

Trucost Environmental Data

Methodology

S&P Global Sustainable1 – June 2024

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Introduction and Context

What is Trucost Environmental Data?

Trucost Environmental Data contains quantitative information on the environmental performance of over 18,000 of the world's largest listed companies, representing 95% of global market capitalization. The dataset is associated with approximately 500 distinct industry sectors across over 100 environmental key performance indicators (KPIs). The data covers hundreds of environmental issues encompassing greenhouse gas emissions, pollution to air, land & water, waste generation, and other natural resource use.

Data Universe

The Trucost *Core Plus* universe consists of the company constituents of the following indices where the minimum data input requirements (e.g., reporting a full year of company revenue), is met:

- S&P Broad Market Index (BMI)
- S&P China A SmallCap 300 Index
- S&P 500 Index
- S&P Global 1200 Index
- S&P/TOPIX 150 Index
- S&P/TSX Composite Index
- S&P/ASX 200 Index
- S&P/ASX 300 Index
- TSE TOPIX Index

In addition, approximately 1,500 companies that are not members of the above indices are included in the *Core Plus* universe.

Once included in the *Core Plus*, companies are researched annually, regardless of index membership, if the minimum data input requirements are available.

The Trucost *Cemetery* universe consists of over 1,000 delisted or defunct companies.

Historical coverage

Historical coverage for small- and mid-cap companies starts from 2016; historical coverage for large-cap companies goes back to 2005.

Research Process

S&P Global Sustainable1 (S1) follows a four-step research process designed to provide a transparent system for companies to verify their environmental performance profile, and, at any time, contribute their most recent data.

Four-step research process

1. **MAP** company business segments:

Company business segments are mapped to more than 450 business activities in the S1 Environmentally Extended Input-Output Model (“the EEIO model”). The EEIO model is based on the North American Industry Classification System (NAICS), but has been customized, and goes into greater granularity in some areas, such as power generating utilities.

2. **ESTIMATE** data-modelled profile:

Once company business segments have been mapped to the Trucost business activities and their share of revenue apportioned to each, a data-modelled profile is generated for the company. The EEIO model is applied to estimate data for over 800 environmental and operational metrics across the entire operations of companies, from the raw materials they depend on in their supply chains to the electricity they purchase to power their operations.

3. **COLLECT** public disclosure:

S1’s research analysts search for environmental performance information in annual reports, sustainability reports, ESG reports, company websites, and other publicly disclosed sources. Third party datasets, like disclosures to the CDP, are also reviewed. Reported environmental performance data is then standardized to best practice guidelines so that it can be compared across companies, regions, and business activities. To correct reporting errors, vigorous data control procedures are applied, such as sector specialist data reviews, data sampling to detect errors, automated outlier identifications and year-on-year comparisons. Wherever a material metric is not disclosed or not sufficiently disclosed, its modelled value is used, thus ensuring that all data gaps have been filled.

4. **ENGAGE** with company:

S1 then conducts an annual engagement process with researched companies, providing an opportunity to verify environmental performance 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 for review and possible incorporation.

Data Sources and Collection

The data comes from a variety of sources, including models developed from scientific literature, a wide array of national, international, and industry databases, industry “top-down” data, as well as sector-specific “bottom-up” data.

The table below provides a list of typical data sources for economic output, prices, resources, and emissions that are used by the S1 EEIO model.

Table 1: Typical Data Sources for the S1 EEIO Model

Data Category	Example Sources
Sector economic output	<ul style="list-style-type: none"> • United States Bureau of Economic Analysis (BEA)
Resource use – energy, water, and land	<ul style="list-style-type: none"> • Industry and academic reports • United States Department of Energy (DOE) • Eurostat
Emissions – greenhouse gases, air pollutants, land pollutants, and water pollutants	<ul style="list-style-type: none"> • Intergovernmental Panel on Climate Change (IPCC) • Toxic Release Inventories • Food and Agriculture Organization of the United Nations • United States Energy Information Agency • International Energy Agency (IEA)

Methodology Overview

A rigorous research process is combined with S1's proprietary economic modeling to respond to the growing demand for:

- Greater transparency about corporate environmental performance
- Greater consistency in corporate environmental data
- Standardized corporate environmental reporting, making it easier for market participants to compare the impacts of different companies
- Support to adhere to new and evolving regulatory requirements
- Measuring environmental impact across a company's operations and supply chain
- Correction of reporting errors

Estimating Environmental Impacts

The S1 Environmentally Extended Input-Output Model ("the EEIO model")

The EEIO model is S1's core environmental profiling model for estimating the environmental impacts across company operations and supply chain tiers including primary resource extraction, secondary processing, and final product assembly. This can be done in the absence of company disclosure or partial disclosure.

The EEIO model brings together S1's vast database of industry-specific environmental impact data with quantitative macroeconomic data on the flow of goods and services between different sectors in the economy. The EEIO model enables environmental impacts for a company's own operations across its entire global supply chain to be estimated, associated with approximately 500 distinct industry sectors across over 100 environmental key performance indicators (KPIs).

The EEIO model covers the most material drivers of impacts across greenhouse gas emissions, pollution of air, land & water, waste generation, and other natural resource use. These environmental intensity factors are reported in units of emissions or resource use per million dollars of economic output, and are derived from a wide array of national, international, and industry databases as mentioned in Table 1. S1 tests this data against the many thousands of disclosures we collect from companies during our annual engagement program. Where available, the S1 methodology uses country-specific information to inform global average intensity factors, which are weighted by production value. This approach allows us to consider differences in the emissions profiles of different sectors within the global model.

This model can be tested against many years of data on quantitative environmental disclosures from thousands of companies.

Strengths of the S1 EEIO model

Quality of Data Sources

S1 applies best-in-class scientific literature to calculate the environmental impacts of different business activities, including industry "top-down" data from the World Bank and U.S. Environmental Protection Agency, as well as sector-specific "bottom-up" data from the U.N. and peer-reviewed academic studies.

Granularity of Analysis

Many publicly available EEIO models may cover only a small proportion of business activities. To ensure the model is representative of dispersed company operations, we leverage granular industry datasets and apply global environmental factors to further disaggregate the coverage of discrete business activities. In particular, high-impact business activities, such as utilities and agriculture are split up to account for variations within the most environmentally significant business sectors.

Regularity of Updates

A frequent criticism of publicly available EEIO models is that they are out of date. In general, the environmental impact data is updated every year, and S1 engages with companies to incorporate the latest publicly disclosed and not publicly disclosed environmental performance information.

Scope of Environmental KPIs

Some models only estimate GHG emissions, but the Trucost Environmental Data’s approach calculates the environmental performance of companies across a broad range of environmental impact categories, including GHGs, air pollution, land pollution, water pollution, water use, and waste disposal.

Calculation Overview

Environmental impacts attributable to a business are calculated by using environmental intensities expressed as pollutant or resource use per unit of revenue. These are calculated by obtaining absolute emissions or resource data by sector and using this data in conjunction with financial data to create environmental intensities. The intensities are applied to financial information gained from ‘make and use’ tables provided by the United States Bureau of Economic Analysis to enable the EEIO model to calculate the environmental impacts of a company’s supply chain. These have been adapted so that the operational and supply chain emissions or resource use of approximately 500 distinct industry sectors can be calculated.

Specific Concepts

- **Sectors:** areas of economic activity (business activities)
- **Environmental intensity:** a metric of the environmental impacts of an economic activity per unit of revenue
- **Operational environmental impacts:** environmental impacts across a company’s own operations
- **Supply chain environmental impacts:** environmental impacts across a company’s entire global supply chain

Key Methodological Steps within the S1 EEIO model

1. Selection of the sector(s) of interest from a list of approximately 500 distinct industry sectors
2. Calculation of environmental intensities
3. Modeling of operational environmental impacts
4. Modeling of supply chain environmental impacts
5. Outputs

Illustration of the methodological steps

The table below outlines the key methodological steps in this process as well as giving some examples at each of these stages.

Table 2: Methodological Steps within the S1 EEIO model

Methodological Steps	Examples
1. Selection of the sector(s) of interest from a list of approximately 500 distinct industry sectors	Cotton farming; natural gas extraction; coal power generation; plastic bottle manufacturing

<p>2. Calculation of environmental intensities</p>	<p>The environmental intensities are calculated in terms of metric tons or cubic meters per unit of revenue.</p> <p>Data is utilized from a wide array of supra-national, international, national, and industry bodies across a wide range of sectors and geographies.</p> <p>Impacts are calculated in one of six categories including:</p> <ul style="list-style-type: none"> • Greenhouse gas emissions • Air pollutants • Land and water pollutants • Waste production • Water consumption • Natural resource use
<p>3. Modeling of operational environmental impacts</p>	<p>Calculated using industry-specific environmental intensity factors for each of the sectors in which a company operates.</p>
<p>4. Modeling of supply chain environmental impacts</p>	<p>By combining the industry-specific environmental intensity described above with an expanded input-output database derived from the latest ‘make and use’ tables published by the United States Bureau of Economic Analysis, the environmental impacts within supply chains are estimated by applying environmental intensities to the flows of monetary transactions.</p> <p>The ‘make and use’ tables are expanded (1) to detail the ratio of expenditure from one sector with every other sector of the economy, termed “intermediate demands” and (2) to provide additional detail on several environmentally important sectors, such as the mining, power generation and wholesale and retail trade sectors, by disaggregating the tables proportionally.</p> <p>Note: The S1 EEIO model uses the US economy as a proxy for the world economy and as a starting point for the creation of its supply chain model.</p>
<p>5. Outputs</p>	<p>Over 100 qualified environmental impacts are classified into the categories listed above, which enables:</p> <ul style="list-style-type: none"> • Identification of the companies or portfolios generating the greatest absolute and relative environmental impacts. • Identification of the most material environmental impacts for each company of portfolio. • Comparison of operational vs. supply-chain impacts.

Monitoring and Review

Disclosed data is subjected to thorough review and quality checking as detailed in the “Research Process” section above. All new methodologies and any material changes to existing methodologies are reviewed and approved by an

independent methodology governance committee.

Maintenance and Updates

The research process for Trucost Environmental Data is annual—each environmental data point is for a complete company financial year. A new company year is added to the database as companies complete their financial years and relevant data is publicly disclosed.

In addition, it is common for a company’s data disclosure to have valuable information pertaining to previous financial years (time-series performance). This allows S1 to refine its modeling or take a disclosed value for a prior year instead of previously estimated values. The research process is continuous; such historical revisions may occur at any point in the year. Company data re-statements are considered in the data when certain criterion is met such as errors in disclosures.

Significant Updates

Changes made to this methodology document include the following:

Document Version	Date	Changes
1.0	07/09/2019	Initial version
1.1	06/01/2020	<ul style="list-style-type: none"> • Research Process <ul style="list-style-type: none"> ○ Updated the section on the four-step research process. • Sources of S1Data <ul style="list-style-type: none"> ○ Updated the list of typical data sources for economic output, prices, resources, and emissions. • Data Standardization/Calculation <ul style="list-style-type: none"> ○ Updated the section on the key methodological steps within the S1EEIO model.
1.2	10/09/2020	<ul style="list-style-type: none"> • FAQs>Sector Classification <ul style="list-style-type: none"> ○ Expanded the discussion for sector classification.
1.3	20/06/2024	<ul style="list-style-type: none"> • Data Universe <ul style="list-style-type: none"> ○ Updated to include the latest coverage of companies • Research Process <ul style="list-style-type: none"> ○ Updated to include independent sampling quality checks • Data Sources and Collection <ul style="list-style-type: none"> ○ Included only sources used for S1 EEIO Model

Related Documentation

There are several supporting documents available on the S&P Global Marketplace:

- *Trucost Environmental Data - Xpressfeed™ User Guide* – This user guide provides an overview of Trucost Environmental Data through Xpressfeed, including the data structure of the packages, database schema, specific details about working with the data, and a common way of querying Trucost data with SQL examples.
- *Trucost Environmental Data Item List* – This spreadsheet provides table names by package and dataItemIds/data item names/data item definitions that exist in each table.
- *S&P Capital IQ Base Files User Guide* – The Base Files associate companies, symbols, securities, and other objects across all S&P Capital IQ data sets. This guide describes the data structure of the Base Files as well as integration of the Base Files with other S&P Capital IQ data sets.
- *Xpressfeed Loader User Guide* – This user guide outlines the features and capabilities of the Xpressfeed Loader. The Xpressfeed Loader generates a database schema and structure and loads the data records as a set of fully indexed tables. The Loader automates the daily updates of records and keeps your database up to date.
- *Xpressfeed File Delivery Technical Guide* – This guide provides information for clients who download S&P Global Market Intelligence data files directly from our server and write their own loading procedures.
- *File Format Spreadsheets* – These spreadsheets contain full and change file zip file prefixes, individual text file names, and information for each column in the file (e.g., column names, column data types, whether the column is nullable, and primary keys).
- *Xpressfeed File Delivery Schedule* – This spreadsheet provides expected full and change file delivery times as well as the length of time the files remain on the server.
- *SNL Reference Data User Guide* – This user guide provides the schema for the SNL Reference package and detailed descriptions of all tables and fields; information on how to link SNL Reference data to S&P Capital IQ data sets or to Compustat data using the Company Cross Reference File; and common ways of querying SNL

If you are linking to other S&P Global Market Intelligence data sets, supporting documents are available on the S&P Global Marketplace [website](#).

Appendix 1: Methodology FAQs

State of environmental reporting

What is the state of environmental reporting?

Despite growing demand for companies to provide transparency about their environmental performance, corporate reporting remains patchy. Some regions are leading the way while others are lagging. Published disclosure is often incomplete or non-standard, making it difficult to compare the liabilities of different companies. Reporting errors can be prevalent. S1's analysis finds that for many companies, environmental risk is often concealed within supply chain tiers, a scope of impact that is significantly underreported.

Company Selection

How does S1 schedule the companies in the Trucost Environmental Data research process?

As a general rule, S1 prioritizes companies based on the companies' fiscal year (FY).

Company Data

What data is collected from companies?

S1's research analysts collect company environmental data, including performance data and disclosure metrics on greenhouse gas (GHG) emissions, fuel consumption, water use, pollution impacts, and waste disposal. S1 also collects information on a company's business activities.

Environmental Reporting Gaps

How is the absence of company reported information navigated?

The S1 methodology uses economic modeling techniques to complete disclosure gaps for hundreds of environmental impact metrics across the entire operation of companies, from the raw materials on which they depend in their supply chains to the electricity they purchase to power their operations. This approach allows for comparisons between all companies, regardless of disclosure levels. Subsequently, S1 engages annually with every company it assesses to verify its research and collect the latest information, which, although available, is undisclosed.

Comparisons made with other data sources

When collating data, are comparisons made with other data sources?

Yes. S1 sense checks all data points as companies often make mistakes in their reporting. When considering company disclosure, it is compared to the modelled estimates as part of its research process, S1 checks the environmental data of companies in sectors and checks for outliers using statistical testing techniques, and further investigates and qualifies notable exceptions to sector averages. Similarly, company environmental metrics are compared year-to-year to investigate any large fluctuations in data, with legitimate variations qualified and quality checked.

Changes in data year-to-year

What explains some large changes in data year-to-year?

Commonly, significant year-to-year changes in company data can be explained by at least one of the following reasons:

- Significant year-to-year changes in revenues and the business activities in which the company is engaged
- Changes in reporting methodologies adopted by companies
- Increased scope of company reporting compared to previous years (it may not have been apparent that the original scope was narrower than desired). Previous year data would subsequently be adjusted to ensure consistency
- Corporate actions (e.g., spin off, acquisition, and merger)
- Significant changes in company operations (e.g., where a company drastically improves its energy efficiency or carbon reduction strategies)
- Improvements in the level of accuracy of a company's measures of their environmental impacts
- A company's first year of data can cause figures rather different to previous modelled values.

Sector classification

What sector classification does the Trucost Environmental Data use?

The Trucost Environmental Data splits the world economy into hundreds of distinct business activities based on the North American Classification System (NAICS), however the dataset's classifications are more granular in some areas such as power generating utilities.

Environmental intensity

What is an environmental intensity?

An 'environmental intensity' is a metric that denominates a quantity of environmental impact, such as greenhouse gas emissions or water, with another data point: *a normalizing factor*. The standard intensity metrics denominate environmental impacts by a company's annual consolidated revenues in millions of US dollars, for example, carbon intensity would be in the units: *tCO₂e/US\$ mn Revenues*. Environmental intensities are useful in comparing companies both within and across different sectors. These metrics can control for different company characteristics, such as size, making it possible to assess the environmental efficiency of a company.

Why are environmental intensities denominated by company revenues?

Environmental impacts, such as greenhouse gas emissions or water, are generated by a company's direct and indirect operations, therefore a suitable normalizing factor should also be correlated with direct and supply chain operations for the environmental intensity metric to reflect the environmental efficiencies of companies more closely. Since it is deemed that a company's revenues are reasonably correlated with its scale of operations, at least within a sector, revenues have become the market-standard normalizing factor for environmental intensities (i.e., all other things held constant, the greater a company's revenues, the greater its environmental impact).

It is also deemed desirable for the intensity metric to be in some way linked to a company's financial performance to begin to understand the relationship between environmental impact and financial risk. Hence, intensity metrics which normalize environmental impact by revenue, such as *tCO₂e/US\$ mn Revenues*, indicate the dependency on the generation of environmental impacts a company has in generating revenues.

Environmental damage costs

What are 'environmental damage costs' and how should I interpret them?

'Damage costs' are estimates of the negative externality associated with the use of a resource or the emission of a pollutant. They reflect the environmental impact of a business activity in monetary terms.

Damage costs assume that the cost of maintaining an environmental benefit is a reasonable estimate of its value. The total cost of environmental damages incurred by a company is calculated by multiplying company data on the quantity of resources used or pollutants emitted (i.e., tCO₂e, m³ of water use, kg of waste generated etc.) by S1 damage cost factors.

An externality, or *external cost*, is a consequence of an industrial or commercial activity that affects other parties (such as society or the environment) but is not reflected in market prices. An 'environmental damage cost' is the quantification of the negative externalities caused by a company's use of a resource or emission of a pollutant across all *impact categories*.

'Impact categories' are the different environmental impacts deriving from a company's activities. These categories cover the company's greenhouse gases, water use, waste generated, land, water and air pollutants generated, and natural resources used.

Environmental damage costs can be either direct or indirect. *Direct damage costs* are those associated with a company's direct operations, while *indirect damage costs* are those that are borne in the company's supply chain. *Total damage costs* are the sum of both.

'Damage costs' are a useful measure of a company's overall environmental impact, since they are denominated in a common unit (US\$ million) and bring together a range of environmental impacts with different units (for example, greenhouse gas emissions are measured in tCO₂e, while water used is measured in cubic meters). Damage costs can also be used alongside other financial metrics since they are based on a US\$ unit.

Company Definitions

What are 'fossil fuel companies'?

The standard definition of 'fossil fuel companies' applied in this dataset are those engaged in primary fossil fuel extractive industries as defined by the following 7 Trucost Sectors: *'Bituminous Coal and Lignite Surface Mining'*, *'Bituminous Coal Underground Mining'*, *'Crude Petroleum and Natural Gas Extraction'*, *'Drilling Oil and Gas Wells'*, *'Natural Gas Liquid Extraction'*, *'Support Activities for Oil and Gas Operations'*, and *'Tar Sands Extraction'*.

What are 'coal companies'?

The standard definition of 'coal companies' applied in this dataset are those engaged in coal extraction and power generation, as defined by 3 Trucost Sectors: *'Bituminous Coal and Lignite Surface Mining'*, *'Bituminous Coal Underground Mining'*, and *'Coal Power Generation'*.

What are 'renewable companies'?

The standard definition of 'renewables companies' applied in this dataset are those engaged in renewables power generation that can be seen in their renewable generation data (GWh) where disclosed. Alternatively, these companies can be seen in the Trucost sector revenues data, defined by having business activities in the 6 Trucost Sectors: *Biomass Power Generation*; *Geothermal Power Generation*; *Hydroelectric Power Generation*; *Solar Power Generation*; *Wave & Tidal Power Generation*; and *Wind Power Generation*.

What are 'fossil fuel power generation companies'?

The standard definition of companies engaged in fossil fuel power generation activities applied in this dataset are those with some generation production data (GWh) from any coal, natural gas (including LNG, LPG) and petroleum (including conventional, unconventional or fuel oils).

Alternatively, sector revenues data can be used to screen for companies engaged in fossil fuel power generation, as defined by the 3 Trucost Sectors: *'Coal Power Generation'*, *'Natural Gas Power Generation'* and *'Petroleum Power Generation'*.

Corporate Actions

How does S1 account for corporate actions?

The Trucost Environmental Data accounts for M&A activity, though there tends to be a lag in the data reflecting such activities. The reason for this is fundamental to our research methodology: Each observation in our data is a complete financial year. Therefore, should any M&A activity occur, this will only be reflected in our data once (i) the financial year has concluded (ii) the company has disclosed its year-end performance data, and (iii) S1 has analyzed, quality checked and engaged with the company to attempt to validate our data for it. Regarding the specific actions taken, these will differ depending on each scenario.

Acquisitions

In such cases, we are likely to consolidate the entities into the Trucost *institutionId* profile of the 'acquirer' and retire the 'acquired' company in subsequent financial years. The acquired company then has its designation changed from being a member of our Core or Core Plus universe (the universe of companies generally analyzed on an annual basis) to our 'cemetery universe' (those companies no longer maintained).

The acquired company's historical data will remain under its prior profile to reflect its prior identity as independent of its acquirer. The specific treatment of each company where acquisitions occur mid-financial year will also depend on how the companies in question report their year-end financial data.

For example, some companies will report this final year's financial data (e.g., consolidated revenues) as separate companies, in which case the environmental data for each company would be assigned to them as separate entities.

Another example would be where the acquired company does not report, and the acquiring company internalizes the complete financial year's performance of the company acquired. In such a case, no financial year's data is entered in the acquired company's legacy Trucost profile with all of the company's performance, in addition to its own, being accounted for in the profile of the acquirer.

One final scenario is where each company reports partial financial year data (e.g., the 8 month's performance prior to the acquisition for the acquired, and a complete financial year for the acquirer, though with the last 4 months representing an alternate corporate structure). For the Trucost Environmental Data to be comparable across all companies, each observation must be complete 12-month financial years. Therefore, in the case of the acquired the 8 months of data would not be collected in the data. This financial year in the company's history would therefore be missing with the company's final data point being its previous complete financial year prior to its acquisition. The acquiring company's data however would be collected since it would reflect a complete 12-month cycle.

Mergers

In the case of mergers where there is no clear acquirer, and often where the merger results in the formation of a new corporate, both entities would be retired to the cemetery universe and a new profile would be created for the new company without any data history. For example, in September 2017, *DuPont* and *The Dow Chemical Company* merged to become *DowDuPont*. This new corporate entity will have a new profile and *institutionId* created where data for this new corporate entity will be collected or modelled once it has completed its first complete 12-month financial year.

De-mergers

For de-mergers, only once the new companies have completed their first full financial year after the corporate action will these companies be accounted for in the Trucost Environmental Data. Often this implies that the incomplete financial year in which the de-merger occurred is not captured in either company's history, or the profile of the pre-de-merged company.

Name changes

Some companies may change their names due to rebranding or other reasons while their corporate structure remains unchanged. In such cases, the company retains its same profile and *institutionId*, but its name is amended to reflect its current name. This new name would also be referenced against any historical data for the company, even in years prior to the name change.

M&A Activity and security identifiers

Often the securities owned by an investor pre- and post-corporate actions will have the same identifiers (e.g., ISINs) despite now relating to a new corporate entity. Regarding mapping these securities to Trucost Environmental Data, mappings in existence prior to the corporate action would remain until Trucost Environmental Data database has a new profile for the new entity and has this identifier reassigned to it. This implies that for a period of time the security's attributed data does not necessarily reflect the company's true operational impacts.

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