

Scope 3 Greenhouse Gas (GHG) Emissions Dataset

Methodology

S&P Global Sustainable1 – May 2024

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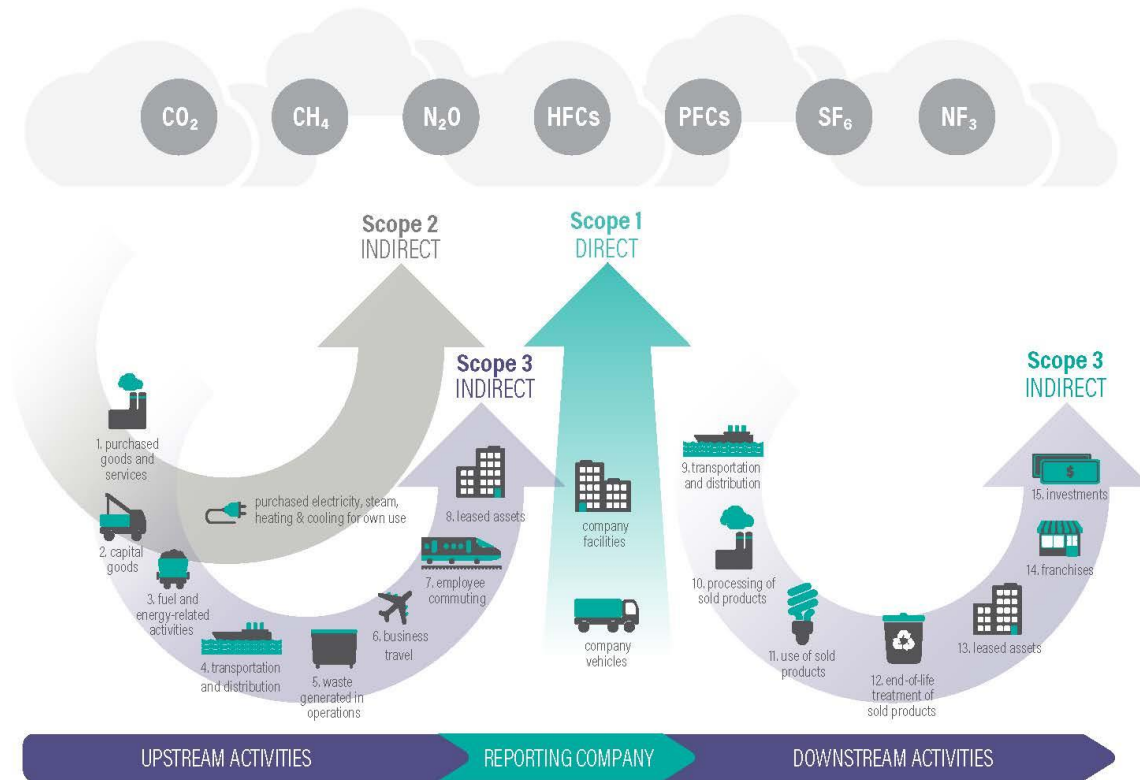
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Terms and Definitions

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 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 Standard¹.

Figure 1: Overview of GHG Protocol Scopes and Emissions



Source: Greenhouse Gas (GHG) Protocol (2024)

¹ 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

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Introduction

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 downstream absolute emissions, intensities expressed in metric tons of carbon dioxide equivalent per million USD revenue (tCO₂e/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).

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 (EEL-O) modeling principles (see *Upstream Emissions (S&P Global Sustainable1's EEL-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 all companies in its research universe, either by email or letter, 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.

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

Emissions coming from Scope 3 upstream activities are calculated using S1's environmentally extended input-output (EEL-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.

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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 EEL-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.

In terms of disclosed upstream Scope 3 emissions, S1 collects data relating to all upstream categories and displayed 'As Reported' whilst S&P Generated values relate to data for air, rail, and truck transportation (relating to Scope 3 categories 'Business Travel' and 'Upstream Transportation & Distribution').

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 Ipeca, 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:

- **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 CO₂e).
- **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 the previous year. In this scenario, emissions intensities (tCO₂e/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.

3.1. Top-Down Approach

S1 uses the 'top-down' modelling approach which applies sector- and Scope 3 category-specific emissions intensities (tCO₂e/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 samples² of disclosed Scope 3 data at the GICS sub-industry level per category to derive the top-down emissions intensities, 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 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, and Industry 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

² Top-down emissions intensities derivations require a minimum sample of 5.

identifies outliers based on the Mean and Standard Deviation approach. A data point is considered as an outlier when its value is more than Mean + 1.65 SD and less than Mean - 1.65 SD. Disclosed data identified as a distribution outlier will be excluded.

Once all necessary exclusions have been made, the emission factors are calculated. This is done by first calculating the categorical emissions intensity (tCO₂e/USD mn revenue) of each reporting company. The approach then takes an equal-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.

3.2. 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 (gCO₂/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.

The bottom-up approach is applied to all companies in key sectors with relevant production data. If a company also reports its downstream emissions associated with one of the modelled categories, the larger of the two values is taken. This discrepancy can occur due to reporting boundaries selected by reporting companies. Taking the larger of the reported or calculated emissions is meant to avoid underestimating the associated risk of downstream emissions.

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

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.

Updates

S1 periodically reviews our methodology as appropriate.

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