# Documentation of the data and calculations to support the Greenhouse Gas Protocol Scope 3 Screening Tool

The purpose of this document is to help the interested user understand the data, assumptions, and calculations used to transform user inputs into estimates of emissions for the various Scopes and Categories as defined in the Greenhouse Gas Protocol Corporate Value Chain Accounting and Reporting Standard (Scope 3 Standard)[[1]](#footnote-1).

To a large extent, the data and calculations used to support this screening tool are based on the suggestions offered in the Technical Guidance for Calculating Scope 3 Emissions[[2]](#footnote-2), which is a supplement to the aforementioned Standard. In some cases, streamlining measures and assumptions have been made by the modeling team to reduce burden on the user for data collection and information. To the extent possible, this screening tool has been built with the intention of balancing accuracy of emissions estimates with ease of use. This screening tool is intended to help the user identify hotspots within the corporate value chain that may merit further data collection.

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While the Screening Tool asks questions of the user in an order that make sense for gathering data from this organization, the output of the tool is structured based on the 15 categories of emissions defined in the Scope 3 Standard. This document explains the calculations of the tool based on these same 15 categories. The following table indicates the relationship of each section of information collected by the tool to these 15 categories.

# Relation of each question to GHG Protocol Scope and Category

|  |  |  |
| --- | --- | --- |
| **Interface question** | **GHG Protocol Scope/Category[[3]](#footnote-3)** | **Details** |
| Industry | n/a | n/a |
| Time period | All/any | Convert user input quantities to the proper reference flow quantity of one year |
| Employees | S3,C7 | Reference flow to apply to an average transport mode environmental factor (EF)[[4]](#footnote-4) (see documentation for Category 7) |
| Scopes 1 and 2 | S1 (plan A[[5]](#footnote-5)) | These are the emissions themselves – no EF necessary. |
| S2 (plan A) | These are the emissions themselves – no EF necessary. |
| S3,C3 (plan A) | Conversion factor to calculate based on Scope 1 and 2 emissions. |
| Fuel use | S1 (plan B pt. 1) | Facility fuel use direct emissions |
| S3,C3 (plan B pt. 1) | Facility fuel use indirect emissions for owned facilities |
| Electricity use | S2 (plan B pt. 1) | Facility purchased electricity production direct emissions |
| S3,C3 (plan B pt. 2) | Facility electricity production indirect emissions for owned facilities |
| Waste | S3,C5 | Waste emissions |
| Facilities | S1 (plan C) | Facility fuel use direct emissions for owned facilities |
| S2 (plan C) | Facility purchased electricity production on-site emissions for owned facilities |
| S3,C3 (plan C) | Conversion factor to calculate based on Scope 1 and 2 emissions. |
| S3,C8 pt.1 | Facility fuel use direct emissions for leased facilities |
| Purchased goods and services | S3,C1 | WIOD sector and revenue identified by user represents sector goods and services |
| S3,C2 | WIOD sector and revenue identified by user represents sector goods and services |
| Vehicles |  |  |
| Owned vehicles | S1 (plan B pt. 2) | Direct emissions for owned vehicles |
| Leased vehicles | S3,C8 pt. 2 | Direct emissions for leased vehicles |
| Third-party transport | S3,C4 pt. 1 | Transport mode |
| Third-party distribution | S3,C4 pt. 2 | Distribution modes “Warehousing” and “Upstream” |
| S3,C9 | Distribution mode “Downstream” |
| Business travel | S3,C6 (plan A) | These are the emissions themselves – no EF necessary. |
| S3,C6 (plan B) | Transport activity and hotel stay $ or distance traveled/number of nights |
| Sold products | S3,C12 | WARM landfilling data |
| Products with use stage impacts | S3,C11 | Fuels and electricity use quantities: emissions include both indirect and direct |
| Additional processing | S3,C10 | WIOD sector emissions and $ |
| Downstream leased assets | S3,C13 | WIOD transport mode/sector and $ |
| Franchises | S3,C14 | Office space direct emissions for electricity and fuel |
| Investments | S3,C15 | WIOD sector emissions and $ |

## General calculations

### Extrapolation of user reported data to one year

Because the user can choose the time period of the data reported in this tool, and because this time period may be less than or greater than a 12 month period required for GHG Protocol reporting, the data must be extrapolated or normalized to 12 months. This correction is done using the following calculation, for all relevant categories of reporting:

12 months / (((12 – ms + 1) + (me)) + (((ye – ys) - 1) \* 12))

Where “ms ” and “me” are the numbers associated with the months of the year (e.g., June = 6) when reporting began and ended (inclusive of those months) and “ys” and “ye ” are the years in which the reporting started and ended.

In the descriptions below for Scopes 1 and 2 calculations, as well as the Category calculations for Scopes 1, 2 and the fifteen Scope 3 categories, this correction is implied and is not stated explicitly.

In case the user inputs span a couple years (e.g., July 2010 to June 2011) the end year is used as the conversion basis year. The year 2000 is the earliest start year possible.

### Alignment of user inputs with I/O database EFs

For many of the Scope 3 categories, greenhouse gas emissions are estimated in terms of expenditures in a given economic industry or sector[[6]](#footnote-6). Such calculations leverage environmental input-output datasets based on the World Input-Output Database (WIOD)[[7]](#footnote-7) and the Open IO Database.

When WIOD emissions datasets are used, to align the year of user input data with the I/O data, output price adjustments are applied. For years 2000-2009, WIOD Socio-economic Accounts factors (July 2014 release[[8]](#footnote-8)) are applied, and for years 2010-2015, price indices from the U.S. Bureau of Economic Analysis (November 03, 2016 release)[[9]](#footnote-9) are applied. It is assumed that these US-based price adjustments apply globally, and a linear average of BEA sectors is used to bridge to WIOD sectors.

For Open IO emissions datasets, price adjustments are made using the BEA sector “Waste management and remediation services”, using a 2002 base year.

These factors can be found in the Price Adjustment factors table of the supporting spreadsheet file (available upon request).

Furthermore, the user is encouraged to input basic prices[[10]](#footnote-10) instead of purchaser prices, since purchaser prices include wholesale and transportation margins, thus often overestimating Scope 3 emissions. Price adjustment data are not yet available for 2016 so 2015 data are used as a proxy.

In the descriptions below for Scopes 1, 2 and the fifteen Scope 3 categories, such conversions are not explicitly stated.

## Scope 1: Direct GHG emissions

*Calculation of direct emissions from purchased fuel for facility, and direct emissions from purchased fuel for owned vehicles*

If user has already calculated Scope 1 and/or Scope 2 emissions, user enters the emissions (*in theory, this should include both facility and owned vehicle purchased fuel emissions*)

If user has *not* already calculated Scope 1 and/or Scope 2 emissions,it isdetermined if instead the user has available expenditure data for their facility operations fuel use.

If yes, the direct emissions are calculated for purchased fuel for facility use with the fuel type, quantity and units selected by the user. Fuel types are linked to direct emissions datasets (USEPA 2008, MIT 2007, SCLCI 2010 in concert with IPCC 2007) and conversion factors from (MIT 2007) and (SCLCI 2010).

If no, the facility fuel use direct emissions are calculated based on any owned facility types and area of space identified by the user. Each facility type is linked to fuel demand statistics (USEIA 2003; 2010). Fuel direct emissions per unit of energy are sourced from (USEPA 2008) and (MIT 2007).

Scope 1 also includes the direct emissions of fuel used by owned vehicles. If the user owns or leases vehicles, then they identify the relevant vehicle types which are linked to WRI transport direct emissions (WRI 2008). Boat and airplane emissions require an assumption about weight by the user. The reference flow quantities are the distances provided by the user.

## Scope 2: Indirect GHG emissions from consumption of purchased electricity, heat or steam

If user has already calculated their Scope 2 emissions, the user enters these emissions.

If user has not already calculated their Scope 2 emissions, it is determined if instead the user has available expenditure data for their facility operations fuel use

If the user has available expenditure data, Emissions are calculated from upstream generation of purchased electricity (Scope 2) using electricity grid and quantity information provided by the user. The user has the option to specify the country of operation among the countries provided by GHG Protocol 2011 Scope 2 grid emissions supporting data (WRI 2014) or use a default global-average electricity grid (SCLCI 2010).

If the user does not have available expenditure data, an assumption about electricity use quantity is based on the user’s choice of facility type and area. Each facility type is linked to electricity demand statistics (USEIA 2003; 2010). A country with average emissions was used to represent the grid emissions, and that country is linked to GHG Protocol 2011 data for Scope 2 emissions (WRI 2014).

## Scope 3, Category 1: Purchased goods and services

**(On the PURCHASES tab)** For any purchase types identified by the user as Standard Good or Service, the sector of purchase chosen by the user is linked to a 2009 world multiregional estimate of average environmental impacts by region-sector combined with global warming potential impact assessment (Timmer 2012, IPCC 2007). The reference flow quantity is provided by the user in the form of purchase quantity in basic price USD.

## Scope 3, Category 2: Capital goods

**(On the PURCHASES tab)** For any purchase types identified by the user as Capital Good (regardless of Direct Procurement or Indirect Procurement), the identified sector of purchase points to a 2009 world multiregional estimate of average environmental impacts by region-sector combined with global warming potential impact assessment (Timmer 2012, IPCC 2007). The basic price USD purchase quantity entered by the user is the reference flow quantity.

## Scope 3, Category 3: Fuel- and energy-related activities

**(On the FACILITIES tab)** It is determined if the user has already calculated Scope 1 and 2 emissions:

If yes, Scope 1 emissions are multiplied by 0.25[[11]](#footnote-11) and Scope 2 emissions by 0.20[[12]](#footnote-12).

If no, it is determined if user has readily-available expenditure data on facility fuel and electricity use:

If yes, upstream emissions are calculated for purchased fuel (*T&D losses and purchased electricity sold downstream aren’t included in this screening tool*) using fuel types, quantities and units identified by the user. Fuel indirect emissions are linked to upstream emissions datasets, which are ecoinvent v2.2 fuel datasets without direct emissions, in concert with GWP impact assessment factors (SCLI 2010, modified; IPCC 2007). Electricity upstream emissions are determined by the user’s choice of country, which is linked to custom data representing the production mix per country, adjusted to exclude direct emissions (emission factor for various fuel types \* fuel mix (SCLCI 2010, USEPA 2014a, IPCC 2007).

If no, the emissions are derived based on the Scope 1 and 2 emissions by applying the conversion factors listed above.

## Scope 3, Category 4: Upstream transportation and distribution

**(On the LOGISTICS tab)** This category considers upstream third-party transport and warehousing.

Upstream transport is determined by any relevant modes chosen by the user. Third party transport emissions factors are calculated using a 2009 world multiregional estimate of average environmental impacts by region-sector combined with global warming potential impact assessment (Timmer 2012, IPCC 2007). The reference flows are any USD expenditures associated with these categories, as identified by the user.

Upstream warehousing is determined by the user for relevant categories. Emissions factors are represented by Open IO emissions data (TSC 2011). The reference flows are any USD expenditures associated with these categories, as identified by the user.

## Scope 3, Category 5: Waste generated in operations

**(On the FACILITIES tab)**: Based on any waste expenditure identified by the user, an OpenIO emissions dataset for waste management is multiplied with the expenditure quantity (TSC 2011).

## Scope 3, Category 6: Business travel

**(On the TRAVEL tab)**: It is determined if the user has already calculated business travel emissions and has the results available:

If yes, the units of CO2-eq are used directly and no dataset is needed.

If no, the user selects business travel activity type, and then chooses whether to enter spend or distance/distance per person data for transport activities, and spend or number of nights for hotel stays. The spend data are linked to a 2009 world multiregional estimate of average environmental impacts by region-sector combined with global warming potential impact assessment (Timmer 2012, IPCC 2007). The basic price USD associated with each transport mode is the reference flow. The distance/distance per person data are linked to process-based emissions factors for each mode of transport (DEFRA 2016) and the number of nights are linked to a country-weighted mean factor based on number of hotel rooms available (Ricaurte 2016).

## Scope 3, Category 7: Employee commuting

**(On the GENERAL tab)**: Using US Department of Transportation data (USDOT 2014), in conjunction with ecoinvent 2.2 datasets for various transportation modes in conjunction with GWP impact assessment (SCLCI 2010, IPCC 2007), as well as some assumptions about commuting and work schedules[[13]](#footnote-13), it is estimated that the average employee emits 1,700 kgCO2-eq/year. Please note that these driving distances and modal splits are only typical of those in the US, and these are likely to vary considerably depending on not only country but location of corporate facilities relative to residences.

The reference flow quantity is the average value of the employee number range provided by the user.

## Scope 3, Category 8: Upstream leased assets (vehicles, facilities)

**Leased vehicle emissions (On the LOGISTICS tab)**: Determine if the user owns or leases vehicles and hadn’t already included such fuel purchases in Scope 1. Incorporate any leased vehicle direct fuel emissions, which are linked to WRI transport sector emissions per mile (WRI 2008). Leased vehicle miles provided by the user are the reference flow quantity. For water and air freight transport, this flow is multiplied by weight of transported goods provided by the user.

**Leased facility emissions (On the FACILITIES tab)**: (*Assuming the landlord pays the electricity bill and not the user*) If the user leases facility space, facility fuel and electricity use direct emissions are calculated based on any owned facility types and area of space identified by the user. Each facility type is linked to fuel and electricity demand statistics for the United States (USEIA 2003; 2010). Fuel direct emissions per unit of energy are sourced from (USEPA 2008) and (MIT 2007).Electricity direct emissions are estimated with an average-emission country proxy, which is linked to GHG Protocol 2011 data for Scope 2 emissions (WRI 2014).

## Scope 3, Category 9: Downstream T&D

**(On the LOGISTICS tab)** Third party downstream distribution is determined by any “Downstream transportation and distribution” selected by the user, which is linked to an Open IO emissions dataset (TSC 2011). The expenditure provided by the user is the reference flow quantity.

## Scope 3, Category 10: Processing of sold products

**(On the CUSTOMER tab):** If any products require additional processing, the related product sector chosen by the user points to a 2009 world multiregional estimate of average environmental impacts by region-sector combined with global warming potential impact assessment (Timmer 2012, IPCC 2007). The expense quantity entered by the user is the reference flow quantity.

## Scope 3, Category 11: Use of sold products

**(On the CUSTOMER tab):** For any products that consume energy during use, the related energy type identified by the user links to emission factors for various types of fuels (MIT 2007, USEPA 2008, SCLCI 2010 in concert with IPCC 2007) and electricity (IEA 2011), and the user can specify the country electricity grid if desired. The emissions from the fuels and electricity include indirect and direct in this tool (although inclusion of indirect emissions is optional under Scope 3 standard). The reference flow is a function of the quantity sold, lifespan in months, and energy demand per month. Please note that the tool only allows estimation of emissions from energy-using products, not those that contain or form GHGs during useful life.

## Scope 3, Category 12: EoL of sold products (intermediate product, if relevant)

**(On the CUSTOMER tab):** For any sold products the related material group identified by the user links to a U.S. landfilling emissions factor (USEPA 2014b). Although a portion of waste is recovered and a portion is incinerated, assuming 100% landfilling is a conservative simplification. All sold product units (as weight or mass) identified by the user are the reference flow quantities.

## Scope 3, Category 13: Downstream leased assets

**(On the DOWNSTREAM LEASED ASSETS AND INVESTMENTS tab):** If there are leased assets to report, the leased asset type/sector identified by the user is linked to a 2009 world multiregional estimate of average environmental impacts by region-sector combined with global warming potential impact assessment (Timmer 2012, IPCC 2007). The basic price USD expense quantity entered by the user is the reference flow quantity.

## Scope 3, Category 14: Franchises

**(On the DOWNSTREAM LEASED ASSETS AND INVESTMENTS tab):** If the user operates from a franchise model, the user enters the area of space franchised. Assuming the space is general commercial space, this facility type is linked to fuel and electricity demand statistics (USEIA 2003; 2010). Fuel direct emissions per unit of energy are sourced from (USEPA 2008) and (MIT 2007).Electricity direct emissions are estimated with an average-emission country proxy, which is linked to GHG Protocol 2011 data for Scope 2 emissions (WRI 2014). The area of space entered by the user is the reference flow quantity.

## Scope 3, Category 15: Investments

**(On the DOWNSTREAM LEASED ASSETS AND INVESTMENTS tab):** If user has equity investments in subsidiaries, associate companies, or joint ventures that are not already included in Scope 1, the investment sector identified by the user is linked to a 2009 world multiregional estimate of average environmental impacts by region-sector combined with global warming potential impact assessment (Timmer 2012, IPCC 2007). Users should enter the annual revenue for the equity companies normalized by the equity share of the investment in the company. Debt investments are not covered by this tool. The USD quantities entered by the user are used as the corresponding reference flow quantities.

# **References**

DEFRA 2016. UK Government GHG Conversion Factors for Company Reporting 2016, v 1. <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/526958/ghg-conversion-factors-2016update_MASTER__links_removed__v2.xls>

IEA 2011. International Energy Agency Energy Statistics

IPCC 2007. GWP 100a method.

MIT 2007. MIT Energy Club Conversion sheet: <http://www.mitenergyclub.org/assets/2008/11/15/Units_ConvFactors.MIT_EnergyClub_Factsheet.v8.pdf>

Ricaurte, E. 2016. Hotel sustainability benchmarking index 2016: Energy, water, and carbon. Cornell Hospitality Report, 16(16), 3-13. <http://scholarship.sha.cornell.edu/chrreports/17/>

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US EIA 2003. Energy Information Administration, Office of Energy Markets and End Use, 2003 Commercial Buildings Energy Consumption Survey.

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USEPA 2008a. Stationary Combustion Guidance. <http://www.epa.gov/climateleadership/documents/resources/stationarycombustionguidance.pdf>

USEPA 2008b: Mobile Source Guidance. <http://www.epa.gov/climateleadership/documents/resources/mobilesource_guidance.pdf>

USEPA 2014a. eGRID data

USEPA 2014b. Waste Reduction Model (WARM) <http://epa.gov/epawaste/conserve/tools/warm/index.html>

WRI 2008. WRI GHG Protocol tool for mobile combustion. Version 2.2.

WRI 2014: World Resources Institute (2014). GHG Protocol tool for stationary combustion. Version 4.5.

# Limitations

To be in conformance with the Scope 3 Standard, organizations shall include all Scope 3 emissions in their inventory, or disclose and justify any exclusions. This screening tool allows users to estimate emissions associated with all 15 categories of Scope 3 emissions. However, some of these categories may not be relevant to your organization and thus include an option to skip irrelevant portions of the tool. In addition, in some cases, the underlying data used in the tool’s methodology is limited in terms of the greenhouse gases or activities accounted for. Listed below are the known limitations. Such exclusions should be assessed and determined by each company whether they may be significant emissions. Companies may need to estimate those missing emissions sources and add them to their inventory in order for it to be in conformance with the standard. However, if these are not significant sources and don’t exceed the company’s significance threshold, then the company can justify them as exclusions.

* Anywhere WIOD is used, only three GHGs are accounted for (CO2, CH4, N2O)
* Anywhere WRI emissions factors are used, these only account for CO2 (no other GHGs)
* Scope 1 calculations do not account for any leaking of refrigerants from building AC systems unless total CO2-e emissions are provided by the user. Gases other than carbon dioxide may not be accounted for, but these are often insignificant contributors to Scope 1 impacts.
* Scope 3 Category 11 only covers energy use by sold products, not products that contain or form GHGs in use.

1. Greenhouse Gas Protocol Corporate Value Chain Accounting and Reporting Standard: <http://www.ghgprotocol.org/standards/scope-3-standard> [↑](#footnote-ref-1)
2. Technical Guidance for Calculating Scope 3 Emissions (version 1.0) http://www.ghgprotocol.org/files/ghgp/Scope3\_Calculation\_Guidance.pdf [↑](#footnote-ref-2)
3. S indicates “Scope” and C indicates “Category.” For example, “S3,C6” indicates “Scope 3, Category 6.” [↑](#footnote-ref-3)
4. “EF” stands for Environmental Factor, which has been defined in this document to represent the quantity of carbon-dioxide equivalents (kgCO2-eq) per quantity of the process under evaluation, such as mass, volume, distance, or dollars spent. [↑](#footnote-ref-4)
5. “Plan A” is used to designate the preferred calculation for a given category. “Plan B” is used to designate the next favored calculation, and “Plan C” is used to designate the least favored calculation, where applicable. [↑](#footnote-ref-5)
6. The World Input Output Database applies industry categories at the ISIC rev. 3 code level, as shown in Table A2 from the paper *An Illustrated User Guide to the World Input–Output Database: the Case of Global Automotive Production* by Timmer et al., found here: <http://onlinelibrary.wiley.com/doi/10.1111/roie.12178/full> [↑](#footnote-ref-6)
7. Marcel P. Timmer (ed) (2012), "The World Input-Output Database (WIOD): Contents, Sources and Methods", WIOD Working Paper Number 10, downloadable at <http://www.wiod.org/publications/papers/wiod10.pdf>. Data accessed at <http://www.wiod.org/new_site/database/seas.htm> [↑](#footnote-ref-7)
8. Next WIOD Socio Economic Accounts Factors are projected to be published in summer 2017. <http://www.wiod.org/database/seas16> [↑](#footnote-ref-8)
9. US Department of Commerce, Bureau of Economic Analysis. GDP by industry accounts. Chain-Type Price Indexes for Gross Output by Industry, November 03, 2016 release. <http://www.bea.gov/industry/gdpbyind_data.htm> [↑](#footnote-ref-9)
10. Basic price is defined by the OECD as the amount receivable by the producer from the purchaser for a unit of a good or service produced as output, minus any tax payable, and plus any subsidy receivable, and excluding any transport charges: <http://stats.oecd.org/glossary/detail.asp?ID=189> [↑](#footnote-ref-10)
11. Conversion multipliers to estimate Category 3 emissions based on Scope 1 and 2 emissions are estimated based on the results of three corporate footprinting case studies carried out by Quantis between 2011 and 2013. [↑](#footnote-ref-11)
12. Conversion multipliers to estimate Category 3 emissions based on Scope 1 and 2 emissions are estimated based on the results of three corporate footprinting case studies carried out by Quantis between 2011 and 2013. [↑](#footnote-ref-12)
13. 240 days of commuting per year; carpoolers are allocated 1/3 of the car ride (Quantis assumptions) [↑](#footnote-ref-13)