

# Scope 3 Greenhouse Gas (GHG) Emissions Dataset

## Methodology

S&P Global Sustainable1 – March 2025

# Table of Contents

**Terms and Definitions ..... 3**

**Introduction and Context ..... 4**

**Data Sources and Collection ..... 6**

**Methodology Overview..... 7**

    1. Latest Year Disclosure: ..... 8

    2. Previous Year Disclosure Extrapolated:..... 9

    3. Modelled Data: ..... 9

**Monitoring and Review..... 13**

**Assumptions and Limitations ..... 14**

**Maintenance/Updates ..... 16**

**Updates and Enhancements..... 17**

**S&P Global Sustainable1 Disclaimer ..... 21**

# Terms and Definitions

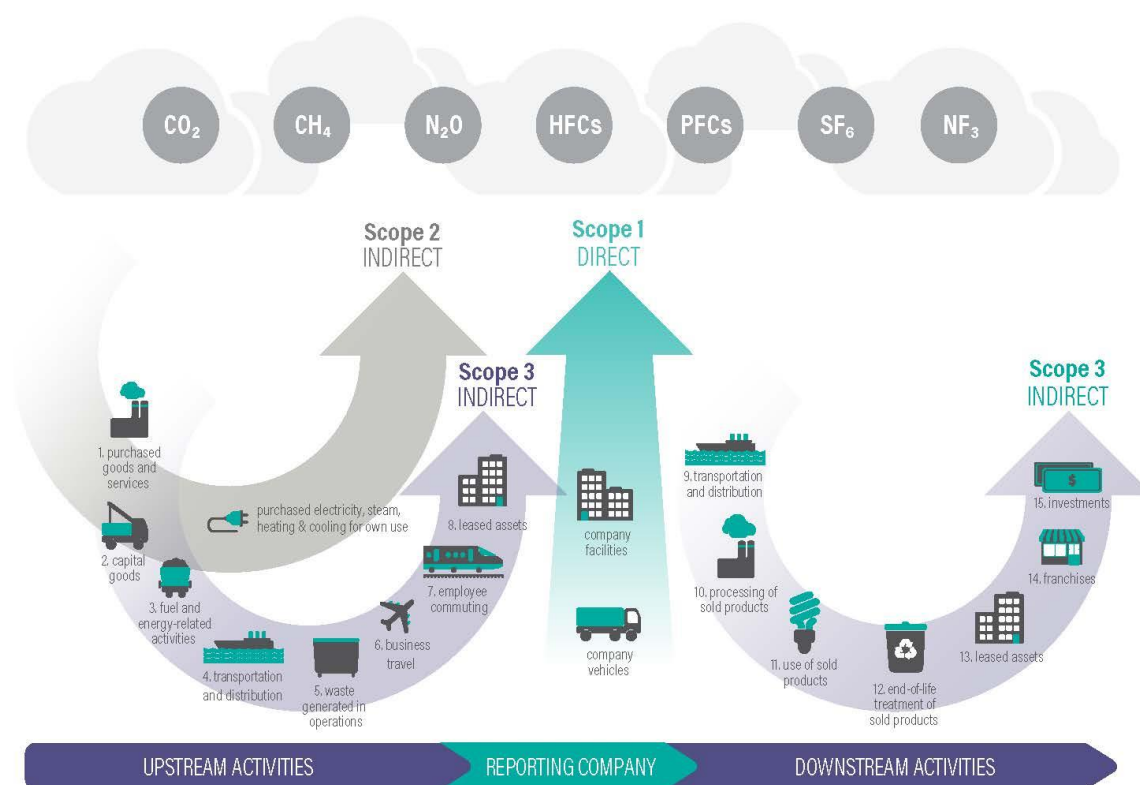
Term	Description
<b>CDP</b>	CDP (Carbon Disclosure Project) is a global nonprofit that provides a platform for companies, cities, and regions to disclose their environmental impacts, focusing on climate change, water security, and deforestation.
<b>GHG Protocol Standard</b>	A widely used standard for accounting and reporting greenhouse gas emissions.
<b>GICS</b>	The Global Industry Classification Standard (GICS) is a widely used system for categorizing companies into sectors, industry groups, industries, and sub-industries based on their business activities. It provides a standardized framework for analysing and comparing companies globally.
<b>Greenhouse gases (GHG)</b>	Gases that trap heat in the atmosphere and contribute to the greenhouse effect, such as carbon dioxide, methane, and nitrous oxide.
<b>Evaluation Status</b>	The evaluation status includes two components: whether a Scope 3 category is relevant to your business and whether you have calculated the emissions in that category.
<b>Scope1</b>	Direct GHG emissions emitted during the operational phase of assets owned by the reporting entity (e.g., on-site fuel consumption, fugitive emissions).
<b>Scope2</b>	Indirect GHG emissions associated with the electricity, heat, and steam purchased and used on-site for the asset operations.
<b>Scope3</b>	Other indirect greenhouse gas emissions resulting from activities of the reporting entity but occurring at sources owned or controlled by another entity. Scope3 covers activities that occur both upstream and downstream such as the construction stage, manufacturing of auxiliary materials used in the production stage and the treatment of waste generated in the production process.
<b>Scope3 downstream</b>	Indirect greenhouse gas emissions from the use of the reporting entity's products or services.
<b>Scope3 upstream</b>	Indirect greenhouse gas emissions from the supply chain of the reporting entity.
<b>Trucost Environmental</b>	<a href="#">Trucost Environmental</a> data measures environmental impact across key dimensions for over 20,000 companies.

# Introduction and Context

**Scope 3 greenhouse gas (GHG) emissions** are defined as all other indirect emissions (not included in Scope 2) that are generated throughout a company's value chain. These indirect activities, highlighted in Figure 1 below, are the largest source of GHG emissions for companies operating in many sectors.

Scope 3 GHG emissions are divided into 15 categories<sup>1</sup> that represent the upstream and downstream activities of a company. Upstream emissions include the impacts that arise from everything required to produce your service or product, while downstream emissions include the impacts that arise from everything related to consuming your service or product. S&P Global Sustainable1 ('S1') considers all upstream and downstream Scope 3 categories as outlined by the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard<sup>2</sup>.

**Figure 1: Overview of GHG Protocol Scopes and Emissions**



**Source:** Greenhouse Gas (GHG) Protocol (2024)

The Scope 3 Greenhouse Gas (GHG) Emissions Dataset provides users with emissions data across the value chain for companies in S&P Global Sustainable 1's covered research universe (incorporating the Core Plus and Private MU indices). Scope 3 Upstream data is also available for the fully modelled private company universe. It includes Scope 3 upstream and

<sup>1</sup> Including 'Other (upstream)' and 'Other (downstream)' increase this count to 17 categories.

<sup>2</sup> Greenhouse Gas (GHG) Protocol. Corporate Value Chain (Scope 3) Accounting and Reporting Standard. Retrieved from: [https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporting-Standard\\_041613\\_2.pdf](https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporting-Standard_041613_2.pdf)



downstream absolute emissions, intensities expressed in metric tons of carbon dioxide equivalent per million USD revenue (tCO<sub>2</sub>e/USD mn) and disclosure sources. For Scope 3 downstream, the dataset also provides a breakdown of the emissions according to the eight categories outlined by the GHG Protocol - these are the seven categories listed in Figure 1, as well as an 'Other (Downstream)' category.

# Data Sources and Collection

The data sources utilized in this dataset includes input from a variety of sources, such as company disclosures, third-party data providers, and calculated emissions data from S&P Global Sustainable1's (S1) proprietary environmentally extended input-output (EEl-O) model. Calculated emissions data includes that derived from company disclosed GHG emissions and fossil fuel production data, SPGI Mobility automobile vehicle sales volume, emission factors from government or regulatory bodies, and the S1 environmentally extended input-output (EEl-O) model (see *Methodology Overview* section for details).

## CDP Disclosure

### Downstream Emissions & Evaluation Status

Although most downstream emission disclosure captured in TRAX is from the CDP, the methodology also extracts disclosures directly from CDP reports. This approach is taken for several reasons:

- **Historical Disclosure Requirements:** Trucost-verified disclosures are predominantly available from FY 2021 onwards. However, the Scope 3 GHG emissions dataset spans back to FY 2019, and the top-down model utilizes a 5-year rolling average, necessitating the inclusion of historical disclosures and the inclusion of company data outside of the Trucost research universe.
- **Relevancy:** Companies provide the evaluation status for downstream emission categories, which helps assess the relevance of a company's category emissions. Because the evaluation status is not recorded in TRAX, the information from CDP reports is utilized to develop the profiles of mapped companies in the final dataset. For Financial Services firms, S1 consistently regards the 'Investments' category as relevant, in accordance with CDP guidance.
- **Partial Disclosure:** Prior to FY 2023, S1 did not collect disclosures classified as partial. However, when a partial disclosure exceeds the estimated value generated by the Python engine, the partial value takes precedence. Therefore, partial disclosures from before FY 2023 are sourced from CDP reports.

It is important to note that Trucost data remains the primary source for emission disclosure wherever it is available.

## S&P Mobility Disclosure

The compilation of companies organized by sales volume based on drive type and manufacturer, pertinent to the Automobile Module universe, is sourced from the internal database – Global Auto Model Tracker.

## Other sources

The development team utilizes other various datasets to operate the Python engine. These datasets include emission factors at both regional and company levels, as well as internal company maps etc. To enhance our model inputs, we continuously assess and review these datasets.

# Methodology Overview

## S&P Global Sustainable1's Research Process

S1 provides a robust and comprehensive lens on the environmental performance of more than 18,000 companies, representing over 95% of global market capitalization, through its four-step research process. This research process has been developed to minimize the environmental reporting burden on companies - also known as "survey fatigue" - while providing a transparent system for companies to verify their environmental performance profile and, at any time, contribute their most recently available data. This research process provides the foundation of S1's Scope 3 GHG Emissions data set.

### 1. Research the Environmental Reporting of Companies

Every year, S1 analysts research the published environmental performance information of companies in annual reports, sustainability reports, websites, and other publicly disclosed sources. Data on environmental impacts are collected, encompassing carbon and other pollution emissions, water dependency, natural resource efficiency, and waste disposal. To make the best use of company reporting, S1 became a CDP Gold Data Partner in 2012, enabling environmental data provided to the CDP Disclosure Programs to be incorporated in this step.

### 2. Standardize Reported Data and Correct Reporting Errors

S1 analysts standardize disclosed environmental performance data to best practice guidelines, including the GHG Protocol Corporate Accounting and Reporting Standard, GRI (Global Reporting Initiative) Standards, and SASB, so that it can be compared across companies, regions, and business activities. To correct reporting errors, vigorous data control procedures are applied, from sector specialist data reviews to automated outlier identifications and year-on-year comparisons.

### 3. Complete Environmental Reporting Gaps

To complete disclosure gaps in environmental reporting, S1 supplements its research with its proprietary economic modeling, founded on environmentally extended input-output (EEI-O) modeling principles (see *Upstream Emissions (S&P Global Sustainable1's EEI-O Model)* section for details). S1's environmental profiling model estimates corporate environmental impacts across company operations and supply chain tiers, back to raw material extraction and processing. Another benefit of this step is that S1 analysts can assess reported data against modeled expectations to further identify reporting errors for in-depth checking.

### 4. Engage With Companies to Verify Their Environmental Performance Profile

Finally, S1 engages annually with most companies in its research universe, either by email or letter (where contact data is available), providing the opportunity to verify their environmental performance profiles and provide additional information. Companies are further welcomed to contact S1 analysts at any point in their environmental reporting cycle to provide their most recently available data. Please note that while S1 makes reasonable efforts to contact companies to gather feedback, not all entities will respond.

## Upstream Emissions (S&P Global Sustainable1's EEI-O Model)

Emissions coming from Scope 3 upstream activities are calculated using S1's environmentally extended input-output (EEI-O) model. Input-output (I-O) tables quantify the ratio of expenditure from one sector across all sectors of the economy. By combining these extended I-O tables with the industry-specific environmental intensity factors, S1 is able to assess the environmental impacts of companies across not only their own operations, but their entire supply chains, including primary resource extraction, secondary processing, and final product assembly as well, thereby covering all the upstream Scope 3 categories.

For example, to produce a single automobile, inputs will be required from other industries, including energy, steel production, and tire manufacturing. In addition, the energy, steel production, and tire manufacturing industries each require their own inputs, and so on throughout the supply chain. A traditional I-O model can estimate the economic transactions required to produce a single automobile across the supply chain. When these economic transactions are extended to include sector-level environmental information, it is also possible to estimate the environmental impacts and dependencies associated with the production of the same automobile throughout the supply chain.

By utilizing its EEI-O model, S1 is able to estimate emissions from all tiers (from cradle-to-gate) of the upstream value chain of a company, covering emissions associated with the company's purchased or acquired goods and services.

Further details on the methodology used to estimate the scope 3 upstream emissions can be found here: [SPG S1 Trucost Environmental Data Methodology.pdf \(spglobal.com\)](#).

## Downstream Emissions

The detailed description of S1's downstream Scope 3 emissions methodology below is divided between how S1 i) uses company reported data, and ii) models to fill in any disclosure gaps. The flow chart below provides a high-level view of the hierarchy used to compile Scope 3 downstream emissions data.

**Figure 2: Quantifying Downstream Scope 3 Emissions**



### 1. Latest Year Disclosure:

For all public and private companies which undergo S1's complete research process (as described above), S1 collects Scope 3 downstream emissions disclosure from the CDP Climate Change Questionnaire, Environmental or CSR Reports, company websites and via direct engagement with companies. S1 also makes use of additional information provided by companies responding to the CDP questionnaire on whether each Scope 3 downstream category is relevant to the company.

Companies are continuously improving their Scope 3 disclosures; therefore, S1 also collects re-stated historical emissions data if the restatement is due to enhanced methodologies, disclosure errors or expansion of reporting boundaries. Note that if a company restructures and restates its historical emissions to reflect the new structure, S1 will not utilize data from these restatements as this would not accurately reflect the company at the time of original reporting in the Scope 3 Downstream Dataset.

Accounting for the category 'Use of Sold Products' emissions of Integrated Oil & Gas subindustry companies can be complicated. Often, companies report the emissions using more than one methodology. In such a situation, based on our understanding of the recommendations provided by different standards and organizations such as Ipieca, CDP and the SBTi, S1 have chosen the methodology with highest emissions.

As part of S1's commitment to ensuring the highest quality, S1 takes steps to evaluate reported data for any obvious outliers in the data points, including:

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- **Data Type:** Ensuring that disclosed data is absolute emissions, not intensity or emission savings.
- **Unit:** Ensuring the data calculated by the company aligns with the required unit (metric tonnes CO<sub>2</sub>e).
- **Duplicate:** Identifying duplicate values reported by the same company for more than 1 Scope 3 category. Where the value disclosed was the same, but the explanatory note was different, S1 assumed the value match was a coincidence and hence did not consider this a duplicate. S1 also identified situations where disclosure for the same fiscal year was disclosed in different CDP questionnaires due to a change in reporting year, in all cases S1 used data which aligned to the updated fiscal year.
- **Relevancy:** Where a company stated that a category was 'Not relevant, explanation provided,' S1 assessed whether the explanation was sufficient. For Financial Services companies, S1 always consider the 'Investments' category to be relevant, as per CDP guidance.
- **Completeness:** S1 assessed whether major emission sources had been excluded from the reported data. For Financial Services companies where portfolio coverage was less than 90%, we reviewed reasons for exclusion. If insufficient reasons were provided, S1 considered the data to be incomplete.

## 2. Previous Year Disclosure Extrapolated:

A small number of companies do not disclose data for the latest fiscal year of analysis, but data was reported in a previous year. In this scenario, emissions intensities (tCO<sub>2</sub>e/USD mn revenue) per disclosed category are calculated for the previous year, and these are then multiplied with the latest year's revenue to estimate latest year's emissions data.

## 3. Modelled Data:

Company reporting on Scope 3 downstream emissions has not been as widely adopted and standardized as Scope 1 and 2 emissions reporting, so it is often necessary to gap fill. Where a category is not disclosed, and the company does not specifically state in CDP that it is not relevant, S1 fills disclosure gaps using S1's 'top down' or 'bottom-up' approaches.

### •Top-Down Approach

S1 uses the 'top-down' modelling approach which applies sector- and Scope 3 category-specific emissions intensities (tCO<sub>2</sub>e/USD mn revenue) at the GICS (Global Industry Classification Standard) sub-industry level. These intensities, developed by S1, are based on disclosed Scope 3 data. Emissions intensities are developed for each of the eight downstream Scope 3 downstream categories:

1. Downstream transportation and distributing
2. Processing of sold products
3. Use of sold products
4. End-of-life treatment of sold products
5. Downstream leased assets
6. Franchises
7. Investments
8. Other (downstream)

The emissions intensity which is applied to estimate a company's downstream Scope 3 category is determined by its GICS sub-industry.

#### Top-Down Emissions Intensity Factors:

Top-down emissions intensity factors are created using Scope 3 downstream disclosed data and S1's consolidated revenue data, collected via its standard company research and data collection process. The approach attempts to cover and derive downstream Scope 3 emissions intensities for all 158 GICS sub-industries.

Disclosure samples for some GICS sub-industries are limited by the number of reporting companies. If there are inadequate samples<sup>3</sup> of disclosed Scope 3 data at the GICS sub-industry level per category to derive the top-down emissions intensities the following approach is used:

- If a valid emission factor cannot be estimated for a given GICS category in a given financial year but is available in a previous or future financial year, forward filling is applied when no emission factor is estimated; otherwise, backfilling will be used.
- Otherwise, samples of companies with a common GICS membership at the next GICS level up (i.e. companies in related GICS sub-industries, like 15101010 (Commodity Chemicals) and 15101050 (Specialty Chemicals), of a common GICS industry, like 151010 (Chemicals)) are used and grouped as one sample. All GICS sub-industries within the GICS industry would use the same emissions intensity factor in modelling. This process would repeat up to another GICS level should sample sizes still not meet the minimum requirement.

Prior to calculating emission factors, the following checks are run on the disclosed emissions data per category and GICS level:

- **Year of disclosure: Factors are calculated using a five-year rolling weighted average (latest fiscal year of analysis plus four previous years), allowing us to consider improvements in disclosure over time.** Therefore, if the fiscal year of reported emissions does not fall into this five-year period, the disclosure will be excluded.
- **Outliers:**
  - **Year-on-year:** A data point is identified as an outlier when the absolute or intensity emissions are more than 80% different to the previous year and the next year. This highlights a “peak” in the data and controls for when companies go from low to high or high to low disclosures, which then remains low or high. If both absolute and intensity emissions are highlighted as outliers, then the data point is discarded. Please note, in case of missing years, the company data points have been linearly interpolated then forward then backward filled, without considering inflation. Disclosed data identified as a year-on-year outlier will be excluded.
  - **Distribution:** A data point is identified as an outlier when looking at the distributions of the selected grouping where the minimum number of data points within a group is 5. Assessment was done at the GICS Subindustry, Industry Group, Industry and Sector levels. S1 have refined the outlier analysis method from the last FY 2020 run so it is better suited to identify outliers given some of the data limitations of the data disclosed to the CDP. In the current method, S1 now identifies outliers based on the Mean and Standard

<sup>3</sup> Top-down emissions intensities derivations require a minimum sample of 5. Note: In the case there are 5 or more valid datapoints to calculate an average for all downstream categories, except for Other (downstream), and the value for 'Other (downstream)' is either 0 or missing, we assume the intensity for Other (downstream) is 0 and accept the emission factor for the GICS Sector.

Deviation approach. A data point is considered as an outlier when its value is more than Mean + 1.645 SD and less than Mean - 1.645 SD. Disclosed data identified as a distribution outlier will be excluded.

- **Manual:** For emission factors exhibiting significant volatility, a manual review is conducted. If the volatility is attributed to flagged or unflagged outliers, manual intervention can be undertaken, where feasible, to ensure the most representative data points are included in the emission factor calculation.

Once all necessary exclusions have been made, the emission factors are calculated. This is done by first calculating the categorical emissions intensity (tCO<sub>2</sub>e/USD mn revenue) of each reporting company. The approach then takes a weighted average of the category-level emissions intensities of companies in each sub-industry to derive the factors at the sub-industry level. This means that for each sub-industry, there are eight emissions intensities, covering each of the downstream categories. These emissions intensities can also be summed together for the overall Scope 3 downstream intensity of the sub-industry.

The derived emissions factors can then be applied to the revenues of non-reporting members of the GICS sub-industry to estimate the expected value of downstream Scope 3 emissions for each category, then summed for the total downstream Scope 3 emissions of those companies. In addition, derived emission factors can be applied to specific categories to fill gaps for companies who have not reported all relevant categories.

As the model is based on company disclosure, S1 expects that the intensity factors will continuously improve over time - as Scope 3 reporting becomes more prevalent and sample sizes at lower GICS levels (i.e., towards sub-industries) grow to meet the minimum required sample size.

### •Bottom-Up Approach

In addition to the top-down approach, S1 utilizes a bottom-up approach for certain key sectors. For Oil & Gas, Coal extraction, and the automotive (passenger) sectors, the categories 'Downstream Transport and distribution', 'Processing of sold products' and 'Use of Products Sold' are material at the portfolio level. Given their emissions profile, Oil & Gas, Coal extraction, and automotive sectors stand out as the top priorities for developing production-based estimation models.

- **Oil & Gas and Coal:** For Oil & Gas and Coal Extraction sectors, S1 uses production data disclosed by each company in the sector. S1 estimates emissions induced by transport, transformation, and combustion of the resource using a life cycle analysis (LCA) approach. Production data are expressed in millions of barrels (MMbbls) of oil, billions of cubic feet of gas, millions of barrels of natural gas liquids, thousands of tonnes of metallurgical and/or thermal coal. These quantities were then broken down by end-product and use type, which allowed S1 to apply emission factors specific to each end-product use, processing, and transportation.
- **Automotive:** For the Automotive sector, annual emissions from vehicle use are a product of vehicle's fleet emissions intensity (gCO<sub>2</sub>/km), number of vehicles sold (units) per drive type (electric, internal combustion, hybrid etc.), and lifetime mileage (km/lifetime). Given a difference in fuel economy and driving patterns across regions worldwide, S1 has calculated the Scope 3 emissions for the operational regions for each auto manufacturer separately, and then aggregated the figure on the global level.

For each auto manufacturer, S1 has collected average fleet emissions per region from regulatory reporting such as those to the European Environmental Agency, US Environmental Protection Agency, Chinese Innovation Centre for Energy and Transportation, among others. Regulatory reporting includes data submitted by the auto manufacturer to the regulatory body for national statistics. Whenever no data has been reported by the company or the regulator, regional averages have been used in their place in the calculations.

The number of vehicles sold per region has been taken from our in-house SPGI Mobility dataset. Average annual mileage per region was taken from LCA country assessments, except sports cars (e.g., Porsche, Ferrari) where the annual mileage corresponds to the company-defined expected annual mileage of those cars.

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The bottom-up approach is applied to all companies in key sectors with relevant production data. If a company also reports valid downstream emissions associated with one of the modelled categories, disclosure is prioritized.

# Monitoring and Review

S1 regularly reviews the Scope 3 GHG Emissions data methodology annually to consider best practice data collection and modelling approaches. All new methodologies and any material changes to existing methodologies are reviewed and approved by an independent methodology governance committee.

Data collected using the S1 research process follows a consistent quality control procedure which includes peer review and data sampling to minimize errors. All final emissions data is calculated using a thoroughly tested Python script to ensure accuracy and consistency. In addition, all external data inputs are reviewed annually as a minimum.

# Assumptions and Limitations

## Assumptions

Most of the assumptions outlined below are either newly introduced or have been adjusted in the latest release of the Scope 3 downstream dataset. For further details, please refer to the **Significant Updates** section.

- **The method for incorporating restatement data from CDP reports.**
  - At present, restatement data are included in the CDP disclosure dataset only if a company has not reported for that specific reporting period in previous CDP reports.
- **Deriving the Financial Year from CDP reports.**
  - The financial year is in part determined by the Report End Date. If this date is missing or cannot be derived from other CDP reports, the reported emissions are excluded.
- **The method for gap filling evaluation status**
  - In cases where evaluation status is missing gaps are filled based on forward filling for a maximum of 3 years. This is important because top-down estimates are only applied to categories with missing emissions and where the evaluation status is not 'Not relevant, explanation provided' or 'Not relevant, calculated'.
- **The method for gap filling zero values**
  - Step 1: Gap fill where the emission value is either NaN or a string and evaluation status is 'Not relevant'.
  - Step 2: For each row, if the evaluation status flag is 'Not evaluated' and the emission value is either NaN or a string, check the most recent non-null value from the past 3 years. If this value is 0, fill the NaN or string emission value with 0. If no value is found, or the most recent non-null value is not 0, leave the emission value unchanged.
- **The method for identifying outliers.**
  - Currently, outliers are identified and removed from the calculation when they are +/- 1.645 standard deviations from the GICS level weighted average. Additionally, if a company's disclosure increases or decreases by 80% or more and it is not part of a longer trend, it is considered an outlier.
- **The method for calculating the valid count of data points.**
  - The current methodology for counting data points includes assumed zeros and disclosures greater than zero, while omitting data flagged for exclusion or identified as outliers.
- **The minimum sample size needed to estimate an emission factor.**
  - Currently, at least five valid data points are needed in each scope 3 downstream category for estimation.
  - If there are 5 or more valid datapoints to calculate an average for all downstream categories, except for Other (downstream), and the value for 'Other (downstream)' is either 0 or missing, we assume the intensity for Other (downstream) is 0 and accept the emission factor for the GICS Sector.
- **The computation method used to create average GICS emission factors.**
  - Estimates are based on a 5-year rolling weighted average, with a weight of 0.5 applied to all 0 values.
- **Removal of emission factors**
  - Currently, if a total emission factor is estimated to be 0, it is excluded.
- **Materiality of specific GICS classification scope 3 downstream categories.**
  - The Financial Services Sector is currently assumed to always have a relevant Investments category, regardless of the disclosed evaluation status.
- **The frequency of updates to GICS emission factors.**
  - Currently, these factors are updated once a calendar year, unless input or methodology changes lead to a significant change in the estimated emission factors. The 'significance' is to be reviewed on a case-by-case basis.
- **The number of years disclosure is scaled-up**
  - Currently, emission values are scaled-up for a maximum of 3 years.
- **Prioritization of available emissions data**

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- Data points are prioritized as follows: full disclosure, partial disclosure (if higher than assumed zero/bottom-up /top-down estimate), assumed zero values, scaled-up values based on previous disclosure and revenue change, bottom-up estimates (production-based), and top-down estimates (revenue-based).

## Limitations

One of the greatest challenges to quantifying company Scope 3 emissions is the lack of reported information. S1's approach aims to overcome this by using the data that is available and using it as the basis to inform the potential Scope 3 emissions of companies not disclosing their value chain emissions. This approach has the following limitations:

- **Reporting bias:** Since the top-down emissions factors are determined by the companies reporting Scope 3 data, they are potentially biased, and potentially towards a lower average intensity than the sector overall if disclosing companies are assumed to be relatively-more carbon efficient. It may be that reporting companies with relatively lower Scope 3 emissions intensities have a greater incentive to disclose this data versus companies with higher downstream impacts that would prefer to not make this information publicly known. This also means that the factors are dependent and highly influenced by the number of companies which report. While S1 takes some initiatives to limit this bias, it is ultimately unavoidable until sample sizes increase, as they are expected to over time.
- **GICS-based Model:** All estimation factors and outlier assessment calculations are run at the GICS subindustry level, but even this might sometimes not be granular enough to account for unusual company situations. For example, Nike is categorized as 'Footwear' along with footwear manufacturing companies, even though it outsources its manufacturing. The company might disclose quite different Scope 3 downstream emissions data to other peers in the same subindustry due to its specific company structure.
- **Consolidation Approach:** The GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard allows companies to select which consolidation approach to use, including: equity share, financial control, or operational control and hence the reporting boundary. These approaches may result in two similar companies reporting quite different Scope 3 figures, depending on the consolidation approach selected. Without having to know which consolidation approach a company may take, S1 estimates the expected value of each Scope 3 category it models, which could lead to overestimating for some companies while underestimating for others. It is assumed that the aggregation of both effects balances out and will approach a truer representation of the population of companies' data as samples increase over time.
- **Minimum or Optional Reporting boundaries:** The GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard also allows companies to select a 'minimum' or 'optional' reporting boundary per Scope 3 category. For example, for the category 'Upstream transportation and distribution' the minimum boundary is the Scope 1 and 2 emissions from the use of vehicles and facilities – such as the jet fuel consumed in airplanes. In contrast, the optional boundary incorporates the full life cycle emissions up the supply chain – such as the emissions of manufacturing and transporting an aircraft. If one company reports in line with the minimum boundary, and another reports in line with the optional boundary, S1 would expect the data to vary significantly.
- **Optional Reporting: the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard, which most reporting companies follow, does not require Scope 3 to be reported to comply with the protocol.** This results in fewer disclosures than for Scope 1 and Scope 2. In addition, because Scope 3 covers all other indirect emissions, there is sometimes different interpretations by companies of what is reported under which categories leading to a lack of standardization of responses, this in turn can have an impact on the modelled intensity factors.

As Scope 3 reporting becomes more prevalent, these limitations should start to improve, in turn improving S1 modelling of Scope 3 emissions.

Additionally for the current methodology there are the following key limitations:

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- **Evaluation Status:** Similar to disclosed emissions, the disclosed Evaluation Status introduces volatility in company profiles. This may result from a genuine change in the materiality of a specific category or a reporting error. Currently, aside from forward-filling Evaluation Status where blanks exist, errors are identified only through analysts investigating significant data jumps in company profiles. Due to the manual nature of this process, it has inherent limitations.
- **Partial Disclosure**
  - **Non-CDP Disclosure:** Currently, Trucost does not collect partial disclosures. Therefore, if a company profile is ingested from a non-CDP source into Trucost and a category emission is not included in the S&P Global Sustainable1 Environmental dataset (TRAX), the partial disclosure logic may subsequently fill this missing value with disclosure from CDP, the result is a mixed profile of disclosures. This will be indicated in the Data Flag.
  - **Restatements:** At present, restatements from CDP are only ingested into the Python engine when there was no prior CDP disclosure for a company in the relevant financial year. This approach does not fully align with company profiles sourced from Trucost, as restatements are sometimes prioritized over earlier disclosures based on analyst research. Consequently, when partial disclosure is pulled into a company profile due to a lack of data in Trucost, the value may originate from the original CDP disclosure, while the rest of the profile might reflect the restated data.

## Maintenance/Updates

S1 periodically reviews our methodology as appropriate.



# Updates and Enhancements

Month/Year of Enhancement	Enhancement Description	Impact of change
March 2025	<p><b>Overall Changes Impact Summary</b></p> <p>There has been an increase in GICS Sub-Industry coverage, rising from an average of 146 sub-industries to 155 sub-industries. Among GICS Sub-Industry emission factors that had a valid factor in the previous release, <b>approximately 45%</b> saw an absolute change in the total emission factor exceeding 50%. Specifically, this applied to <b>85</b> factors in FY 2019, <b>70</b> in 2020, <b>57</b> in 2021, and <b>49</b> in 2022.</p> <p>Less than 10%, but more than 5%, of the companies within the research universe experience a ranking shift of more than one decile within their sub-industry, assuming all other factors remain constant. This analysis is based on a comparison of companies included in the previous release for financial years 2019–2022.</p> <p>Approximately 5,500 companies (35%) in 2019, 5,400 companies (31%) in 2020, 5,100 companies (29%) in 2021, and 6,700 companies (35%) in 2022 experienced an absolute change in emissions exceeding 100,000 tonnes CO<sub>2</sub>e/USD million. The mean change in total Scope 3 downstream emissions is as follows: approximately -620,000 tonnes for 2019, approximately -370,000 tonnes for 2020, approximately -220,000 tonnes for 2021, and approximately 130,000 tonnes for FY 2022. This analysis is based on a comparison of companies included in the previous release for financial years 2019–2022.</p> <p>Among those companies that experienced an absolute change in emissions greater than 100,000 tonnes CO<sub>2</sub>e/USD million, approximately 18% in 2019, 34% in 2020, 55% in 2021, and 74% in 2022 had a change greater than 100,000 tonnes CO<sub>2</sub>e/USD million, while the remaining companies experienced a change of less than -100,000 tonnes CO<sub>2</sub>e/USD million.</p>	
March 2025	<p><b>Use a standardized approach to ingest CDP disclosure data</b></p> <p>Ingest all CDP disclosure data using a standardized approach for emissions and evaluation status disclosure (including restatements). This process ensures consistent and accurate data extraction within the Python engine. Previously, disclosures from CDP reports for the years 2014–2019 were collected using a different method. The updated method ensures all available disclosure is considered.</p> <p>A centralized disclosure dataset for all Financial Years (FYs) has been generated and used to create GICS emission factor (EF) averages. This has replaced the previous layered approach, where FY 2019 data only included CDP disclosures from the 2020 report and earlier, and FY 2020 only included disclosures from the 2021 report and earlier etc.</p> <p>Restatements ingested directly from CDP reports are only added to the disclosure dataset for FYs where a company has not previously reported emissions; earlier disclosures remain unchanged.</p> <p>Separately, S1 also collects re-stated historical emissions data if the restatement is due to enhanced methodologies, disclosure errors or expansion of reporting boundaries. Note that if a company restructures and restates its historical emissions to reflect the new structure, S1 will not utilize data from these restatements as this would not</p>	<p>Changes in the company disclosure in the covered research universe. This change impacts approximately 3% of companies in the covered research universe, which now pull emissions directly from CDP reports that were not included prior to the centralized database and acceptance of CDP restatements.</p> <p>Changes in the GICS-level average emission factors and the emission values of companies modeled using these factors. This has a greater impact on later years. While earlier financial years rely heavily on disclosure data extracted directly from CDP reports, company coverage in the CDP reports has significantly improved over time. With an updated mapping of CDP account numbers, this approach led to an approximately 80-150% increase in CDP disclosures contributing values to at least one downstream emissions category within the GICS emission factor average across FY 2019 -2022. The variation in percentage depends on the financial year.</p>

	accurately reflect the company at the time of original reporting in the Scope 3 Downstream Dataset.	
March 2025	<p><b>Standardization of approach for gap filling evaluation status and missing emissions disclosure</b></p> <p>In cases where evaluation status is missing, gaps are filled based on a forward filling approach, for a maximum of 3 years.</p> <p>Previously (2014-2019), missing or string value emissions disclosure data from CDP reports was treated as 'zero'. This practice stopped in 2020. The new standardized approach to gap filling, applied across all years of data, enhances stability when analysing company profiles from year to year.</p>	<p>Change in the company disclosure in the covered research universe. Compared to the previous approach, this results in over a 60% increase in the number of gap-filled zeros.</p> <p>Changes in the GICS-level average EFs and the emission values of companies modeled using these factors. Due to the previous approach outlined in the left column, this change resulted in fewer zeros being gap-filled for the dataset used to estimate emission factors for FY 2019-2020, leading to an increase in their average values. Conversely, the increased gap-filling of zeros for FYs 2021 and onwards contributed to a decrease in their average emission factors, if all other factors remained constant.</p>
March 2025	<p><b>GICS Emission Factor (EF) estimation</b></p> <p>GICS EF estimations minimum datapoint thresholds have been updated based on number of emission values available (for each category), rather than number of companies with valid disclosure within the sub industry.</p> <p>If a given sub-industry has five or more valid data points available to calculate an average for all downstream categories—excluding non-material ones—and the non-material category's average value is low or missing, the sub-industry's EF is accepted.</p> <p>Gap-filled zero values are included in the average calculation, consistent with the previous approach. However, zero values now carry half the weight of non-zero values.</p> <p>Manual adjustments have been enabled for highly volatile sub-industry EFs such that factors deemed inappropriate due to their low estimated values, which are considered unrepresentative of the GICS Sub-Industry, are removed.</p> <p>If a valid emission factor cannot be estimated for a given GICS category in a given financial year but is available in a previous or future financial year, forward filling is applied when no emission factor is estimated; otherwise, backfilling will be used.</p>	<p>Changes in the GICS-level average EFs and the emission values of companies modeled using these factors.</p> <p>There has been an increase in GICS Sub-Industry coverage, rising from an average of 146 sub-industries to 155 sub-industries.</p> <p>Over 80% of manual adjustments to emission factors result in an increase in the total GICS-level emission factor. These adjustments are more common in earlier financial years, often due to limited disclosure compared to later years.</p>
March 2025	<p><b>Removal of condition for CDP disclosure to be Third Party Verified across all years</b></p> <p>For all modelled years, the requirement for CDP disclosure to be third-party verified to be considered valid disclosure has been removed. Previously, this third-party verification requirement applied only to FY 2019-2020.</p>	<p>Changes in the company disclosure in the covered research universe. This change impacts &lt; 1% of companies in the covered research universe which now report non-third party verified emissions for at least one downstream category.</p> <p>Changes in the GICS-level average EFs and the emission values of companies modeled using these factors. There has been an approximately 8% increase in the total company-year records within the calculation engine used to estimate emission factors. Since these companies have a</p>

		FY earlier than 2021, this change will have a greater impact on GICS emission factors for earlier years compared to later years.
March 2025	<b>Standardized approach for deriving FY</b> Incorporation of financial accounting dates when deriving the FY of CDP data.	Changes in the company disclosure in the covered research universe. This change impacts < 1% of the companies in the calculation engine and < 1% of the companies in the final dataset.  Changes in the GICS-level average EFs and the emission values of companies modeled using these factors.
March 2025	<b>Amend business rule as to when we use bottom-up (production-based) estimates</b> When validated company disclosure and bottom-up estimates are both available, disclosed data is given the higher priority. This replaces the previous approach that if bottom-up estimates are available and higher than disclosure or scaled-up emissions, the bottom-up values were used.	The companies impacted by this enhancement will see a decrease in their total downstream emissions, all other factors will remain constant.
March 2025	<b>Scale-up emissions for three years</b> Where there was no disclosure for a specific downstream category in a given year, and disclosure was provided in the previous financial year, disclosed emissions were scaled up based on the year-on-year change in revenue, for a maximum of one year. This approach has been extended to three years.  Additionally, scale-up can now only occur when the GICS Sub-Industry from the previous year is the same as the Sub-Industry from the year without disclosure.	The companies affected by this enhancement will likely experience more stable estimated emissions year to year. This change impacts < 1% of data points in the final dataset.  Compared to the previous approach, this results in over a 60% increase in the number of scaled-up estimates.
March 2025	<b>Apply new rule for 'partial disclosure'</b> If company disclosure is classified as partial data, it is excluded from the GICS EF estimation. Once category emissions for the specified company and Scope 3 downstream category have been estimated, the higher value of the two (partial or estimated) is used.  Note: Partial data is not included in the estimation of emission factors to ensure consistency and accuracy in the estimates by avoiding incomplete or unreliable data, which could skew results.	The companies impacted by this enhancement will see an increase in their total downstream emissions, all other factors will remain constant. This change impacts < 1% of data points in the final dataset.

March 2025	<b>Change in Downstream Category Data Flags</b> The following additional rules are applied when deriving the disclosure flags of data points: Gap-Filled Zero Values <ul style="list-style-type: none"> <li>If the assumption is based on the reported CDP evaluation status flag for that financial year, the disclosure flag is set to 'Value derived from data provided in CDP.'</li> <li>Otherwise, the disclosure flag is assigned as 'Zeroed out (as covered by another KPI or otherwise not relevant) based on data provided in [source],' where [source] refers to the origin of the adjusted Evaluation Status.</li> </ul> Adjusted CDP Emission Disclosure <ul style="list-style-type: none"> <li>When a CDP emission value is manually adjusted by an Analyst, the disclosure flag is designated as 'Value derived from data provided in [source],' where [source] indicates the origin of the adjusted Evaluation Status.</li> </ul>	Changes in the company data flags in the covered research universe.
March 2025	<b>Fix GICS-level average emission factors for a 12 month period</b> For all years, the Q1 GICS-level average EF are set for the rest of the calendar year, unless model re-runs indicate significant changes in the estimated factors.	The companies impacted by this enhancement will have more stable estimated emissions throughout the calendar year.

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