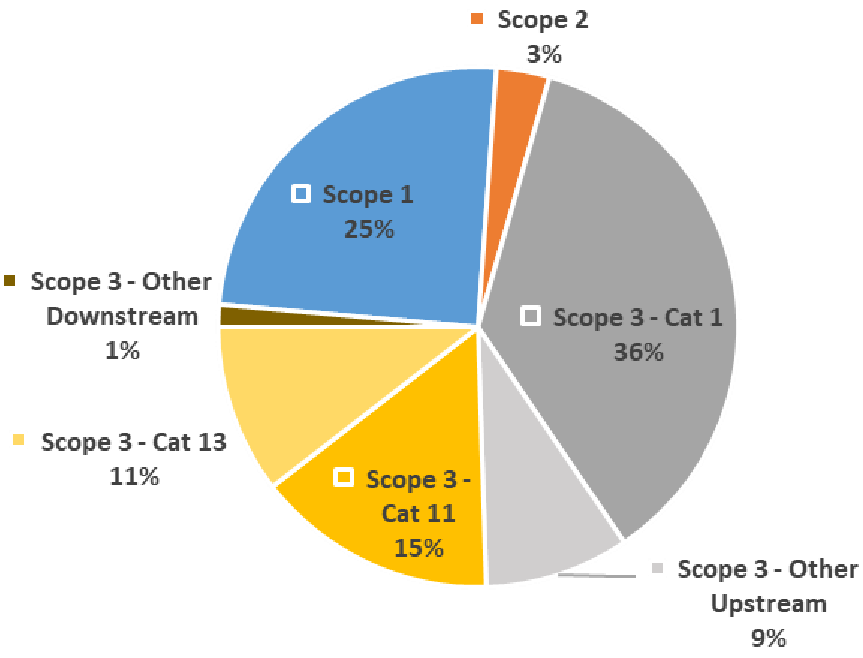
Based on ISS STOXX universe of Scope 1 & 2 reporting companies for FY2021 (n ≈ 7,400)

Benefits of Emissions Scopes Disaggregation

Disaggregating an issuer's total emissions into multiple scopes is important in the scenario alignment methodology as it:

- Reflects the total climate impact of the companies' business activities and supply chain.
- Avoids 'Scope leakage', as described by the Science Based Target initiative (SBTi)11. Depending on the ownership structure and level of integration of the company, emissions may be reported at the corporate level as Scope 1 if the source of emissions is owned or as Scope 3, otherwise. Looking at companies in the Trucking sector in Figure 4, Scope 1 represents on aggregate c.25% of the sector's emissions and Scope 3 accounts for c.72%. Nevertheless, the proportion of scope 1 and scope 3 emissions varies significantly at company-level due to the company owning its vehicle fleet or not. By mapping all three emission scopes—Scope 1, Scope 2, and Scope 3—the possibility of arbitrage within scenario alignment assessments is reduced.
- Allocates the correct pathway of emissions to the corresponding sector. For instance, the scope 3 of an automotive manufacturer and the scope 1 of car fleet management company will both relate to the Transport Sector (mainly emissions from combustion of fuel in vehicles).

Figure 4: Scope 3 Emissions by Scope for Companies in the Trucking Sector



Based on ISS STOXX's proprietary CICS sector classification. Includes reported and estimated emissions. Scope 3 reported emissions by category were used as a proxy to split estimated Scope 3 upstream and downstream emissions.
Source: ISS STOXX Climate data for FY2021

[11] This particularly relevant for industrial sectors such as Cement, in which companies may be more or less integrated, as well as the Transport sector

Scope Mapping

The Scenario Alignment methodology aims to allocate the relevant pathway to the main carbon-intensive activities of the companies, as defined by the company's emissions scope. The mapping is done through an expert judgement mapping proprietary to ISS STOXX and reconciles issuers' NACE sector of activity. The mapping reconciles the issuer emissions scopes to that of the scenario sectoral pathways as illustrated in the Figure 5 below.

In the example provided, a car manufacturer can be mapped to the 'other industry' sector for its Scope 1 and 2 emissions under the scenario sectoral pathways, whereas its scope 3 emissions relating to car emissions are mapped to the 'automobile' sectoral pathway. For the second company in the data processing industry, its scope 1 and 2 emissions will be mapped to the 'services' emission pathway under the relevant scenario. However, no scope 3 emissions have been identified at the pathway level, and therefore a fallback methodology to a default contraction rate (for the given scenario) is used.

Figure 5: Sector and Scope Mapping Illustration

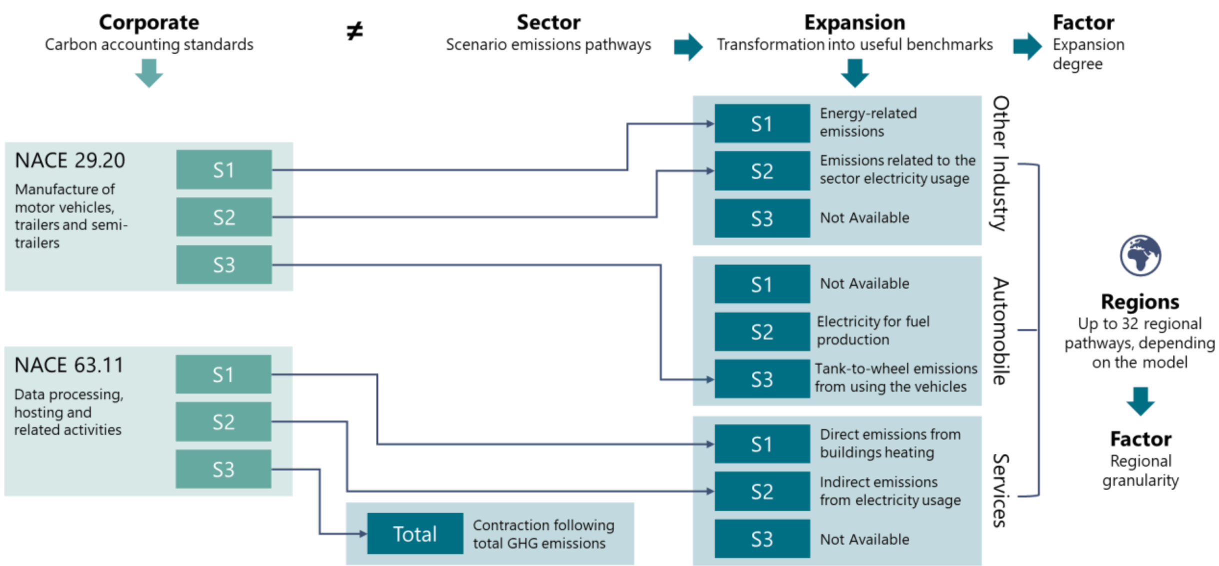


Figure 5 displays both a need to harmonize scope definitions between issuer and scenario sectoral pathways and the definition of the scenario sectors themselves, to become a useful benchmark (see *Glossary*), through a process called the expansion degree, which follows below.

Sectoral Granularity

Expansion Degree

Financial Institutions (FI) have exposure to a range of sectors, which differ in their emissions profiles and decarbonization potential. For instance, some sectors are considered hard to abate due to high abatement costs and/or the lack of low-carbon or substitute technologies. Whereas other sectors will see the biggest potential for Net Zero Transition such as the power sector.

The scenarios emissions pathways included in the Scenario Alignment solution provide different levels of sectoral granularity, ranging from around 10 to 20 distinct sub-sectors. The main difference across emissions pathways is the granularity of the '*other industry'* sector. If left untreated, this would mean that an issuer could be tallied to the sector '*other industry'* under one model and a specific subsector in another. The conclusions on its carbon budget under the different scenarios and alignment therefore would not be as informative.

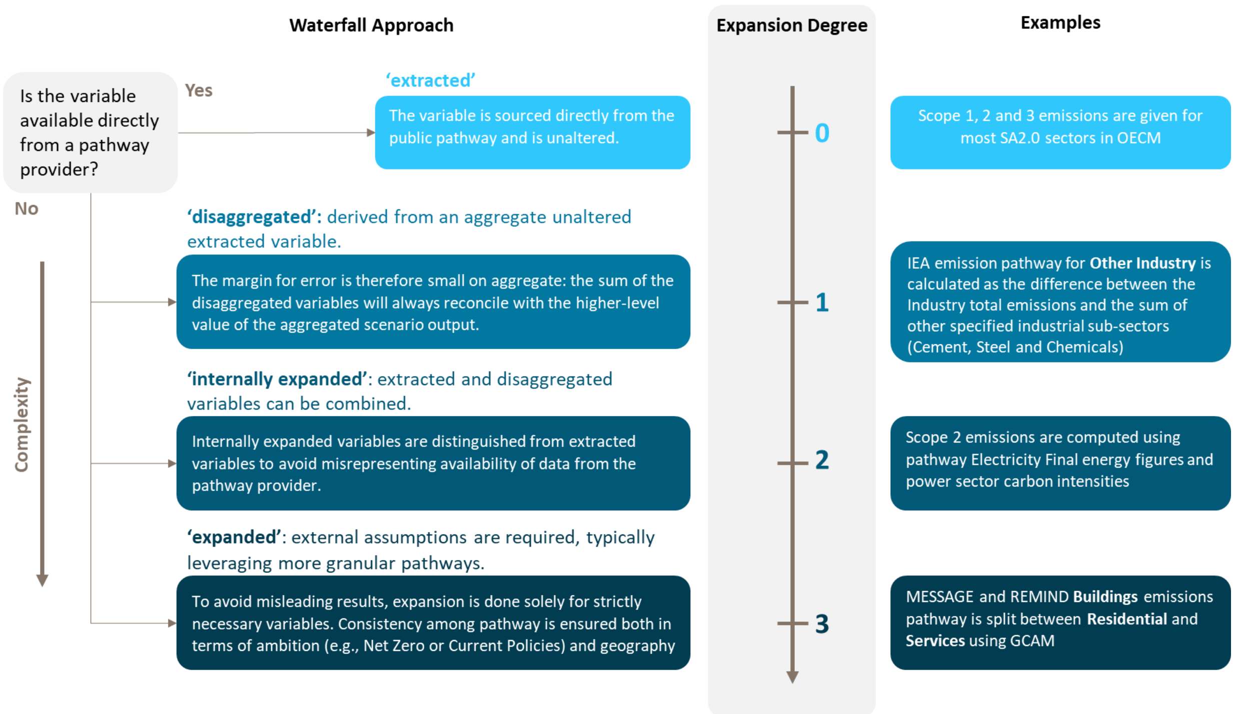
Therefore, developing the expansion of sectoral, and regional, pathways to enhance comparability of outputs across models is to be considered. The mapping of issuer's sector of activity to the appropriate scenario sector emissions pathway(s) is the biggest driver of carbon budget allocation.

A harmonization framework has been developed in this Scenario Alignment Methodology to increase the granularity between scenario models, getting insightful and actionable outputs. The extent of harmonization required has been labeled as *expansion degree* in the Scenario Alignment methodology.

Figure 6 describes four levels of expansion, ranging from data directly extracted from public sources to data expanded using external sources.

Typical examples are the creation of a Scope 2 pathway for the sector using the electricity consumption and power sector carbon intensities from the scenario, or disaggregating emissions pathways from residential and commercial buildings and distinguishing the different transport sub-sectors.

Figure 6: Expansion Degree Waterfall Approach



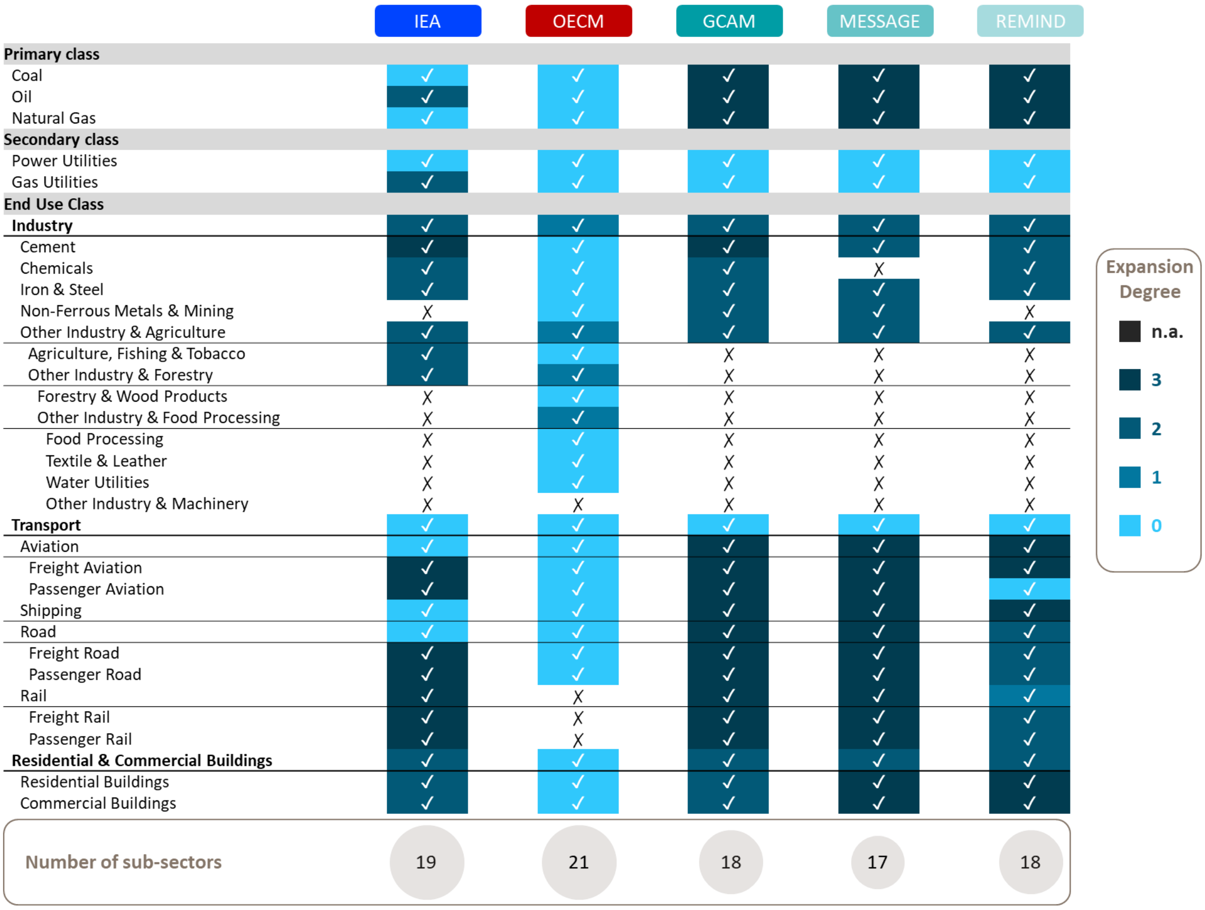
The resulting expansion degree score (factor name *ClimateExpDeg*) indicates the level of transformation required to harmonize scenarios across providers. The score is provided by scenario, as defined below:

Table 5: Expansion Degree Definition

EXPANSION DEGREE	DEFINITION
0	The variable is sourced directly from the scenario and is unaltered
1	The variable is disaggregated, it is derived from an aggregate unaltered extract variable
2	Extracted and disaggregated variables can be combined
3	External assumptions are required, typically leveraging more granular scenarios

Figure 7 shows that the approach helped increase the sector granularity of the pathways, from a minimum of 10 to 17 sub-sectors. This approach increases the mapping of subsectors and their emissions scopes.

Figure 7: Highest Sectoral Granularity per Model, and Associated Levels of Derivation



Source: ISS STOXX Research

Table 6 shows the expansion degree for the emissions pathways of the Iron & Steel sector under IEA and OECM as an example. OECM provides directly scope-specific pathways, thus, each are given a score of 0. The IEA Scope 2 emissions pathway is derived from data internal to the scenario (energy and intensity variables), whilst external assumptions are required to expand the Iron & Steel pathway into scopes 1 and 3. The resulting average expansion degree score is therefore 2.7 for IEA.

Table 6: Expansion Degree for the Iron & Steel Sector

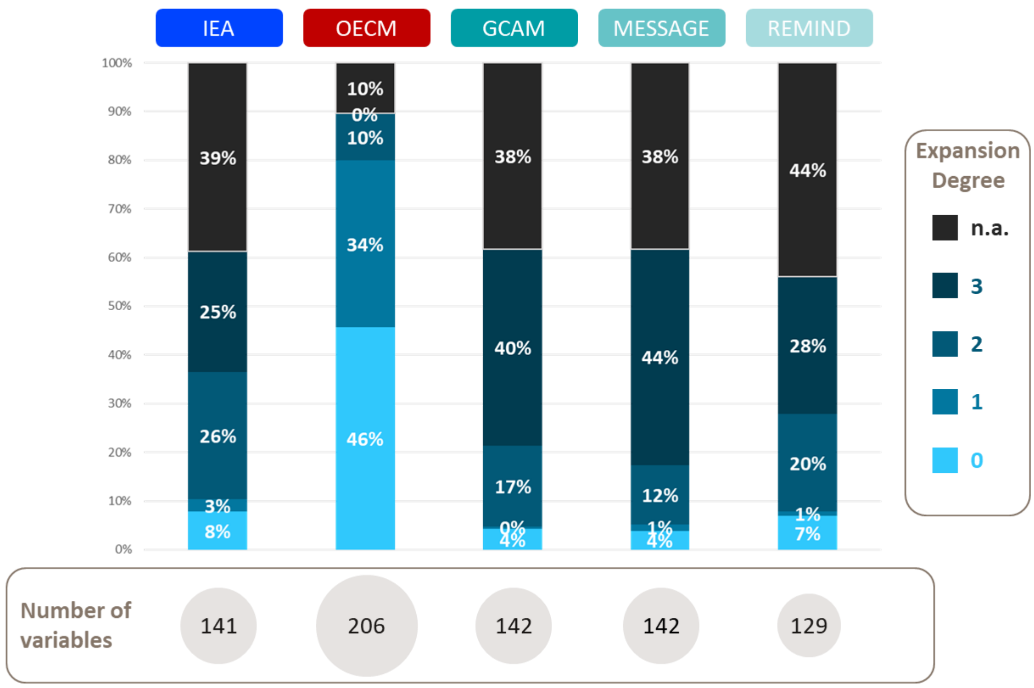
	OECM	IEA
Scope 1	0	3
Scope 2	0	2
Scope 3	0	3
Average	**0**	**2.7**

The expansion degree can provide an analysis on the granularity of the scenarios as well as an indication of the models' sectoral focus. For example, a lower expansion degree would suggest that a pathway was more explicit and therefore that said sector has been an integral part within the design of the models behind the scenarios.

Impact on the Number of Variables

Figure 8 shows the impact on an increased number of variables that enable the calculation of relevant carbon budgets. Around half of IEA and NGFS variables are internally or externally expanded, to reach a total of respectively 142 and 129 variables. IEA achieves the same level of sector granularity (19) narrowly followed by the NGFS (17/18 sectors depending on the model). OECM presents the highest number of variables and the lowest level of derivation.

Figure 8: Number of Distinct Variables and Type for Selected Model at World level (the distribution may change at regional level)



Some key considerations appeared in the pathway expansion methodology:

- Around 40% of variables are not available (n.a.) – at this stage – for IEA and NGFS models. This highlights the trade-off between increased granularity and increased derivation, and thus complexity and lack of transparency. On the one hand, it appears critical to break down some sectors such as Residential and Commercial buildings pathways (Figure 7) as building types and usages are fundamentally different. On the other hand, some scopes of emissions are seen too difficult to derive for now (e.g., scope 3 of services companies).

- The defining characteristics of the pathways, including the aggregate carbon budget, are always preserved. Expansion happens at the sub-sector or scope levels. MESSAGE and REMIND **'expanded'** Residential and Commercial Buildings pathways sum up to the **'extracted'** Buildings pathway (refer to Figure 7 for subsectors).

- Robustness and consistency of external assumptions for **'expanded'** variables. Scientific literature and business reports can be used as sources. Yet, finding assumptions that match in terms of scope of study, or geographies, is challenging. Another challenge is that most of the literature will be backward-looking while the core purpose of Scenario Alignment is to understand the dynamics of how a Current Policies or Net Zero pathway may unfold. Using a constant figure (e.g., ratio, intensity) presents the risk of overestimating the carbon budget of sectors with relatively high carbon intensities now but with high decarbonization potential. The expansion approach therefore typically leverages more granular pathways. Pathways have been mapped to ensure the consistency both in terms of ambition and geography. Should Pathway A information be used to expand Pathway B, then the risk of skewing the data is contained.

Regional Granularity

FI have different geographical footprints, and pathways may try to provide differentiated regional outputs. Paris Agreement signatories adhere to the principle of "*common but differentiated responsibilities and respective capabilities, in the light of different national circumstances*" (Article 2.2.) defining the types and timing of actions. Financing needs and opportunities are therefore not uniform. Generally, developed markets are expected to lead the way in decarbonization investments and are expected to reach Net Zero emissions earlier than developing economies.

When possible, carbon budgets are therefore allocated based on the company geographic footprint. The country breakdown of corporates' revenues and PPE (Property, Plants, and Equipment) data is leveraged.

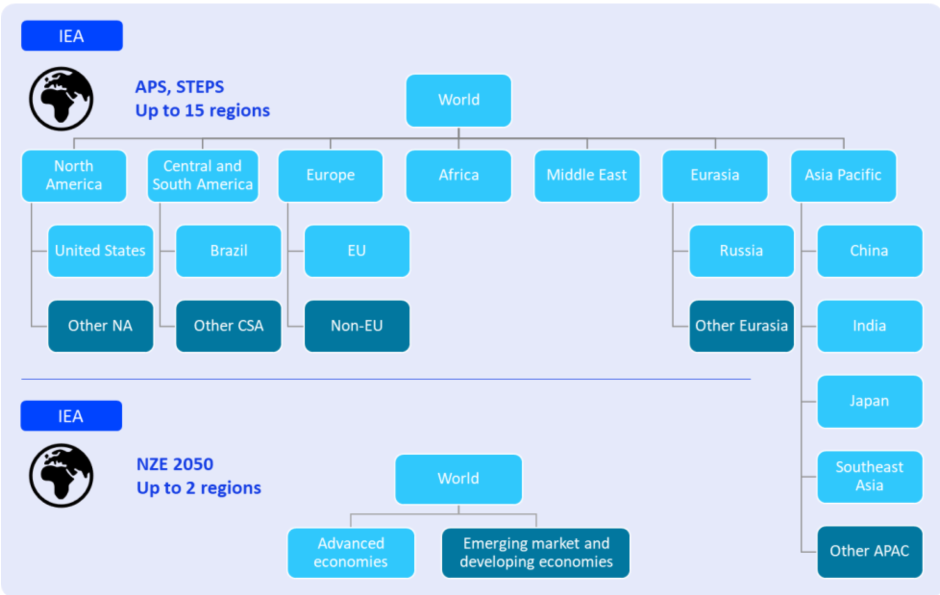
This Scenario Alignment solution pursues the highest regional granularity possible. However, this is largely dependent on two factors.

- **The geographic granularity** of data differs across models.
    - IEA: Figure 9 shows that IEA NZE is less granular than APS and STEPS (2 versus up to 15 regions). Because some regional pathways are not directly available in the IEA dataset, they are **'disaggregated'** variables. The operation is simple, however. For example, **Emerging Markets and Developing Economies** is the difference between **World** and **Advanced economies**.
    - NGFS REMIND: up to 12 regions
    - NGFS GCAM: up to 32 regions
    - NGFS MESSAGE: up to 12 regions
    - OECM: up to 20 regions

- **The sector**: Most sectors are assumed to account for regional granularity. For instance, Power utilities can be justified as electricity is a commodity whose trade is limited to the physical boundaries of the electricity grids, which tend to be regional at most. Due to the global nature of their operations and/or value chain operations, the regional granularity is truncated for some sectors.
    - Energy production companies
    - Passenger and Freight Aviation
    - Shipping

The issuer-level *ClimateRegionalGran[model]* factor reflects the highest level of regional granularity available in a given scenario model, providing that the company geographic footprint is available and that it operates in a regional sector. The factor can take on two values: World or Regional.

Figure 9: IEA WEO Geographic Granularities



Source: ISS STOXX Research, based on IEA WEO

Projection Phase: Carbon Budgets and Projected Emissions

Projected Emissions

Projected emissions are emissions that have yet to be observed by companies, but which are projected through various analytical lenses. As of March 2024, three methodologies to project emissions are leveraged:

1. **Historical**: assumes that the historical rate of emissions evolution will carry on in perpetuity for the issuer. This is done for each scope of emissions (i.e., scope 1, 2, and 3) separately.

2. **Policies**: assumes that the emissions of the issuers will follow the industry's evolution under a neutral scenario which is based on current commitment of governments in place, and not any commitments or ambition which have yet to materialize in actual policies.
3. **Target**: assumes that the emissions of the issuers will reach their disclosed target.

Realized emissions refer to $E_{C_i Y}$ Emissions of the counterparty i in the year Y, for Y ranging from 2020 to the last published fiscal year, if available. Projected emissions refer to $E_{C_i Y}$ Emissions of the counterparty i in the year Y, for Y ranging from the last published fiscal year + 1 to 2050. For example, for an analysis as of Q1 2026, realized emissions range 2020-2024 and the projection starts from 2025.

Historical

The historical approach to project an issuer's future emissions is calculated based on recent historical reported data (2017 to last published fiscal year) for each scope of an issuer. In other words, every issuer will have 3 empirical growth rates, one per scope. A cleaning of outliers is performed and when the issuer-level growth rate has been assessed as an outlier value, a fallback onto sectorial empirical rate is used.

The sectorial historical growth rate is also calculated on all available reported historical data per NACE levels. Level 4 is always taken as the first choice, which is the highest level of granularity under the NACE classification, and a fallback onto subsequent less granular levels is used whenever the sample size of said level 4 is not consequent or the value has been assessed as being an outlier.

Once the growth rate has been identified for each scope of the issuer, it is applied in perpetuity until 2050. This has the advantage of enabling the integration of past trends into the projection. Historical projection has been designed to enable a neutral view of the company's emission and give historical context to the feasibility of projected emissions under other methodologies. Illustratively, many companies might have set aggressive targets for 2050, however, if they have been steadily growing their emissions for the past years, it is also important to be able to see this against their targets.

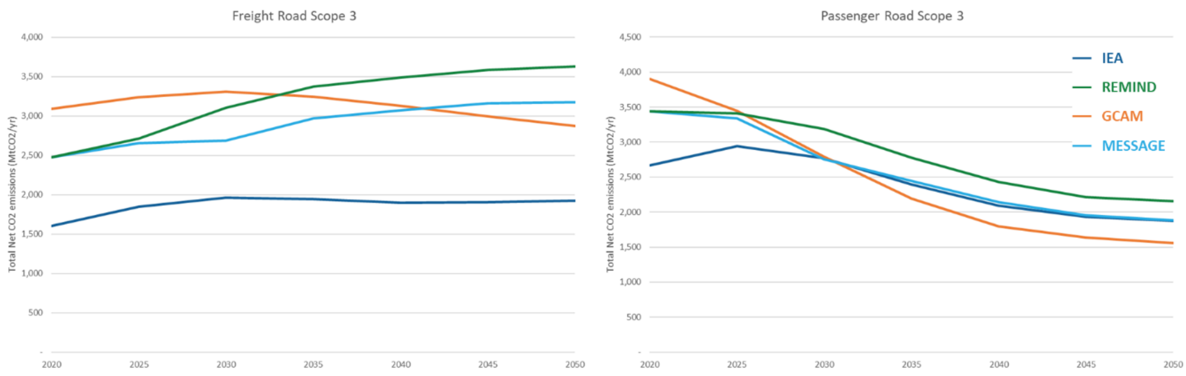
Table 7: Historical Emissions Projection

PROS	LIMITATIONS
Rewards tangible past actions	Backward looking linear projection

Policies

The policies emission projection methodology leverages various scenarios that reflect policies that are already in place. Such projection reflects the trend in future emissions of a given sector and is therefore not company specific. It integrates, however, forward-looking assumptions on technology development and scaling-up which are included by the scenario providers. Figure 10 shows the importance of considering multiple pathways as they diverge at global level, and even more so at a sectoral level. There is no perfect answer as to what the future entails, even when ignoring new commitments.

Figure 10: Selected "Current Policies" Global Emissions Pathways for the Freight and Passenger Road



Scope S_x emissions of the counterparty i in the year Y are computed as the last published fiscal year emissions (reported or modelled) with the average policies trajectory for a given sector.

$$E_{C_i S_x Y} = E_{C_i S_x Y_0} \times \frac{E_{B Y}}{E_{B Y_0}}$$

Table 8: Policies Emissions Projection

PROs	LIMITATIONs
Forward-looking Projections are forward looking and reflect an industry average	Not company specific Under- or overestimates the ambition of companies

Target

ISS STOXX collects GHG target data for Scope 1, Scope 2, Scopes 1&2, Scope 3, and/or Scope 1 & Scope 2 & Scope 3 independently. The dataset is sourced via the Environment and Social (E&S) Raw dataset. Company absolute GHG reduction targets are characterized by base year, target year, and a reduction percentage, assuming a linear reduction pathway. In Q1 2025, an update to the upstream E&S dataset allowed for multiple time horizon of targets which enables Scenario Alignment's model to better breakdown target projection. An intermediate target is now reflected in the target projected emissions whereas before it would not have been possible.

- The projection curve is calculated within the following parameters:
- Targets that covers < 90% of emissions scope are excluded.
- Base year emissions are taken from ISS STOXX's historical emissions database and may be reported or modelled.
- For any individual scope of emissions which do not have future targets until 2050, the latest target year's value is kept constant until 2050. E.g., if a company only has a target until 2045, its emission are kept at the same level of its target at 2045 until 2050.

- In cases where not all three scopes are covered by an absolute GHG reduction target, it is assumed that emissions scopes that are not covered in the target follow the policies projection.

Table 9: Target Emissions Projection

PROS	LIMITATIONS
Forward-looking Reward companies committed to reduce their GHG emissions	Commitments taken at face-value and interpolated linearly

A more granular step-by-step process of target projections and the data challenges that surround it are further expanded on in Appendix 4.

Carbon Budgets

The Scenario Alignment tool leverages sectoral and regional emissions pathways from various climate models (IEA, NGFS & OECM) to derive company-specific carbon budgets expressed in absolute terms. Carbon budgets are allocated to companies according to their sector and geographical footprint based on a 'fair-share' basis. The 'fair-share' approach compares the current emissions intensity of a company to a relevant benchmark and can be done either on a production or economic denominator.

Figure 11 illustrates how two companies are allocated a carbon budget. In this example, the scenario emission intensity is compared to that of issuer A and issuer B.

- Issuer A has a greater intensity than its peer sector in the given scenario.
- Issuer B has a lower intensity than its peer sector in the given scenario.

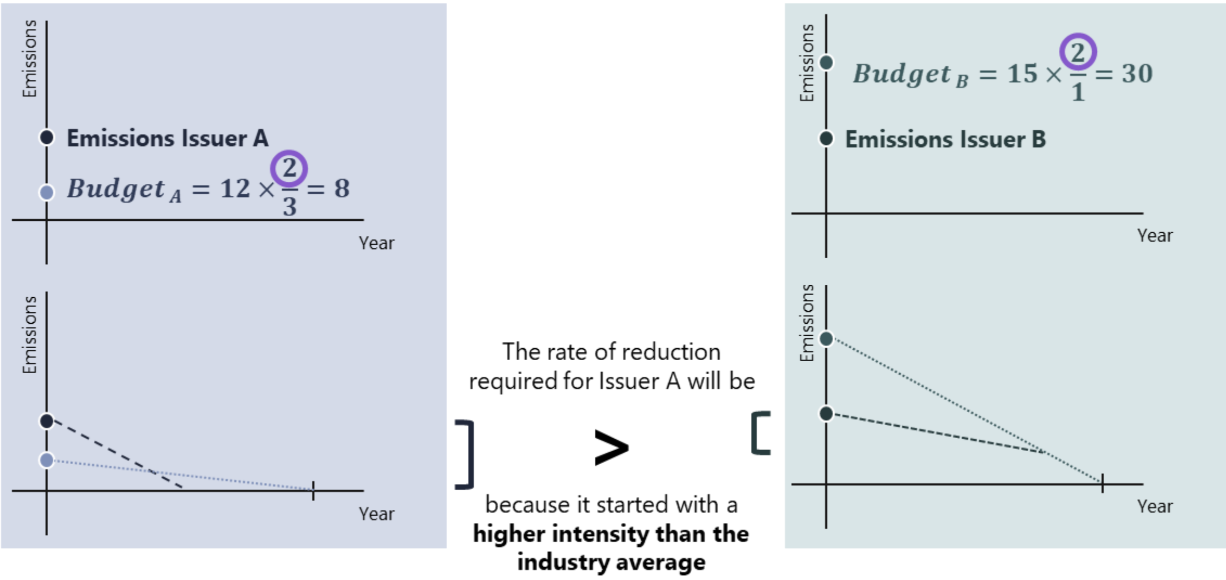
This means that issuer A is less efficient than its sector therefore emits more per unit (of revenue or production). Issuer B is more efficient than its sector therefore emits less per unit (of revenue or production).

The consequence for the carbon budget allocation is that issuer A will have a smaller carbon allocation compared to its absolute emissions and therefore it will have to reduce its emissions at a faster rate to catch up and align with the sector decarbonization trajectory. Issuer B, on the other hand, is rewarded for its efficiency and is allocated a larger carbon budget, that is above its absolute emissions. Finally, this shows that less efficient issuers within the same sector will have a smaller carbon budget compared to their more efficient peers.

Figure 11: 'Fair-Share' Allocation Illustration

	Sector	Issuer A	Issuer B
Absolute emissions (a)	100	12	15
Denominator (b)	50	4	15
Emission intensity (a/b)	2	3	1

$$Initital\ Budget = Issuer\ Em * \frac{Sector\ EmInt}{Issuer\ EmInt}$$



ISS STOXX applies a 'fair-share carbon budget' benchmark approach from PAT[12] to each scope S_x of emissions. The GFANZ equations, referred to equation (1) and equation (2), are provided in *Appendix 3: GFANZ 'Fair-Share' Carbon Budget* .

The following sections provide the calculations to arrive at the allocation of carbon budget.

ISS STOXX 'Fair-Share' Carbon Budget Approach

Disclaimer: the term 'fair-share[13]' is a common term, popularized by GFANZ, referring to a carbon budget allocation that is based on a comparison of a company's emissions intensity with the sector average.

[12] Portfolio Alignment Team | Measuring Portfolio Alignment – Technical considerations (2021), Appendix 2
[13] https://www.gfanzero.com/publications/

Table 10: Variable Definitions

OBJECTS DEFINITION		VARIABLES DEFINITION	
$\boldsymbol{N}$	Climate universe size $N = \sum_s \sum_i C_{i,s}$	$E_{C_i\,S_x\,Y}$	Scope S_x emissions of the counterparty *Ci* in the year *Y*
$\boldsymbol{M}$	Model *OECM, IEA, GCAM, REMIND, MESSAGE*	$E_{B_i\,S_x\,Y}$	Scope S_x emissions of the benchmark *Bi* in the year *Y*
$\boldsymbol{n}$	Highest sectoral granularity of the Model *M* $n = \sum_s s$	$EI_{C_i\,S_x\,Y}$	Scope S_x emissions intensity of the counterparty *Ci* in the year *Y*
$\boldsymbol{P_s}$	Pathway provided by model *M*	$EI_{B\,S_x\,Y}$	Scope S_x emissions intensity of the benchmark *Bi* in the year *Y*
$\boldsymbol{B}$	Segment benchmark (made of the universe of counterparties *i*) corresponding to sector *s*		
$\boldsymbol{B_i}$	Counterparty-specific benchmark associated with the counterparty *i* and the segment benchmark *B*		
$\boldsymbol{S_x}$	Scope *Include Scope 1, Scope 2 and Scope 3*		
$\boldsymbol{r}$	Region *Depends on the model and sector*		
$\boldsymbol{\overline{R}}$	Revenues		

- The Baseline year $\boldsymbol{Y_0}$ is set at 2020 and year $\boldsymbol{Y}$ to range from 2020 to 2050.
- The approach described in equation (1) (see *page 47)* is applied to each Scope S_x and region. The adjustment of the ratio of the benchmark[14]'s emissions intensity against the counterparty's emissions intensity is performed for year *Y*

$$(1'): E_{B_i\,S_x\,Y\,r} = E_{C_i\,S_x\,Y_0\,r} \times \frac{EI_{B\,S_x\,Y\,r}}{EI_{C_i\,S_x\,Y\,r}} \times \frac{E_{B\,S_x\,Y\,r}}{E_{B\,S_x\,Y_0\,r}}$$

- Equation (1') can be interpreted as
  a. A company that is more carbon efficient than its benchmark is allocated a larger share of the carbon budget. i.e., $EI_{C_i\,S_x\,Y_0} < EI_{B\,S_x\,Y_0}$ meaning that the emissions intensity comparison $\frac{EI_{B\,S_x\,Y_0}}{EI_{C_i\,S_x\,Y_0}} > 1$
  b. A company that is less carbon efficient than its benchmark is allocated a smaller share of the carbon budget. i.e., $EI_{C_i\,S_x\,Y_0} > EI_{B\,S_x\,Y_0}$ meaning that the emissions intensity comparison $\frac{EI_{B\,S_x\,Y_0}}{EI_{C_i\,S_x\,Y_0}} < 1$

[14] Benchmark here takes the meaning of the appropriate mapped scenario sector. Please see Glossary for full definition.

At $Y = Y_0$, an equivalent to equation (2) is obtained (see *page 47)*

$$E_{B_i\,S_x\,Y_0\,r} = E_{C_i\,S_x\,Y_0\,r} \times \frac{EI_{B\,S_x\,Y_0\,r}}{EI_{C_i\,S_x\,Y_0\,r}}$$

$$(2'):\ E_{B_i\,S_x\,Y\,r} = E_{B\,S_x\,Y\,r} \times \frac{D_{C_i\,Y_0\,r}}{D_{B\,Y_0\,r}}$$

Key assumptions to use (2'):

i. $E_{B\,S_x\,Y}$ can be identified[15]

ii. $E_{B\,Y} = E_{B\,S_1\,Y} + E_{B\,S_2\,Y} + E_{B\,S_3\,Y}$

iii. $\frac{D_{C_i\,Y_0\,r}}{D_{B\,Y_0\,r}}$ is independent from the Scope S_x

Combustion Based Allocation

Oil & Gas and Coal production can be considered as a **homogenous** sector, in which emissions are linked to an identifiable and accessible physical production output.

For companies belonging to NACE Classes related to fossil fuels production, equation (2') is applied for each scope of emissions and use the production of coal, gas and/or oil as a denominator D. Due to the global nature of fossil fuels extraction, trade, and consumption, the Scenario Alignment methodology does not apply the regional granularity.

$$E_{B_i\,Y} = \frac{Coal\ Production_{\,C_i\,Y_0}}{Coal\ Production_{\,World\,Y_0}} \times \sum_{x=1}^{3} E_{Coal\,S_x\,Y} + \frac{Gas\ Production_{\,C_i\,Y_0}}{Gas\ Production_{\,World\,Y_0}} \times \sum_{x=1}^{3} E_{Gas\,S_x\,Y} + \frac{Oil\ Production_{\,C_i\,Y_0}}{Oil\ Production_{\,World\,Y_0}} \times \sum_{x=1}^{3} E_{Oil\,S_x\,Y}$$

- $Production_{\,C_i\,Y_0}$ is collected by the Energy & Extractives team.
- $Production_{\,World\,Y_0}$ is sourced from the different IEA WEO reports.
- The factor *ClimateCbnBgtType* available in the dataset would return 'Combustion Based Allocation' as the allocation type.

It is important to note that as per the equation above the absence of any 2 production data points does not prohibit the calculation of the allocation. In other words, companies that are solely focused on coal production for example can still be calculated despite not having any oil or gas data.

[15] In other words, ISS is only able to do fair-share for companies which have a distinct sector pathway for the relevant scope given the current data availability.

Generation Based Allocation

Power Generation can also be considered as a homogenous sector, in which emissions are linked to an identifiable and accessible physical production output.

For companies belonging to NACE sectors related to electricity generation, equation (2') is applied for each scope of emissions and regional exposure. Electricity generation and installed capacity are used as a denominator D.

- There are structural differences between electricity generated from renewable or thermal sources, the latter having in general higher load factors. Consequently, using installed capacity (e.g., in MW) for the market share calculation tends to allocate bigger budgets to renewable players. Conversely, using electricity generation (e.g., in GWh) for the market share calculation tends to allocate bigger budgets to thermal / nuclear / hydro players.

To smooth out the differences, a market share combining both indicators was devised. Data gaps in either Generation or Capacity are filled based on best-fit linear relationship observed in collected data.

$$E_{B_i\ Y} = \sum_r \frac{\left(\frac{Generation_{\ C_i\, Y_0\, r}}{Generation_{\ Y_0\, r}} + \frac{Capacity_{\ C_i\, Y_0\, r}}{Capacity_{\ Y_0\, r}}\right)}{2} \times E_{Power\ Y\ r}$$

- The Regional distribution of PPE w_r is deemed a reasonable proxy for the distribution of the issuer's power generation activities.
  - $Generation_{\ C_i\, Y_0\, r} \approx w_{C_i\, r} \times Generation_{\ C_i\, Y_0}$
  - $Capacity_{\ C_i\, Y_0\, r} \approx w_{C_i\, r} \times Capacity_{\ C_i\, Y_0}$
- $Generation_{\ C_i\, Y_0}$ and $Capacity_{\ C_i\, Y_0}$ are collected by the Energy and Extractives team.
- The U.S. Energy Information Administration (EIA) country-level electricity database[16] is used to compute regional generation and installed capacity total figures ($Generation_{\ Y_0\, r}$, $Capacity_{\ Y_0\, r}$). Some values may be missing at the time of the assessment. Reported data from available years (e.g., 2018-2023) is used to extrapolate missing data (e.g., 2024) based on historical capacity and generation per country. Global installed capacity and generation have historically increased. For example, global capacity and generation respectively increased by 6.5% and 2.0% in 2023 compared to 2022. But country-level trends may vary. Using a CAGR approximation approach is therefore more conservative as it reduces the issuer's market share.
- The factor *ClimateCbnBgtType* available in the dataset would return 'Generation Based Allocation' as the allocation type.

[16] https://www.eia.gov/international/data/world

Economic Intensity Based Allocation

For the remaining sectors, equation (1) is used (*see page 47)* for each scope of emissions and regional exposure. For each issuer, their allocated carbon budget is the ratio of the intensities between theirs and the sector average, which gives a share that is then applied to the sector benchmark.

- $E_{B_i\, S_x\, Y\, r} = E_{C_i\, S_x\, Y_0\, r} \times \frac{EI_{B\, S_x\, Y_0\, r}}{EI_{C_i\, S_x\, Y_0\, r}} \times \frac{E_{B\, S_x\, Y\, r}}{E_{B\, S_x\, Y_0\, r}}$

Most sectors can be considered as heterogenous, in which emissions are not clearly linked to an identifiable and accessible physical production output. No single metric can capture the complexity of a company's activities. The emissions intensity comparison is therefore based on an economic indicator: revenues. The intensity is using the same revenue figure for all 3 scopes.

$$EI_{C_i\, S_x\, Y_0\, r} = \frac{E_{C_i\, S_x\, Y_0\, r}}{\bar{R}_{C_i\, Y_0\, r}}$$

There are other homogenous sectors (e.g., cement, steel). However, there is a lack of accessible and consistent company level production data. Thus, emissions intensities remain based on revenues.

The scope specificity and regional granularity is integrated within the carbon budget as described above which means that the equation provided by GFANZ needed to be expanded as the steps below describe:

Step #1

However, determining $EI_{B\, S_x\, Y_0\, r}$ poses several challenges.

i. The denominator is often not provided within the scenario data to calculate adequate intensities.
ii. The aggregation of issuers Scope 1, 2, and 3 emissions contain double-counting and largely overshoots the pathways 'net' total emissions.

Therefore, ISS STOXX's sectorial intensities are used instead.

$\sum_j a_j$ is the ensemble of counterparties in NACE Level 4. NACE intensities in tCO_2/sales in millions USD (real term for each year of analysis) follow the approach of ISS STOXX industry average emission intensity methodology developed for large portfolios of corporates. The Scenario Alignment methodology uses global averages based on Scope 1 & Scope 2 reporting universe[17], for reporting years 2020 to the last published fiscal year . It also requires a minimum sample size[18], and fallback onto a higher-level NACE if needed.

$$EI_{B\, S_x\, Y_0\, r} = \frac{\sum_j E_{C_j\, S_x\, Y_0\, r}}{\sum_j \bar{R}_{C_j\, Y_0\, r}}$$

[17] Scope 3 emissions intensity averages may contain Scope 3 modelled emissions
[18] Defined as statistically significant internally.

Step #2

The emissions intensity comparison $\frac{EI_{B\,S_x\,Y_0\,r}}{EI_{C_i\,S_x\,Y_0\,r}}$ could be performed at a regional level, in theory. There are, however, numerous challenges to its practical application. The main ones relating to availability of quality data at the regional level (issuer emissions, issuer revenues, sector emissions, sector revenues). The intensity comparison is therefore assumed to be global.

$$E_{B_i\,S_x\,Y\,r} = E_{C_i\,S_x\,Y_0\,r} \times \frac{EI_{B\,S_x\,Y_0}}{EI_{C_i\,S_x\,Y_0}} \times \frac{E_{B\,S_x\,Y\,r}}{E_{B\,S_x\,Y_0\,r}}$$

Step #3

The Benchmark referred in $EI_{B\,S_x\,Y_0\,r}$ is the ensemble of counterparties in the relevant NACE level.

The Benchmark referred in $\frac{E_{B\,S_x\,Y\,r}}{E_{B\,S_x\,Y_0\,r}}$ is a forward-looking indication of the trend in emissions for the sector and region, i.e., emissions pathways from scenarios. For clarity, the Scope S_x emissions of the benchmark in the year Y $E_{B\,S_x\,Y\,r}$ are distinguished as a share of the Scope S_x emissions of the pathway $E_{P\,S_x\,Y\,r}$. As noted earlier, $E_{B\,S_x\,Y}$ may be larger than $E_{P\,S_x\,Y}$ due to double counting.

$$E_{B\,S_x\,Y\,r} = \frac{E_{B\,S_x\,Y_0\,r}}{E_{P\,S_x\,Y_0\,r}} \times E_{P\,S_x\,Y\,r}$$

Step #4

Aggregating across regions:

$$E_{B_i\,S_x\,Y} = \sum\nolimits_r E_{B_i\,S_x\,Y\,r}$$

$E_{C_i\,S_x\,Y_0\,r} \approx w_{C_i\,r} \times E_{C_i\,S_x\,Y_0}$ with $w_{C_i\,r}$ corresponding to the regional distribution of PPE

$$E_{B_i\,S_x\,Y} = E_{C_i\,S_x\,Y_0} \times \frac{EI_{B\,S_x\,Y_0}}{EI_{C_i\,S_x\,Y_0}} \times \sum\nolimits_r w_{C_i\,r} \times \frac{E_{P\,S_x\,Y\,r}}{E_{P\,S_x\,Y_0\,r}}$$

(3) Final equation

$$\boldsymbol{E_{B_i\,S_x\,Y} = E_{C_i\,S_x\,Y_0} \times \frac{\bar{R}_{C_i\,Y_0}}{E_{C_i\,S_x\,Y_0}} \times \frac{\sum_j E_{C_j\,S_x\,Y_0}}{\sum_j \bar{R}_{C_j\,Y_0}} \times \sum\nolimits_r w_{C_i\,r} \times \frac{E_{P\,S_x\,Y\,r}}{E_{P\,S_x\,Y_0\,r}}}$$

Note that the regional granularity r is variable among models, as indicated in the Regional Granularity section. Furthermore, carbon budget allocation for Aviation and Shipping sectors is performed at a global level due to the global nature of their operations and/or value chain operations. This is applicable to **transport operators**, as well as **manufacturers**.

- The factor *ClimateCbnBgtType* available in the dataset would return 'Economic Intensity Based Allocation' as the allocation type.

Economic Intensity Fallback for Production-Based Allocations

If Fossil Fuels or Power generation data is missing for all historical years, but emissions and revenues are available, a fallback on the economic intensity-based allocation is implemented.

The *ClimateCbnBgtType* factor would therefore be changed from Combustion or Generation Intensity Based Allocation to Economic Intensity Based Allocation.

Fallback on Emissions Pathway Trajectory

Step #5

A final limitation to the full application of equation (3) is the ability to clearly identify $E_{P\,S_x\,Y\,r}$. For certain scope of emissions S_x, $E_{P\,S_x\,Y\,r}$ is not directly available.

Going back to equation (1'), where:

$$(1'){:}\ E_{B_i\,S_x\,Y\,r} = E_{C_i\,S_x\,Y_0\,r} \times \frac{EI_{B\,S_x\,Y\,r}}{EI_{C_i\,S_x\,Y\,r}} \times \frac{E_{B\,S_x\,Y\,r}}{E_{B\,S_x\,Y_0\,r}}$$

- Equation (1') can be simplified in this instance and be interpreted as $\frac{EI_{B\,S_x\,Y\,r}}{EI_{C_i\,S_x\,Y\,r}} = 1$. The issuer is as carbon efficient as its benchmark.

$$E_{B_i\,S_x\,Y} = E_{C_i\,S_x\,Y_0} \times \frac{E_{P\,S_x\,Y}}{E_{P\,S_x\,Y_0}}$$

This approach can be seen as equivalent to a contraction approach, for which no 'fair-share' adjustment is performed.

For instance, $E_{P\,S_x\,Y}$ may correspond to:

- Electricity emissions pathway trajectory for the Scope 2 of fossil fuel companies using the production-based allocation.
- Global total 'net' emissions pathway trajectory, i.e., the entire economy, to proxy the decarbonization required for the Scope 3 of diversified industrial or services companies.
- Residential & Commercial Buildings "sector scope 1 & 2" pathways for the Scope 3 of Real Estate Investment Trusts.
- When available, GHG emissions from AFOLU (in tCO_{2eq}) for Agriculture Scope 3.

Year-on-Year Market Share and Carbon Budgets Adjustments

(3) Final equation

$$\boldsymbol{E_{B_i\,S_x\,Y} = E_{C_i\,S_x\,Y_0} \times \frac{\bar{R}_{C_i\,Y_0}}{E_{C_i\,S_x\,Y_0}} \times \frac{\sum_j E_{C_j\,S_x\,Y_0}}{\sum_j \bar{R}_{C_j\,Y_0}} \times \sum_r w_{C_i\,r} \times \frac{E_{P\,S_x\,Y\,r}}{E_{P\,S_x\,Y_0\,r}}}$$

The universe of covered emissions is assumed to be equal to a portion of the emissions pathways from the provider at $Y_0 = 2020$.

For each subsequent year, when realized emissions of an issuer are collected, the under/overshoot from their budget is factored in and this re-adjusts the remaining budget. Equation (3) is generalized as $\boldsymbol{Y}$ **replaces** $\boldsymbol{Y_0}$ in the **emissions intensity comparison**, for $Y_0 < Y <$ issuer specific last published fiscal year.

(4) $$E_{B_i\, S_x\, Y} = E_{C_i\, S_x\, Y_0} \times \frac{\bar{R}_{C_i\, Y}}{E_{C_i\, S_x\, Y}} \times \frac{\sum_j E_{C_j\, S_x\, Y}}{\sum_j \bar{R}_{C_j\, Y}} \times \sum_r w_{C_i\, r} \times \frac{E_{P\, S_x\, Y\, r}}{E_{P\, S_x\, Y_0\, r}}$$

The **initial allocated budget level remains unchanged, and the overall budget is still decreasing with the pathway**. This materializes in the term $E_{C_i\, S_x\, Y_0} \times \sum_r w_{C_i\, r} \times \frac{E_{P\, S_x\, Y\, r}}{E_{P\, S_x\, Y_0\, r}}$

Yet, such a generalization allows for adjustments in the market share and thus carbon budgets.

- Companies that are performing better than their benchmark get more budget. However, the overall pathway is still decreasing.
- Worst performers have their budget reduced by the combined effect of
    i. worse emissions intensity comparison
    ii. the emissions pathway trajectory

Output Phase: Results

The outputs resulting from the calculations phase are presented below.

Crosspoint Year

Crosspoint year corresponds to the year at which the cumulative emissions are expected to cross their allocated budget threshold under the chosen **Net Zero (NZ) scenario** using a given emission projection approach.

The allocated budget threshold corresponds to the total 2020-2050 cumulative carbon budget.

If the cumulative budget is not exceeded during the study period, the factor *ClimateCrsptYr* will return a sentence describing complete alignment *"The issuer cumulative emissions are projected to align with "* + *[model name]* + *" (NZ) carbon budget (until 2050)."*

Cumulative Alignment

Cumulative alignment (*ClimateCuAlign* factors) provides the result of the issuer's divergence or alignment represented as an under or overshoot versus the allocated carbon budget under the chosen scenario in 2030 or 2050 using a given emission projection approach.

$$a = 20XX\ Cumulative\ Projected\ Emissions$$

$$b = 20XX\ Cumulative\ Carbon\ Budget$$

$$Cumulative\ Alignment\ 20XX\ = \frac{a - b}{|b|} + 1$$

The interpretation of Cumulative alignment is described as:

- $0 < Cumulative\ Alignment < 1$: undershoot
- $Cumulative\ Alignment = 1$: aligned with the chosen scenario over the analysis period
- $Cumulative\ Alignment > 1$: overshoot

Break down according to the sign of b

For some sectors / regions, $2020 - 20XX\ Cumulative\ Carbon\ Budget$ (i.e., b) may be negative. ISS STOXX uses absolute value $|b|$ in the expression above.

- b < 0, $|b| = -b$.
  - As $a > 0$, such cases need to show as overshoot.
  - The expression becomes $\frac{a}{-b} + 1 > 1$
- b > 0, $|b| = b$.
  - If b > 0, $|b|$ = b and $Cumulative\ Alignment = \frac{a}{b}$, which covers most cases and behaves as expected.

Issuer Implied Temperature Rise (ITR)

Market Standard

GFANZ describes 2 approaches to derive a temperature score: [19]

1) **TCRE multiplier**: translate the overshoot into warming terms by making the explicit assumption that the rest of the world will exceed its carbon budget proportionally.

   - The Intergovernmental Panel on Climate Change (IPCC) AR5 report found that 'there is a near-linear relationship between cumulative CO_2 emissions and the increase in global average temperature caused by CO_2' (high confidence). This finding was reaffirmed in the latest AR6 Report[20] published in August 2021. It is then possible to define Transient Climate Response to cumulative carbon Emissions (TCRE), expressed in °C/GtC or °C/GtCO_2, and which provides an estimate of global temperature rise due to additional cumulative anthropogenic carbon emissions.

[19] P50. PAT Measuring Portfolio GFANZ
[20] IPCC AR6 WGI Technical Summary, 2021

- It considers a single scenario and cumulative emissions (and carbon budget) to compute a portfolio alignment metric, which aims to reflect the concept of remaining carbon budget defined by the IPCC.
- It is possible for IEA, NGFS, and OECM
- It is advised as better suited for longer-term horizons (2022 GFANZ Portfolio Alignment Measurement)

2) **Multiple Benchmark interpolation**:

- Calculating a cumulative carbon budget for multiple benchmarks so a 2°C benchmarks, 3°C benchmarks etc. and then interpolating.
- It requires an internally consistent set of scenarios in terms of models, assumptions, regional developments, etc.). It would only be possible to different extents with IEA and NGFS.

ISS STOXX Methodology

ISS STOXX utilizes the first approach recommended as it allows consistency across all scenario outputs of the Scenario Alignment tool.

- The ITR for the year $20XX$ $(2030\ or\ 2050)$ is defined as

$$20XX\ ITR\ (°C) = [1850 - 2019\ Global\ historical\ emissions\ (GtCO_2) + Cumulative\ Alignment\ 20XX\ \times\ Scenario\ Remaining\ Carbon\ Budget\ (GtCO_2) + Uncertainty\ upper\ bound\ (GtCO_2)\ ] \times\ YY^{th}\ TCRE\ (°C/GtCO_2)$$

- The ITR is calculated for each of the **Net Zero Scenarios** provided in the solution.
- The presented ITR calculation assumes that the rest of world would under/overshoot the global carbon budget by the same amount as the issuer.
- ITR results are bounded within the 1.3°C – 6°C range to avoid underestimating the climate impact and remove outliers, respectively.

Global Historical Emissions

$$1850 - 2019\ Global\ historical\ emissions = 2390\ GtCO_2$$

Scenario Remaining Carbon Budget

$Cumulative\ Alignment\ 20XX$ corresponds to the *ClimateCuAlign* factor described in the Cumulative section. It is provided for 2030- and 2050-time horizons.

The different remaining carbon budgets to Net Zero are provided below. Numbers are rounded.

Table 11: Net Zero Remaining Carbon Budgets Until 2030 and 2050, per Model

MODEL	2030 REMAINING CARBON BUDGET ($GTCO_2$)	2050 REMAINING CARBON BUDGET ($GTCO_2$)
IEA GEC25 *Net Zero Emissions by 2050 Scenario*	375	575
REMIND-MAgPIE 3.3-4.8 *Net Zero 2050*	380	565
GCAM 6.0 NGFS *Net Zero 2050*	375	635
MESSAGEix-GLOBIOM 2.0-M-R12 *Net Zero 2050*	375	655
OECM 2.0 2023 *NZE 2050*	295	430

TCRE

The Transient Climate Response to cumulative carbon Emissions (TCRE)[21] is "equivalent to a 0.27°C–0.63°C range with a best estimate of 0.45°C when expressed in units per 1000 $GtCO_2$."

- All models used in the Scenario Alignment tool incorporate IPCC AR6 WGI new assessment of the TCRE. IEA GEC and NGFS Phase V use the version 7 of the MAGICC to convert emissions pathways into Climate diagnostics for surface temperature. Such a version was used in AR6. OECM uses the 67th percentile TCRE AR6 carbon budget of 400 $GtCO_2$.
- ISS STOXX's methodology is using the 50th percentile TCRE value of 0.00045°C/$GtCO_2$ for IEA and NGFS scenarios to convert the cumulative alignment into an ITR and computing the 67th percentile value (c. 0.00053 °C/$GtCO_2$) for OECM[22].

Uncertainties

TCRE and remaining carbon budget estimates are subjected to high uncertainties. This has been highlighted by the IPCC AR6 Working Group 1. For instance, in the Table SPM.2 from the Summary for policymakers (Section D.1.2[23]) replicated below, and the quote extracted from Table TS.3 of the Technical Summary[24] "*Estimates assume that non-CO2 emissions are mitigated consistent with the median reductions found in scenarios in the literature as assessed in SR1.5. Non-CO2 scenario variations indicate how much remaining carbon budget estimates vary due to different scenario assumptions related to the future evolution of non-CO2 emissions in mitigation scenarios from SR1.5 that reach net zero CO2 emissions. This variation is additional to the uncertainty in TCRE. The Working Group III Contribution to AR6 will reassess the potential for non-CO2 mitigation based on literature since SR1.5*"

[21] P98. IPCC AR6 WGI Technical Summary (ipcc.ch)
[22] assumes a normal distribution of TCRE estimates
[23] IPCC AR6 Working Group 1: Summary for Policymakers | Climate Change 2021: The Physical Science Basis
[24] Technical Summary (ipcc.ch)

Table 12: Estimates of Remaining Carbon Budgets and Their Uncertainties.

GLOBAL WARMING BETWEEN 1850-1900 AND 2010-2019 (°C)		HISTORICAL CUMULATIVE CO_2 EMISSIONS FROM 1850 TO 2019 ($GTCO_2$)					
1.07 (0.8 – 1.3; likely range)		2390 (± 240; likely range)					
Approximate global warming relative to 1850 – 1900 until temperature limit (°C)	**Additional global warming relative to 2010-2019 until temperature limit (°C)**	**Estimated remaining carbon budgets from the beginning of 2020 ($GtCO_2$)** Likelihood of limiting global warming to temperature limit					**Variations in reductions in non-CO_2 emissions**
		17%	*33%*	*50%*	*67%*	*83%*	
1.5	0.43	900	650	500	400	300	Higher or lower reductions in accompanying non-CO_2 emissions can increase or decrease the values on the left by 220 $GtCO_2$ or more
1.7	0.63	1450	1050	850	700	550	
2.0	0.93	2300	1700	1350	1150	900	

Finally, the IPCC states that there is low confidence that the TCRE alone remains an accurate predictor of temperature changes in scenarios of very low or net negative CO_2 emissions beyond this century. This is due to uncertain Earth system feedback that can result in further changes in temperature or a path dependency of warming as a function of cumulative CO_2 emissions.

ISS STOXX recognizes the limitations of an ITR approach and aims to account for the uncertainties highlighted by the IPCC. The main sources of said uncertainties are:

- historical temperature
- recent emissions
- non-CO_2 effects
- zero CO_2 emissions commitments

Results and Deliverables

ISS STOXX provides Scenario Alignment data on its proprietary DataDesk platform, covering a broad universe of listed companies and issuers of corporate debt.

The portfolio analytics tools on the DataDesk platform enable investors to assess the climate impact of their portfolios. For public equity and fixed income strategies, the Climate Impact Report (CIR) is generated using factors available on DataDesk. The reports include alignment analysis against a range of climate scenarios, including Net Zero scenarios as well as sector deep dives and top portfolio contributors. Please refer to the Climate Impact Report methodology for more details.

It is also possible for clients to receive these data factors as part of standardized and custom data feeds directly via multiple modes of delivery.

Issuer-Level Factors: Navigating the Combination of Results

The enhanced Scenario Alignment solution incorporates the latest industry standards (cumulative approach, multiple time horizons, holistic emission scopes) and provides greater transparency. Its outputs are divided into three categories:

- Underlying data: (1) Carbon Budgets, (2) Projected Emissions for aggregated Scope 1 & 2 and Scope 1, 2, & 3 separately
- Results : (3) Cumulative Alignment, (4) Implied Temperature Rise (ITR), (5) Crosspoint Year for aggregated Scope 1 & 2 and Scope 1, 2 & 3 separately
- Transparency factors : (6) Carbon Budget Type, (7) Regional Granularity, (8) Expansion Degree

The Scenario Alignment tool covers a wide variety of scenarios and methodologies thus, creating a matrix of results.

- For example, there are three projected emissions methodologies (historical, policies, and taget) and 25 scenarios. Thus, each projection methodology is accompanied by a result metric such as cumulative alignment to a specific scenario.
- Each issuer displays per scenario, cumulative alignment results for 2030 and 2050. Therefore per issuer, over 25 scenarios, there are 75 factors of cumulative alignment for each year (2030 and 2050).
- This allows the user to select the relevant models or scenarios and have the same level of outputs available.

Below is a summary of the factors and their dependencies.

- The first set of factors released in 2024 relates to aggregated Scope 1, 2, & 3 outputs.
- Factors with a 'd' suffix relate to aggregated Scope 1 & 2 outputs, i.e., emissions for which issuer have more direct operational control.

Table 13: Factor Definitions

FACTOR ROOT NAME	DESCRIPTION	COUNT	DEPENDENCIES			
			Models	Scenarios	Periods[25]	Proj. Meth
ClimateCbnBgt *ClimateCbnBgt + d*	Carbon Budgets Scope 1, 2 & 3 Scope 1 & 2	175 175		25 25	7 7	
ClimateProjEmss *ClimateProjEmss + d*	Projected Emissions Scope 1, 2 & 3 Scope 1 & 2	93 93			31 31	3 3
ClimateCuAlign *ClimateCuAlign + d*	Cumulative Alignment Scope 1, 2 & 3 Scope 1 & 2	150 150		25 25	2 2	3 3

[25] Every factor can be given a yearly time series – the difference in periods given is solely due to practical reasons and axis of analysis.

ClimateITR *ClimateITR + d*	ITR Scope 1, 2 & 3 Scope 1 & 2	30 30		5* 5*	2 2	3 3
ClimateCrsptYr *ClimateCrsptYr + d*	CrossPoint Year Scope 1, 2 & 3 Scope 1 & 2	15 15		5[26] 5		3 3
ClimateCbnBgtType	Carbon Budget Type	1				
ClimateRegionalGran	Regional Granularity	5	5			
ClimateExpDeg	Expansion Degree	5	5			

The distinction between model dependent and scenarios comes down to the outputs. Cumulative alignment is the most granular level of analysis and therefore is performed for each scenario for every projection methodologies. However, certain outputs are not scenario dependent but model[27] dependent such as the crosspoint year because by definition it only addresses the net zero scenarios within models.

The detailed methodology explaining the dependence can be found in the methodology section of this document.

Update Cycle

Data Update Frequency

The Scenario Alignment tool will be updated as a product on a annual basis during Q1.It is important to note that the underlying data points on which the solution is built upon are only updated annually (financial and emissions reporting are done so on an annual basis). During Q3 a coverage assessment is made to determine whether an additional update is needed to increase coverage due to late reported emissions or targets etc.

ISS STOXX maintains its efforts to provide the most comprehensive and up-to-date Scenario Alignment solution to its clients. In Q1 2025, the underlying scenarios were updated to the latest available.

Quality Assurance

- Quality Control and Assurance over the SA calculations and data is based on an internally developed system of quality checks, that are in-line with the internally developed methodologies and all the input data sources.

[26] ITR and Crosspoint Year are computed for Net Zero scenarios only

[27] Please refer to the glossary for a detailed nomenclature of model vs. scenario. Models are the level above scenarios whereby, NGFS REMIND is a model, and NGFS REMIND Net Zero is the scenario.

- Multiple levels of data quality checks are performed during the data collection and calculation. This ensures that only entities with a complete input data profile are available in the coverage universe. This involves a QC checklist that encompasses:
    - Universe analysis (including comparisons to previous updates, additions, and exclusions)
    - Key population analysis (including aligned with Net Zero pathways and outliers)
    - Coverage by sectors (including significant changes)
    - Distribution and outlier analysis
- All companies in the universe are analysed for consistency and quality in and across update periods.

QC/QA is performed on multiple stages for the published data, all along the internal data chain, up to, and including, the final deliverables.

Methodology Review Process

The methodology is reviewed on an annual basis as part of the ongoing R&D efforts to ensure that it is consistently aligned with the latest industry standards. Methodology changes are internally reviewed, approved, and recorded prior to implementation.

Minor updates are delivered during the Q1 update and communicated to clients ahead of time. Any major updates to the underlying methodology would be introduced as a new dataset giving the time for users to transition and to assess impact.

Major update cycles are not time-bound, rather they are dictated by user needs and availability of either new data source or better data sources. Therefore, major methodological changes are treated as a new product development and would follow the process of a new product launch.

Glossary

Carbon Budgets
The allocated carbon budget of the issuer to be in line with a given scenario given as a point in time value at a 5-year interval.

Projected Emissions
The projected emissions of the issuer under a given projection methodology, such as historical, policies, or GHG reduction target, given as a yearly time series.

Cumulative Alignment
The result of the issuer's alignment or divergence represented as an under- or overshoot versus the cumulative allocated carbon budget under a given scenario. The alignment is measured in 2030 and 2050.

Implied Temperature Rise (ITR)
The Implied Temperature Rise quantifies the temperature rise associated with the issuer's projected under- or overshoot of its allocated carbon budget under the Net Zero scenario of the selected model.

Crosspoint Year
The year at which the projected emissions is expected to cross their allocated budget threshold under a given Net Zero scenario.

Carbon Budget Type
The type of the "fair-share" allocation denominator, such that it could be production based such as combustion and power generation, or economic based.

Regional Granularity
The highest level of regional granularity a given scenario model can provide.

Expansion Degree
The degree of expansion, ranging from 0-3, a pathway has gone through in order to derive the allocated budgets. For example, if a scenario's data is taken unaltered then the expansion degree would be 0. A higher degree of expansion is sometimes necessary when the scenario does not give granular sector data explicitly. Sub-sector data is derived to enhance sectoral granularity.

Fair-Share
In the words of GFANZ: *"defines the average rate of reduction in emissions for an industry as a whole but recognizes that individual counterparties will be better- or worse-performing than that average. Based on comparing the counterparty's emissions intensity to its industry average, this approach creates a counterparty-specific rate-of-reduction benchmark for absolute emissions."*

Global Reduction Rate
The global reduction rate – or rate-of-reduction, assumes that every company within a given sector will reduce their emission at the same rate.

Benchmark

The term benchmark is used in many places within the Scenario Alignment methodology. Benchmark is referred to scenario data and specifically to its translation on a company level. Therefore, benchmark can be scenario data that have been transformed either through a fair-share approach to give carbon budgets to an issuer.

Cumulative

There is a big emphasis on the cumulative aspect of the methodology. This means that carbon budgets and projected emissions are aggregated year-on-year. Thus, for year T the value would be on a cumulative basis for n-periods, the sum of all values at years T-n until year T included. This is often opposed to a point-in-time analysis where the values at year T are only compared at year T and the values before are not factored in.

TCRE

The Transient Climate Response to Emissions (TCRE) is a climate metric used by the Intergovernmental Panel on Climate Change (IPCC) to estimate the change in global mean surface temperature resulting from a cumulative carbon dioxide emission. It quantifies the temperature increase expected for each ton of CO_2 emitted into the atmosphere.

Issuer

The term issuer is used interchangeably throughout this document with the terms company and counterparty to refer to an economic entity who emits carbon emissions.

Provider, Model, Scenario, Pathways

The nomenclature chosen to clarify the different levels and dimension of scenario data goes as follows: The provider of scenario data is an entity such as NGFS which can carry multiple models such as Remind-Magpie in which there can be multiple scenarios, Net Zero, or Current Policies and these scenarios will describe a pathway for each sector.

Historical vs Realized emissions

Scenario Alignment uses 2020 as baseline for cumulative emissions in line with the scenarios. Therefore, all emissions used before 2020 are labeled historical and realized emissions are all emissions that have already been materialized after 2020 to now.

Appendices

Appendix 1: GFANZ Key Judgements

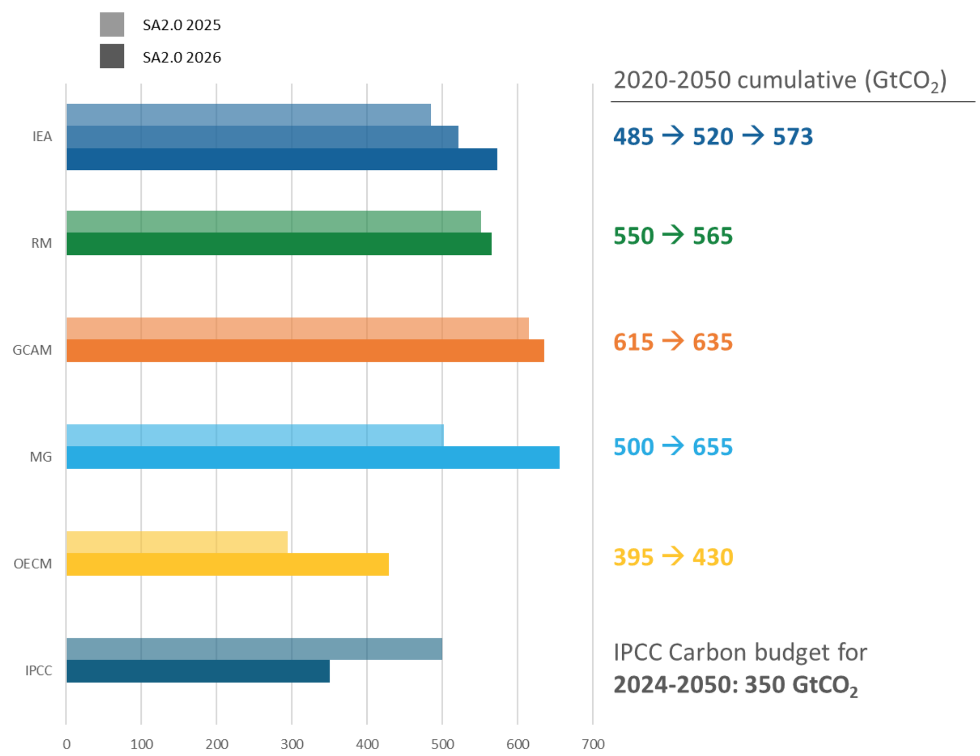
	GFANZ Glasgow Financial Alliance for Net Zero		Sustainability Solutions
Judgement 1:What type of benchmark should be built?	**Single-benchmark** and **fair-share carbon budget** approach converting an intensity into absolute emissions	✓	
Judgement 2: How should benchmark scenarios be selected?	Select a **1.5°C-aligned benchmark** scenario (e.g., IEA NZE, UTS OECM, NGFS GCAM / REMIND / MG) Prioritize **regional** and **sectoral** granularity	✓	
Judgement 3: Should you use absolute emissions or intensity	**Absolute emissions (tCO_2)**, computed from physical intensity (e.g., barrels of oil, GWh) for homogenous sectors economic intensity (e.g., tCO_2/m$ revenues) for Heterogenous sectors **Oil & Gas:** use **multiple metrics** in combination (e.g., absolute, per unit of production, per unit of total energy)	✓	Three carbon budget allocation types: combustion, generation and economic
Judgement 4: What scope of emissions should be included?	Scope 1 and 2 and consider the inclusion of **scope 3, where material** (>40% or >10Mt CO_2e)	✓	All 3 scopes are included in the analysis. Pathway trajectory refinement depends on issuer and scenario data availability
Judgement 5: How should emissions baselines be quantified?	All 7 GHGs as mandated by the Kyoto Protocol when possible	✓	Dependent on the scenario used – IEA does not provide all GHGs – and corporates disclosures
Judgement 6: How should forward-looking emissions be estimated?	Waterfall approach to a variety of methodologies: 1) Credibility assessment + weighted historical/target When no targets: 2) Production forecasts, 3) Historical emissions trend, 4) Neutral emissions intensity, 5) Benchmark rate	✓	Current observed data availability restricts methods 1) and 2) Three emissions projections approaches: historical, policies, target
Judgement 7: How should alignment be measured?	**Cumulative-emissions** basis Compute alignment over **short- and medium-term** time horizons (e.g., 2030) and **longer-term** time horizons (e.g., 2050)	✓	
Judgement 8: How should alignment be expressed as a metric?	1. Binary target measurement 2. Maturity scale 3. Benchmark divergence 4. Implied Temperature Rise (ITR) As **metrics are refined**, GFANZ acknowledges that some practitioners may find it preferable to **use multiple portfolio alignment metrics** in a dashboard approach in order to minimize the limitations of particular metrics	✓	All types available within the climate products range. ISS has always been recommending the use of multiple metrics for better contextualization and insights, acknowledging the strengths and weaknesses of each metric
Judgement 9: How do you aggregate counterpart-level metrics into a portfolio-level score?	**1. aggregated-budget approach - preferred** 2. portfolio-owned approach 3. portfolio-weight approach	✓	

Appendix 2: Scenario Descriptions

Pathway Ambition: Total Carbon Budget

In its latest Assessment Report, the IPCC (Intergovernmental Panel on Climate Change) restated that there is a near-linear relationship between cumulative human-induced CO_2 emissions and the increase in global surface temperature. Figure 12 shows the *remaining carbon budgets*—that is, the amount of carbon that society can emit before overshooting a given temperature limit—under both IPCC estimates and the pathways identified above.

Figure 12: Total Cumulative 2020-2050 Net CO_2 Emissions (from Energy Combustion, Industrial Processes, and AFOLU) under different Pathways

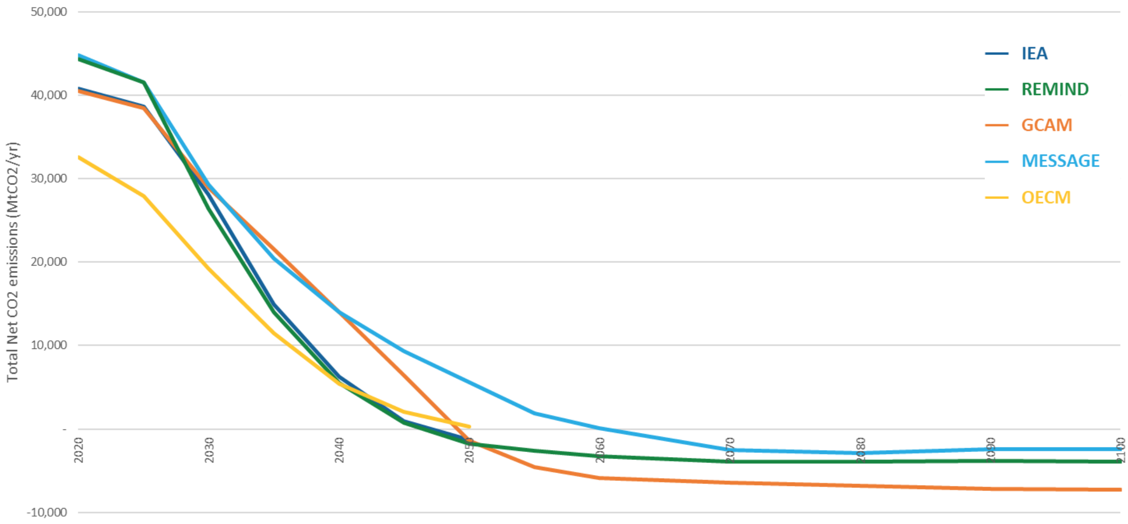


Note: AFOLU = Agriculture, Forestry, and Other Land Use. Measures to address AFOLU emissions are not explicitly part of the IEA NZE Scenario, thus only cumulative 2020-2050 net CO_2 emissions from energy combustion and industrial processes are displayed for IEA.
Source: ISS STOXX Research, based on IEA WEO, OECM 2022 and 2023, NGFS Phase III and V, IPCC AR6

Climate science is inherently uncertain, which means that carbon budgets are estimated based on a given probability: the higher the probability of staying below a temperature threshold is, the smaller the carbon budget. The remaining 1.5°C carbon budgets for the selected pathways differ because of the timing of Net Zero emissions, as shown in Figure 13, and the reliance on carbon dioxide removals, as shown in Figure 15. Some scenarios may also overshoot their temperature goal in the mid-term before returning to the set temperature towards end of century. OECM is the most stringent pathway, projecting a temperature rise limited to 1.5°C with a 50% probability and no temperature overshoot. In NGFS scenarios, net CO_2 emissions reach zero around

2050, giving at least a 50 % chance of limiting global warming to below 1.5°C by the end of the century, with *limited* overshoot (< 0.2°C) of 1.5°C in earlier years.

Figure 13: Total Net CO_2 Emissions of Selected Orderly Net Zero Pathways for the Period 2020-2100 (from Energy Combustion, Industrial Processes and AFOLU)



Source: ISS STOXX Research, based on IEA WEO, OECM 2023, NGFS Phase V

Figure 13 also highlights that historical data is not consistent across pathways, indicating differences in baseline estimations, methods, and coverage and creating further comparison challenges.

Using up-to-date pathway data or adjusting for the current level of emissions is critical for scenario alignment. In the last three years, the world has consumed 30% of a 30-year budget that aligns with limiting temperature rise to a 1.5°C with a 50% likelihood, as outlined by the IPCC (AR6 Summary for Policymakers, Table SPM.2).

Socio-Economic Assumptions

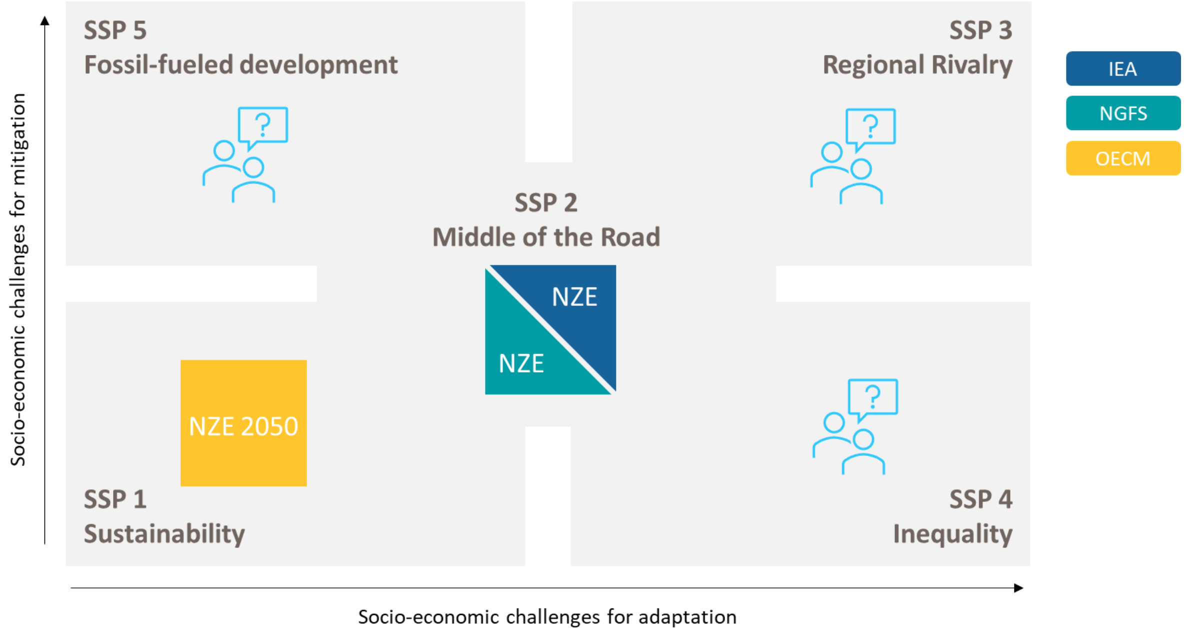
The climate scenarios take also into account Shared Socio-economic Pathways (SSPs)[28]. SSPs are narratives which include projections for economic and population growth, which are key drivers of energy demand and therefore of scenario output such as emissions. NGFS explicitly follows the Shared Socio-Economic Pathway of SSP2 for all its seven Phase V scenarios (refer to p148 of the Technical Documentation), while OECM takes SSP1. IEA scenarios are constructed from energy and policy analysis and do not explicitly use SSPs. Nevertheless, one can consider that the moderate population and economic growth assumptions incorporated in IEA scenarios are closer to a "middle of the road" scenario. Therefore, the selected pathways depict futures where global development and growth follow historical patterns, may improve as shown in Figure 14.

Even though selected pathways rely on five major public models, only two Shared Socioeconomic Pathways (SSPs) are explored; potentially hiding from financial institutions a full set of possible futures, and its associated financial impacts and risks. SSPs are narratives which include projections for economic and population growth, which are key drivers of energy demand and shape therefore model outputs. Figure 14 shows that several narratives are left unexplored, representing a major drawback for scenario alignment,

[28] https://unfccc.int/sites/default/files/part1_iiasa_rogelj_ssp_poster.pdf

especially in the context of financial institutions. For instance, if regional GDP trajectories were more aligned with *SSP 3 Regional Rivalry*, higher but uneven transition and physical risks financial impacts would be expected across regions and sectors. The introduction of the *Fragmented World scenario* in NGFS Phase V is welcomed as it assumes delayed and divergent climate policy ambition globally, leading to high physical and transition risks. However, *Fragmented World* is comparable to a SSP2 RCP3.4 scenario. Such limitation has been highlighted by the NGFS itself in its 2023 Survey on Climate Scenarios and FAQ.

Figure 14: Positions of Selected Net Zero Pathways Relative to the SSPs Narratives



Source: ISS STOXX Research, adapted from SSPs. For illustrative purposes only

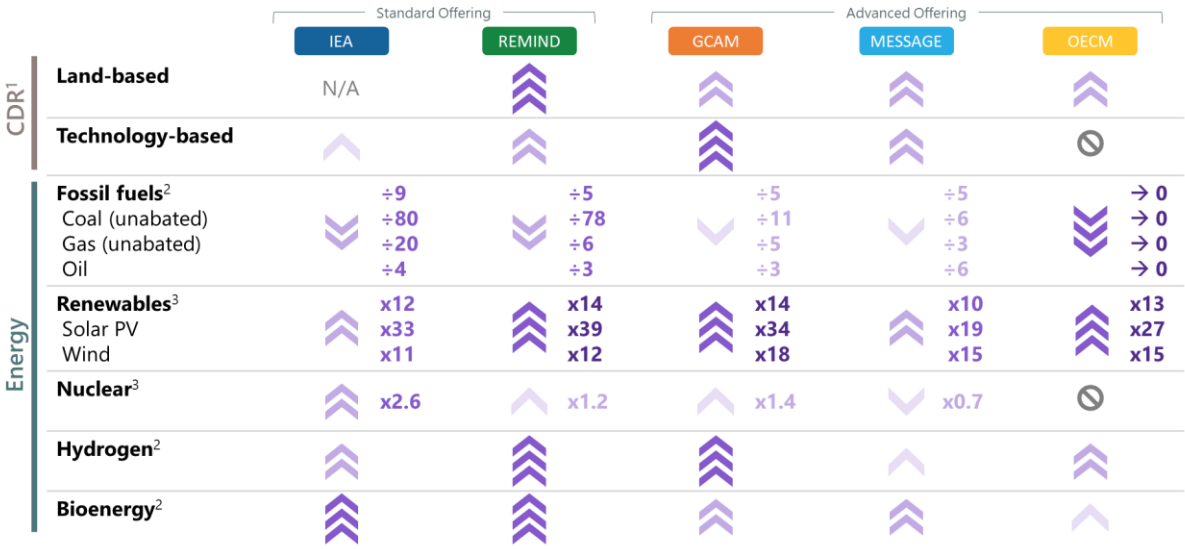
Technological Development Assumptions

Models do not provide the same pathway outputs, but one should not expect them to do. Models are built differently: IEA GEC is a granular energy model, NGFS models include macro-economic impacts, and OECM is a technical pathway based on proven solutions. Pathways are developed by different working groups with a diversity of focus and guiding principles which may lead to different assumptions on technology availability and cost assumptions.

Figure 15 shows that there is relative consensus on two fundamental elements of the energy transition, namely the rapid phase down of fossil fuel usage and the expansion of renewable energy. Coal power plants are phased out by mid-century, with advanced economies leading the way. IEA and OECM Net Zero Pathways explicitly do not allow for new oil, gas, and coal project development from 2021.

However, Figure 15 also shows that some other technologies are deployed differently among pathways. For instance, new nuclear power is viewed as not cost competitive and too slow to implement by OECM while IEA mobilize more than a doubled installed capacity. Nevertheless, most nuclear reactors are reaching end-of-life and would need to be replaced even if capacity is just to be maintained as in NGFS models, requiring significant investments. Carbon sequestration through land-related activities and/or technologies is also dividing. As an energy modeler, the IEA does not rely on land-based sequestration but relies extensively on Carbon Capture and Storage (CCS) to offset residual emissions. CCS is excluded in OECM as seen as not market ready while NGFS models use both solutions to larger extents.

Figure 15: Selected Pathways Carbon Dioxide Removal (CDR) and Energy Assumptions Comparison



Indicators compare 2050 value with a 2020 baseline, at a world-level.
[1]Based on $MtCO_2$ removed. [2]Based on energy (EJ). [3]Based on electricity generation installed capacity (GW)
Source: ISS STOXX Research. Based on IEA WEO, OECM 2023, NGFS Phase V

The underlying pathway assumptions provide a useful benchmark for financial institutions to shape their lending, investment, and insurance activities, and related services, in line with their expectations of what a net-zero transition in specific sectors may entail.

Appendix 3: GFANZ 'Fair-Share' Carbon Budget Approach

Table 14: GFANZ variable definition

OBJECTS DEFINITIONS		VARIABLES DEFINITION	
$C_{i,s}$	Counterparty *i* included in the sector *s*	$E_{C_i\,Y}$	Emissions of the counterparty *Ci* in the year *Y*
B	Segment benchmark (made of the universe of counterparties *i*) corresponding to sector *s*	$E_{B_i\,Y}$	Emissions of the benchmark *Bi* in the year *Y*
B_i	Counterparty-specific benchmark associated with the counterparty *i* and the segment benchmark *B*	$D_{C_i\,Y}$	Denominator of the counterparty *Ci* in the year *Y* (e.g., fossil fuel production, electricity generation, revenue[29])
Y	Year	$D_{B_i\,Y}$	Denominator of the benchmark *Bi* in the year *Y* (e.g., fossil fuel production, electricity generation, sector contribution to GDP)
Y_0	Baseline year	$EI_{C_i\,Y}$	Emissions intensity of the counterparty *Ci* in the year *Y*
		$EI_{B\,Y}$	Emissions intensity of the benchmark *Bi* in the year *Y*

In order to build a counterparty-specific benchmark in absolute terms, first, the industry benchmark and counterparty emissions intensities are compared in the baseline Y_0, which are expressed as the ratio of their respective absolute emissions and denominators in Y_0

$$EI_{C_i\ Y_0} = \frac{E_{C_i\ Y_0}}{D_{C_i\,Y_0}}$$

$$EI_{B\ Y_0} = \frac{E_{B\ Y_0}}{D_{B\,Y_0}}$$

Then the counterparty-specific benchmark starting point in Y_0 is built in absolute terms, starting at the counterparty's absolute emissions in Y_0, adjusted with the ratio of the benchmark's emissions intensity with the counterparty's emissions intensity in Y_0.

$$E_{B_i\ Y_0} = E_{C_i\ Y_0} \times \frac{EI_{B\ Y_0}}{EI_{C_i\ Y_0}}$$

Projecting over time, the counterparty-specific benchmark can then evolve following the same trend as the benchmark, which is equivalent to multiplying the counterparty-specific benchmark's absolute emissions in

[29] In PCAF terms, fossil fuel and electricity are production-based metrics whereas revenue is an economic-based metric

Y_0, with the segment benchmark's absolute emissions in year Y, divided by the segment benchmark's absolute emissions in Y_0

$$(1): E_{B_i\ Y} = E_{C_i\ Y_0} \times \frac{EI_{B\ Y_0}}{EI_{C_i\ Y_0}} \times \frac{E_{B\ Y}}{E_{B\ Y_0}}$$

$$E_{B_i\,Y} = E_{C_i\ Y_0} \times \frac{D_{C_i\,Y_0}}{E_{C_i\,Y_0}} \times \frac{E_{B\ Y_0}}{D_{B\ Y_0}} \times \frac{E_{B\ \ Y}}{E_{B\ Y_0}}$$

This formula can then be simplified.

$$(2): E_{B_i\,Y} = E_{B\ Y} \times \frac{D_{C_i\,Y_0}}{D_{B\ Y_0}}$$

Appendix 4: GHG Reduction Target

GHG Reduction target information is collected based on company disclosure. The data is structured across 5 scopes (3 distinct scopes: S1, S2 & S3 and 2 aggregate: S1 + S2 & S1 + S2 + S3). The goal is to provide a target projection as a time series from 2020 to 2050 for each scope. Aggregated values at S1S2 and S1S2S3 will be directly available on DataDesk.

Each scope can have up to three reduction rates and time horizons. The reduction is given based on the value at base year, a target year, and an absolute emissions reduction rate. Intensity-based reduction targets are not considered in the present analysis due to the uncertainty around the denominator forecast.

A sample GHG Reduction target data is provided in Table 15.

Table 15: Sample GHG Reduction Target Data

SCOPE	TARGET 1			TARGET 2			TARGET 3		
	Base year	Target year	Rate	Base year	Target year	Rate	Base year	Target year	Rate
S1									
S2									
S1S2	2020	2027	29.4	2020	2030	42	2018	2050	100
S3	2020	2027	17.5				2020	2030	25
S1S2S3	2018	2050	90						

Target Projection

Each of the 5 scopes has **2 possible states**:

- **Have at least one target** in any of its 3 time-horizons, or
- **Have no targets at all**.

For **1 time horizon**, each of the 5 variables has 2 states, resulting in: $2^5 = 32$ combinations

For **3-time horizons**, each time horizon still independently has **2 possible states** (yes or no). For each variable, this leads to $2^3 = 8$ combinations per variable

Considering both the target presence across horizons and variable state, there are $2^{3\times5} = 2^{15} = 32{,}768$ total combinations

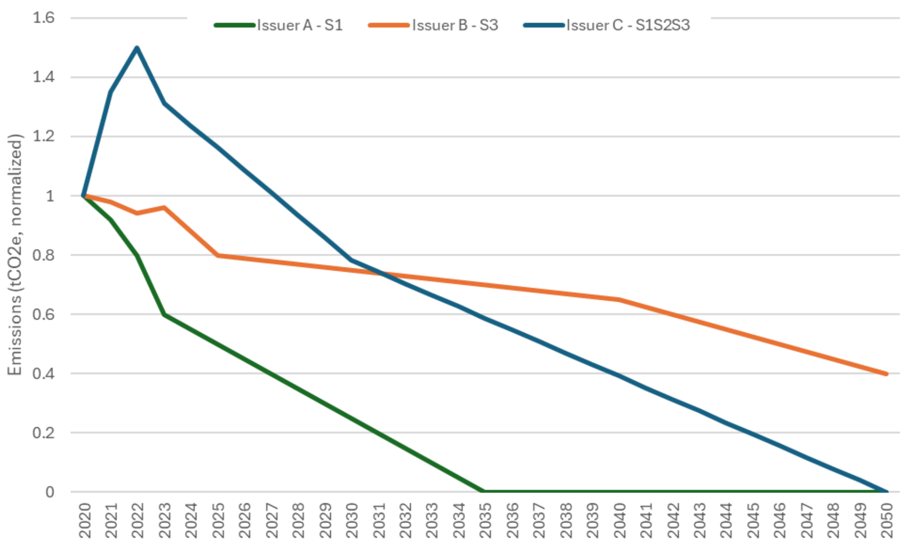
We also note that S1S2 can have its own reduction rate(s) but it is also the sum of S1 and S2. S1S2S3 can have its own reduction rate(s) but it is also the sum of S1, S2, and S3.

Iterative Process Across Target Years

- Compute target emissions for all scopes and all target years
- We go through ascending years, as the soonest target (across all variables) takes priority. We use the last published fiscal year or previous target year as the start year for the interpolation. Compared to 2024 methodology, in which we were using an interpolation between the target base year and target year, it represents more accurately the company's required steps to meet their target
- Companies that have increased their emissions since base year are penalized in cumulative terms by both the rollover approach, and a larger interpolation starting point.

The target emissions projection captures non-linear changes, and quantifies companies targets as per various disclosures. Figure 16 shows the variety of targets that can be included in the projection. For example, the target of Issuer A Scope 1 is an absolute reduction of 100% by 2035. Issuer B Scope 3 target has 3 distinct time horizons: 2025, 2040 and 2050. Issuer C Scope 1, 2 and 3 would be the result of the iterative process described above. Note that in this illustration 2023 is considered here as the last published fiscal year available so emissions between 2020 to 2023 are historical.

Figure 16: Target Emissions Projection Examples Accounting for Multiple Scopes and Target Horizons



Example: Quantifying Scope 1 and 2 Target Emissions at the First Target Year

Table 16: Data Availability Permutations, for a Given Target Year

	1	2	3	4	5	6	7	8
S1	✓ $E_{T\,S_1\,Y_T}$	✗ $E_{T\,S_{12}\,Y_T} - E_{T\,S_2\,Y_T}$	✓ $E_{T\,S_1\,Y_T}$	✗ $w_{S_1} \times E_{T\,S_{12}\,Y_T}$	✓ $E_{T\,S_1\,Y_T}$	✗ $E_{P\,S_1\,Y_T}$	✓ $E_{T\,S_1\,Y_T}$	✗ $E_{P\,S_1\,Y_T}$
S2	✓ $E_{T\,S_2\,Y_T}$	✓ $E_{T\,S_2\,Y_T}$	✗ $E_{T\,S_{12}\,Y_T} - E_{T\,S_1\,Y_T}$	✗ $w_{S_2} \times E_{T\,S_{12}\,Y_T}$	✓ $E_{T\,S_2\,Y_T}$	✓ $E_{T\,S_2\,Y_T}$	✗ $E_{P\,S_2\,Y_T}$	✗ $E_{P\,S_2\,Y_T}$
S1S2	✓ $E_{T\,S_{12}\,Y_T}$	✓ $E_{T\,S_{12}\,Y_T}$	✓ $E_{T\,S_{12}\,Y_T}$	✓ $E_{T\,S_{12}\,Y_T}$	✗ $E_{T\,S_1\,Y_T} + E_{T\,S_2\,Y_T}$	✗ $E_{P\,S_1\,Y_T} + E_{T\,S_2\,Y_T}$	✗ $E_{T\,S_1\,Y_T} + E_{P\,S_2\,Y_T}$	✗ $E_{P\,S_1\,Y_T} + E_{P\,S_2\,Y_T}$

- $E_{T\,S_x\,Y_T}$ are the Target projected emissions for a given scope S_x and Target Year Y_T
- $E_{P\,S_x\,Y_T}$ are the Policies projected emissions at Target Year Y_T, for a given scope S_x

Comprehensive Data Disclosure (1-5)

- S1S2 is defined by an aggregate target (1-4)
- Definition of scope S_X specific targets (S1 or S2)
  - Explicit definition (1)
  - Implicit definition
    1. As the difference between the aggregate and scope-specific targets S1S2 – S_X (2 and 3)
    2. As the constant ratio between scope-specific and aggregate emissions at base year (4)
- S1S2 is implicitly defined as the sum of S1 and S2 (5)

Incomprehensive Data Disclosure: Inclusion of Policies Projections (6-8)

- S1S2 is not defined by an aggregate target, and lack scope-specific information
  - Prioritize scope S_X specific targets or fill with the Policies projection

Targets Ending After 2050

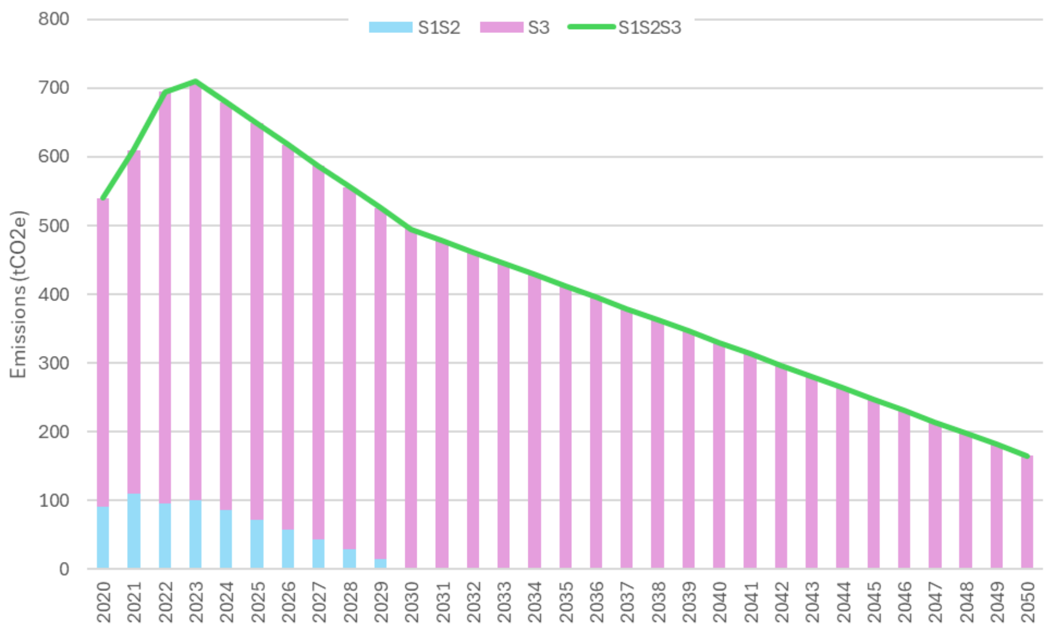
Target years may go beyond our analysis period of 2050. Some companies, especially in hard-to-abate sectors and emerging markets may set 2060 Net Zero targets for example.

Table 17: Example of Target Ending in 2060

SCOPE	TARGET 1			TARGET 2			TARGET 3		
	Base year	Target year	Rate	Base year	Target year	Rate	Base year	Target year	Rate
S1									
S2									
S1S2	2023	2030	100						
S3	2023	2060	100						
S1S2S3									

The method still reflects this decarbonisation commitment by interpolating from the penultimate target year (2030 in Figure 17) to the zero emissions point in 2060. Thus, emissions in 2050 will remain above zero, but expected to be significantly reduced.

Figure 17: Scope 1 & 2 and Scope 1, 2 & 3 targets with 2030 and 2060 horizons



Companies Without Targets

Companies without targets have the same target projected emissions as the Policies projection.

Target Tracking

Table 18 aims at defining the different concepts of historical and target emissions.

Table 18: Definitions for Target Translation, Projection, and Tracking

	SCOPES	TIMESERIES	ASSUMPTIONS	FACTORS
Historical emissions $E_{H\,S_x\,20XX}$	S1, S2, S1S2, S3, S1S2S3	2017 - last published fiscal year [30]	Modelled and reported	e.g., using Historical Projection for year 20XX in 2020- last published fiscal year S1S2: *ClimateProjEmssHist20XXd* S1S2S3: *ClimateProjEmssHist20XX*
Target translation $E_{T\,S_x\,20XX}$	Based on company disclosure	Target base year – target year	Linear interpolation for the first / only absolute target	
Target tracking	Based on company disclosure	Target base year – last published fiscal year	Annual divergence % Cumulative divergence % Adjusted reduction rate	SCOPE in [S12, S3, S123] *Climate[SCOPE]TgtTrck20XX* *Climate[SCOPE]CuTgtTrck* *Climate[SCOPE]NewTgt*
Target projection	S1, S2, S1S2, S3, S1S2S3	2020 - 2050	Iterative process across target years prioritizing explicit scope-specific target and implicit scope definition or filling with the scope policies projection. Overwrite with historical emissions.	S1S2: *ClimateProjEmssTgt20XXd* S1S2S3: *ClimateProjEmssTgt20XX*

Target Translation

For a given scope S_x, Target emissions $E_{T\,S_x\,Y_T}$ are equal to the baseline emissions reduced by the reduction rate R.

$$E_{T\,S_x\,Y_T} = E_{H\,S_x\,Y_B} \times (1 - R)$$

For Y within Y_B and Y_T, we interpolate linearly.

[30] e.g., FY2024 for a 2026 analysis

Target Tracking

We compare the realized historical emissions with the annual target linear translation.

On an annual 20XX basis for years between [2020 or base year] and the last published fiscal year(e.g., 2023).
We define $a = E_{H\,S_x\,20XX}$, $\mathrm{b} = E_{T\,S_x\,20XX}$.

$$Climate[SCOPE]TgtTrck20XX = \mathrm{sign}(\mathrm{a}-\mathrm{b})\frac{|a-b|}{\frac{a+b}{2}}$$

We use signed absolute percentage change formula to calculate the annual target tracking as it is more robust with (near-)zero values. Target emissions can be zero (b = 0).

Interpretation

- Positive values: $E_{H\,S_x\,20XX}\,(a) > E_{T\,S_x\,20XX}\,(b)$. It means that the issuer has increased or did not manage to reduce its emissions below its expected target emissions level (assuming a linear reduction).
- Negative values: $E_{H\,S_x\,20XX}\,(a) < E_{T\,S_x\,20XX}\,(b)$. It means that the issuer managed to reduce its emissions below its expected target emissions level (assuming a linear reduction).
- Zero: $E_{H\,S_x\,20XX}\,(a) = E_{T\,S_x\,20XX}\,(b)$. It means that the issuer annual emissions are in line with their expected target emissions level (assuming a linear reduction).
- Magnitude: Scores are bound [-2; 2] by construction. *The formula uses the average of a and b as the reference point for the percentage change (symmetric measure).*

- On a cumulative basis for years Y between [2020 or base year] and last published fiscal year (e.g., 2023).

$$\mathrm{Climate[SCOPE]CuTgtTrck} = \frac{\sum_Y E_{H\,S_x\,Y} - \sum_Y E_{T\,S_x\,Y}}{\sum_Y E_{T\,S_x\,Y}}$$

We use a simple percentage change formula as we do not expect $\sum_Y E_{T\,S_x\,Y}$ to be equal to 0 so that the interpretation is easier.

Interpretation

- Positive values: $\sum_Y E_{H\,S_x\,Y} > \sum_Y E_{T\,S_x\,Y}$. It means that the issuer has increased or did not manage to reduce its emissions below its expected target emissions level (assuming a linear reduction).
- Negative values: $\sum_Y E_{H\,S_x\,Y} < \sum_Y E_{T\,S_x\,Y}$. It means that the issuer managed to reduce its emissions below its expected target emissions level (assuming a linear reduction).
- Zero: $\sum_Y E_{H\,S_x\,Y} = \sum_Y E_{T\,S_x\,Y}$. It means that the issuer cumulative emissions are in line with their expected target emissions level (assuming a linear reduction).

- Magnitude: simple percentage change formula. *The formula uses the sum of target translation emissions as the reference point for the percentage change (asymmetric measure).*

Adjusted Target Rate

S the cumulative sum of Target emissions $E_{T\,S_x\,Y_T}$ from base year Y_B to target year Y_T.

$$S = \sum_{Y_B}^{Y_T} E_{T\,S_x\,Y}$$

We define the adjusted target emissions $E_{T_a\,S_x\,Y_T}$ from the latest available year Y_0 to target year Y_T. so that the cumulative sum S is constant, when considering the realized historical emissions $E_{H\,S_x\,Y}$ from base year Y_B.

$$S = \sum_{Y_B}^{Y_0-1} E_{H\,S_x\,Y} + \sum_{Y_0}^{Y_T} E_{T_a\,S_x\,Y}$$

$$(a): \sum_{Y_0}^{Y_T} E_{T_a\,S_x\,Y} = S - \sum_{Y_B}^{Y_0-1} E_{H\,S_x\,Y}$$

Assuming a linear decrease of emissions r_{lin} from the latest available historical emissions $E_{H\,S_x\,Y_0}$, we define the annual adjusted target emissions $E_{T_a\,S_x\,Y}$ for $Y \in [Y_0; Y_T]$

$$(b): E_{T_a\,S_x\,Y} = E_{H\,S_x\,Y_0} + r_{lin} \times (Y - Y_0)$$

Applying the formula of the sum of a linear curve over the number of years $n = Y_T - Y_0 + 1$

$$\sum_{Y_0}^{Y_T} E_{T_a\,S_x\,Y} = r_{lin} \times \frac{(n-1) \times n}{2} + E_{H\,S_x\,Y_0} \times n$$

Using (a):

$$S - \sum_{Y_B}^{Y_0-1} E_{H\,S_x\,Y} = r_{lin} \times \frac{(n-1) \times n}{2} + E_{H\,S_x\,Y_0} \times n$$

We can deduct the required linear decrease of adjusted target emissions r_{lin}

$$r_{lin} = \frac{2 \times (S - \sum_{Y_B}^{Y_0-1} E_{H\,S_x\,Y} - E_{H\,S_x\,Y_0} \times n)}{(n-1) \times n}$$

At $Y = Y_T$**, adjusted** target emissions $\boldsymbol{E_{T_a\,S_x\,Y_T}}$

$$(c): E_{T_a\,S_x\,Y_T} = E_{H\,S_x\,Y_0} + r_{lin} \times (Y_T - Y_0)$$

Adjusted reduction rate R_a

For a given scope S_x, the adjusted target emissions $E_{T_a\,S_x\,Y_T}$ are equal to the baseline emissions reduced by the adjusted reduction rate R_a.

$$E_{T_a\,S_x\,Y_T} = E_{H\,S_x\,Y_B} \times (1 - R_a)$$

$$R_a = 1 - \frac{E_{T_a\,S_x\,Y_T}}{E_{H\,S_x\,Y_B}} = \text{Climate[SCOPE]NewTgt}$$

The interpretation of Climate[SCOPE]NewTgt concurs with the sign of Climate[SCOPE]CuTgtTrck. For example, if Climate[SCOPE]CuTgtTrck > 0 then the required rate will be greater than the initially stated target rate.

Illustrative Example

Table 19: Sample Target Data used for Tracking example

SCOPE	TARGET 1			TARGET 2			TARGET 3		
	Base year	Target year	Rate	Base year	Target year	Rate	Base year	Target year	Rate
S1	2018	2030	35						
S2									
S1S2									
S3	2018	2030	35						
S1S2S3	2018	2050	100						

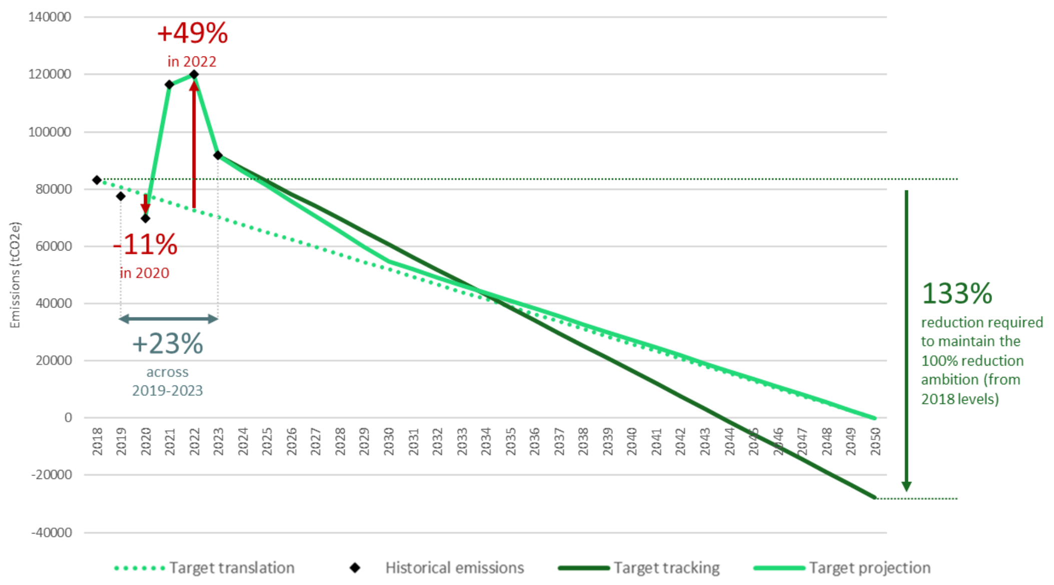
Table 20: Example of Historical Emissions, Target Translation, Target Tracking, and Target Projection for Scope 1, 2, & 3

	HISTORICAL	TRANSLATION	TRACKING	TARGET
	(a)	(b)	$sign(a-b) \times \frac{\lvert a-b \rvert}{\frac{a+b}{2}}$	
2018	83130	83130		N/A
2019	77560	80532	- 0.04	N/A
2020	69804 *ClimateProjEmssHist2020*	77934	- 0.11 *ClimateS123TgtTrck2020*	69804 *ClimateProjEmssTgt2020*
2021	116545 *ClimateProjEmssHist2021*	75336	0.43 *ClimateS123TgtTrck2021*	116545 *ClimateProjEmssTgt2021*
2022	120108 *ClimateProjEmssHist2022*	72739	0.49 *ClimateS123TgtTrck2022*	120108 *ClimateProjEmssTgt2022*
2023	91680 *ClimateProjEmssHist2023*	70141	0.27 *ClimateS123TgtTrck2023*	91680 *ClimateProjEmssTgt2023*
…				*ClimateProjEmssTgt20XX*
2030	N/A	51956	N/A	54667 *ClimateProjEmssTgt2030*
…				*ClimateProjEmssTgt20XX*
2050	N/A	0	N/A	0 *ClimateProjEmssTgt2050*
Cumulative (2019-2023)	475697	376683	0.23 *ClimateS123CuTgtTrck*	

In the example illustrated in Figure 18, the factors will show:

- *ClimateS123TgtTrck2020* = - 0.11 and *ClimateS123TgtTrck2022* = 0.49
- *ClimateS123CuTgtTrck* = 0.23
- *ClimateS123NewTgt* = 1.33 (2050 vs. 2018 base year)

Figure 18: Example of Historical Projection, Target Translation, Target Tracking, and Target Projection for Scope 1, 2, & 3



Appendix 5: Version Control

VERSION	DATE	DETAILS
1.0	February 2020	Initial Version
1.1	February 2021	Documentation of specific approaches for Fossil fuel producers, Utilities, and other economic sectors
1.2	March 2022	Documentation of input scenario changes (IEA CPS discontinued, APS added)
2.0	March 2024	Documentation of enhanced methodology regarding emissions projections, carbon budgets, and alignment metrics
2.1	February 2025	Documentation of increased granularity of target data and new disaggregated factors for Scope 1 & 2
2.2	October 2025	Document review and update
2.3	March 2026	Document review and update

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