# Automating **Carbon Emission Reporting** of Scope 1, 2, & 3 **GHG Emissions Data**

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# Introduction

Carbon emission data capture and statutory reporting is front and center in the US and EU with both public and private corporations. The CFOs, CLCs, and Compliance executives of leading organizations are scrambling to determine how they will comply with both the mandatory and voluntary reporting requirements. In many cases the data may not exist and using manual spreadsheets will prove to be labor-intensive, challenging to update, and difficult to audit. This white paper provides an overview of greenhouse gas (GHG) reporting, describes US GAAP compliance challenges with the GHG Protocol, and makes the argument for automating the collection and reporting process to support an activity-based accounting approach. Seven case studies are also provided highlighting the successes of early adopter organizations.

## Greenhouse Gases (GHG)

Greenhouse gases contribute to global warming by trapping the sun's radiant heat. GHGs can occur naturally in the atmosphere or occur from human activities. The Corporate Accounting and Reporting Standard covers the accounting and reporting of seven GHGs covered by the Kyoto Protocol:

- Carbon dioxide ($CO_2$ )
- Methane ($CH_4$)
- Nitrous oxide ($N_2O$)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulphur hexafluoride ($SF_6$)
- Nitrogen trifluoride ($NF_3$)

# The **GHG** (Green House Gas) **Protocol**

Created in 1998 and first published in 2001, the GHG Protocol seeks to develop internationally accepted GHG accounting and reporting standards and tools to promote their adoption worldwide. The GHG Protocol is the world's most widely used greenhouse gas accounting standard and the framework for ThinkIQ's carbon reporting solutions. The GHG Protocol creates three categories of emissions:

- **Scope 1** Emissions are GHGs released directly from an organization.
- **Scope 2** emissions are indirect GHGs released from the energy purchased by an organization.
- **Scope 3** emissions are another type of indirect GHG emissions, accounting for upstream and downstream emissions of a product or service, and emissions across a business's supply chain.

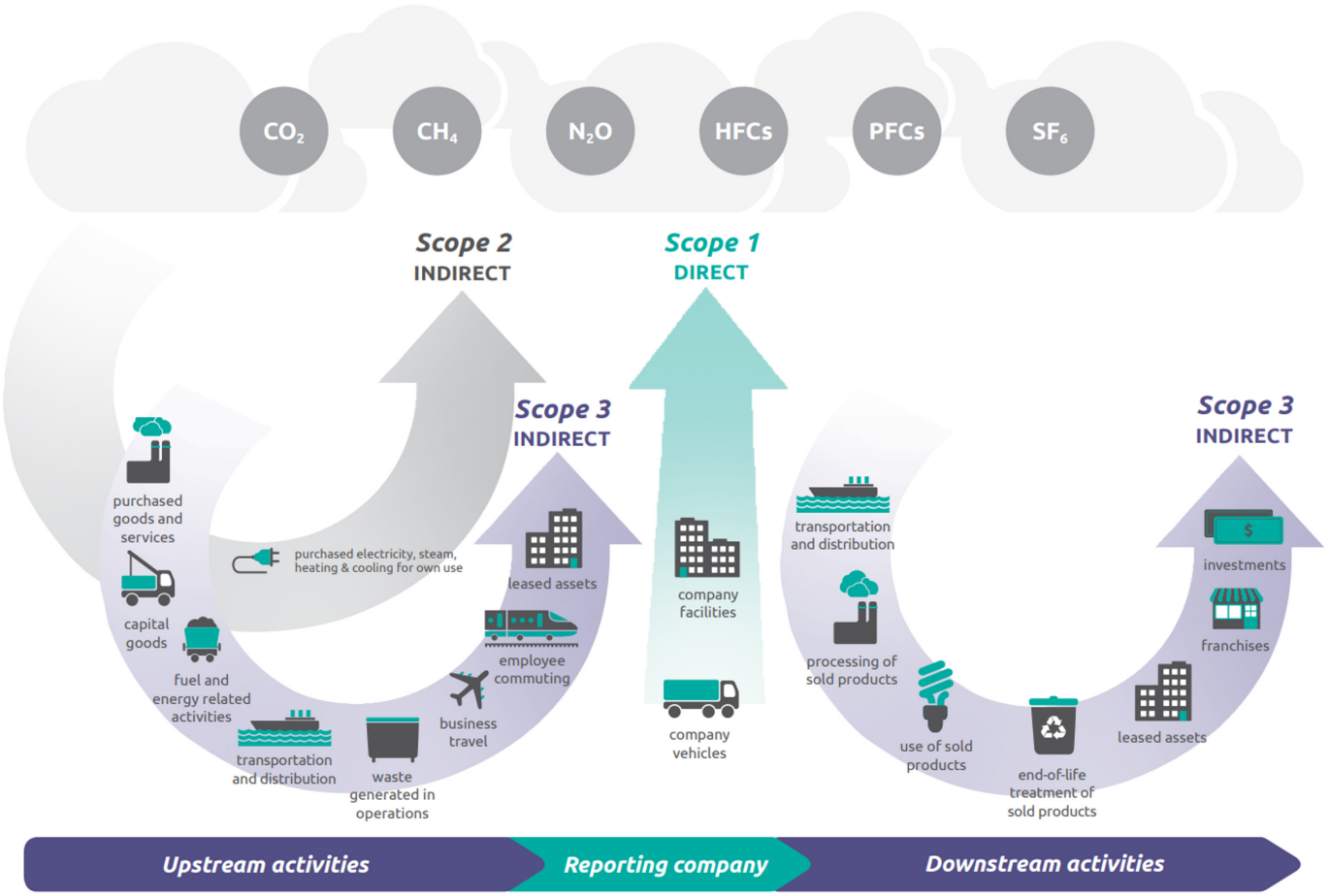
The following chart is from the Green Business Bureau showing examples for the three categories.[1]

| Scope 1 | Scope 2 | Scope 3 |
|---|---|---|
| **Direct Emissions** Owned Assets | **Indirect Emissions** Energy Purchased | **All Other Indirect Emissions** 3rd Party |
| ■ Facilities<br>■ Equipment<br>■ Vehicles<br>■ Onsite landfills | ■ Purchased electricity<br>■ Purchased heating<br>■ Purchased Cooling | ■ Transportation<br>■ Distribution<br>■ Waste<br>■ Energy and fuel<br>■ Leased Assets<br>■ Travel |

The objectives of the GHG Protocol and its related standard include the following:

- To help organizations prepare their GHG inventory representing an accurate account of their GHG emissions following standardized approaches and principles
- To lower the costs and simplify the process of compiling a GHG inventory
- To provide organizations with the information needed to build an effective strategy to lower their GHG emissions
- To facilitate participation in mandatory and voluntary GHG programs
- To increase transparency and consistency in GHG accounting methods and their reporting among various organizations and GHG programs.[2]

The following graphic is used widely by SEC, FDA, and EU regulators to show the three categories of carbon emissions and their upstream, downstream, and reporting organization sources.




# **Four Methods** to Calculate **Scope 3 Emissions**

As of now there are four methods proposed to report Scope 3 emissions. They can be used alone or in combination.

1. Spend-based
2. Activity-based (average data)
3. Supplier-specific
4. Hybrid (mix of spend, activity, and supplier-specific)

**Spend-Based Method.** Using the spend-based method the dollar value of purchased goods and services are multiplied by an emission factor, which is the emissions quantity produced per unit or the monetary value of the services and goods. The good news is that there are emission factors available from various government agencies, industry reports, standards organizations, and academic publications. Three data sources are required to optimally use the spend-based method: supplier data, purchase data, and emission factors. If direct supplier data is not available, but your organization's total annual material and services spend from your Tier 1 suppliers is known, you can calculate the value or quantity of units you purchased, multiplied by an industry-based emissions factor for each item.

**Activity-Based (Average Data Method).** Whereas the spend-based method uses financial data, the activity-based method uses the weight of materials to calculate emissions. For example, if an organization's clothing is made of 100 tons of wool, you would multiply the weight times the applicable industry-based emissions factor for wool. The limitation of both the spend-based method and the activity-based method is their reliance on averages. To greatly increase the accuracy of the activity-based method, supplier-specific averages should be applied.

**Supplier-Specific Method.** The most accurate method of measuring Scope 3 emissions is to obtain data from individual suppliers. This requires each supplier to collect their cradle-to-gate data. The supplier-specific method is a form of activity-based estimation. For example, if an organization uses five local suppliers who all use the same local power utility company who are willing to share their utility bills, we can convert their energy usage in megawatt or kilowatt hours to carbon. The process will work the same for transportation vehicles, water usage, shipping, and all the various steps and activities in your supply chain.

The carbon emissions from supplier to supplier can be very significant, especially when comparing domestic and offshore sourcing. For example, the carbon

footprint from a local manufacturer following US and EU strict environmental regulations and only shipping a few dozen miles is going to be far smaller than those from an offshore supplier in a country with limited environmental regulations, and transporting thousands of miles. The differences are especially profound when using Chinese suppliers. As of 2020, China represented 28% of global manufacturing and reported that over half of its energy production is from coal. By comparison, 14% of US energy production is from coal. Coal is responsible for over 0.3C of the 1C increase in global average temperatures, making it the single largest source of global temperature rise.

**Hybrid Method.** Gathering supplier-specific emission data may be labor-intensive or not available. Some suppliers may not have begun to collect detailed emission data. The hybrid method will use activity-based and supplier-specific data when it is available and then fills in the gaps with industry averages. The hybrid method has the advantage of greater accuracy over relying solely on spend-based or average data-based data.

A PDF of the 152 Page Scope 3 Guidance can be found at
Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf (ghgprotocol.org)

# **EU** and **US GHG Reporting** Regulations

The EU's 525/2013 regulations, issued in 2013, require companies to report on their Scope 1, 2, and 3 emissions. The US EPA and SEC also require companies to report on their Scope 1, 2 and 3 emissions,[3] The EU requires companies to report on their emissions from all sources, while the US only requires companies to report on their emissions from certain sources.

Approximately 8,000 US facilities are required to report their annual emissions each October. The Wall Street Journal estimates that 50,000 EU companies will be required to report GHG emissions along with 10,000 companies outside of the EU who are doing business in the EU.[4]

## Carbon Dioxide Equivalent (CO2-eq) and MMTCDE

Carbon dioxide equivalent (abbreviated as CO2-eq) is used to normalize GHG emissions by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential (GWP). Since one ton of any particular GHG is not the same GWP as one ton of another, this standard unit is a simple way to normalize and express GHGs as an equivalent of CO2.

Carbon Dioxide Equivalents are typically expressed in million metric tons of carbon dioxide equivalents, or MMTCDE. The carbon dioxide equivalent for a gas is calculated by multiplying the tons of the gas by the associated GWP:

"MMTCDE = (million metric tons of a gas) * (GWP of the gas).

For example, the GWP for methane is 25 and for nitrous oxide 298. This means that emissions of 1 million metric tons of methane and nitrous oxide respectively is equivalent to emissions of 25 and 298 million metric tons of carbon dioxide."[5]

## Emission Factors

Emission factors are used to calculate GHG emissions for any given source, relative to units of activity. Emission factors reflect average values by sector, technology type, and/or fuel type. For example, eGRID emission factors for electricity use in the NPCC New England sub region indicate that for every MWh of electricity consumed, 563.7 lbs. of CO2 e are emitted. This emission factor can be used to determine the total CO2 e emissions resulting from the company's purchased electricity in that region.

[1] PR Newswire, ThinkIQ and CESMII Partner to Drive Adoption of Smart Manufacturing Technology, https://www.prnewswire.com/news-releases/thinkiq-and-cesmii-partner-to-drive-adoption-of-smart-manufacturing-technology-301610553.html

To maximize accuracy, it is important to select emission factors that are appropriate for the relevant context. The default emission factors embedded in the referenced calculators are updated and relevant to the calculation context of the tool.

A full list of the emission factors can be found in the US EPA Center for Corporate Climate Leadership (emission-factors_mar_2018_0.pdf (epa.gov))[6]

Below is a sample of the EPA's emission factors.

**Table 1** **Stationary Combustion**

| Fuel Type | Heat Content (HHV) | $CO_2$ Factor | $CH_4$ Factor | $N_2O$ Factor | $CO_2$ Factor | $CH_4$ Factor | $N_2O$ Factor |
|---|---|---|---|---|---|---|---|
| | mmBtu per short ton | kg $CO_2$ per mmBtu | g $CH_4$ per mmBtu | g $N_2O$ per mmBtu | kg $CO_2$ per short ton | g $CH_4$ per short ton | g $N_2O$ per short ton |
| **Coal and Coke** | | | | | | | |
| Anthracite Coal | 25.09 | 103.69 | 11 | 1.6 | 2,602 | 276 | 40 |
| Bituminous Coal | 24.93 | 93.28 | 11 | 1.6 | 2,325 | 274 | 40 |
| Sub-bituminous Coal | 17.25 | 97.17 | 11 | 1.6 | 1,676 | 190 | 28 |
| Lignite Coal | 14.21 | 97.72 | 11 | 1.6 | 1,389 | 156 | 23 |
| Mixed (Commercial Sector) | 21.39 | 94.27 | 11 | 1.6 | 2,016 | 235 | 34 |
| Mixed (Electric Power Sector) | 19.73 | 95.52 | 11 | 1.6 | 1,885 | 217 | 32 |
| Mixed (Industrial Coking) | 26.28 | 93.90 | 11 | 1.6 | 2,468 | 289 | 42 |
| Mixed (Industrial Sector) | 22.35 | 94.67 | 11 | 1.6 | 2,116 | 246 | 36 |
| Coal Coke | 24.80 | 113.67 | 11 | 1.6 | 2,819 | 273 | 40 |
| **Other Fuels - Solid** | | | | | | | |
| Municipal Solid Waste | 9.95 | 90.70 | 32 | 4.2 | 902 | 318 | 42 |
| Petroleum Coke (Solid) | 30.00 | 102.41 | 32 | 4.2 | 3,072 | 960 | 126 |
| Plastics | 38.00 | 75.00 | 32 | 4.2 | 2,850 | 1,216 | 160 |
| Tires | 28.00 | 85.97 | 32 | 4.2 | 2,407 | 896 | 118 |
| **Biomass Fuels - Solid** | | | | | | | |
| Agricultural Byproducts | 8.25 | 118.17 | 32 | 4.2 | 975 | 264 | 35 |
| Peat | 8.00 | 111.84 | 32 | 4.2 | 895 | 256 | 34 |
| Solid Byproducts | 10.39 | 105.51 | 32 | 4.2 | 1,096 | 332 | 44 |
| Wood and Wood Residuals | 17.48 | 93.80 | 7.2 | 3.6 | 1,640 | 126 | 63 |
| | mmBtu per scf | kg $CO_2$ per mmBtu | g $CH_4$ per mmBtu | g $N_2O$ per mmBtu | kg $CO_2$ per scf | g $CH_4$ per scf | g $N_2O$ per scf |
| **Natural Gas** | | | | | | | |
| Natural Gas | 0.001026 | 53.06 | 1.0 | 0.10 | 0.05444 | 0.00103 | 0.00010 |
| **Other Fuels - Gaseous** | | | | | | | |
| Blast Furnace Gas | 0.000092 | 274.32 | 0.022 | 0.10 | 0.02524 | 0.000002 | 0.000009 |
| Coke Oven Gas | 0.000599 | 46.85 | 0.48 | 0.10 | 0.02806 | 0.000288 | 0.000060 |
| Fuel Gas | 0.001388 | 59.00 | 3.0 | 0.60 | 0.08189 | 0.004164 | 0.000833 |
| Propane Gas | 0.002516 | 61.46 | 3.0 | 0.60 | 0.15463 | 0.007548 | 0.001510 |
| **Biomass Fuels - Gaseous** | | | | | | | |
| Landfill Gas | 0.000485 | 52.07 | 3.2 | 0.63 | 0.025254 | 0.001552 | 0.000306 |
| Other Biomass Gases | 0.000655 | 52.07 | 3.2 | 0.63 | 0.034106 | 0.002096 | 0.000413 |
| | mmBtu per gallon | kg $CO_2$ per mmBtu | g $CH_4$ per mmBtu | g $N_2O$ per mmBtu | kg $CO_2$ per gallon | g $CH_4$ per gallon | g $N_2O$ per gallon |
| **Petroleum Products** | | | | | | | |
| Asphalt and Road Oil | 0.158 | 75.36 | 3.0 | 0.60 | 11.91 | 0.47 | 0.09 |
| Aviation Gasoline | 0.120 | 69.25 | 3.0 | 0.60 | 8.31 | 0.36 | 0.07 |

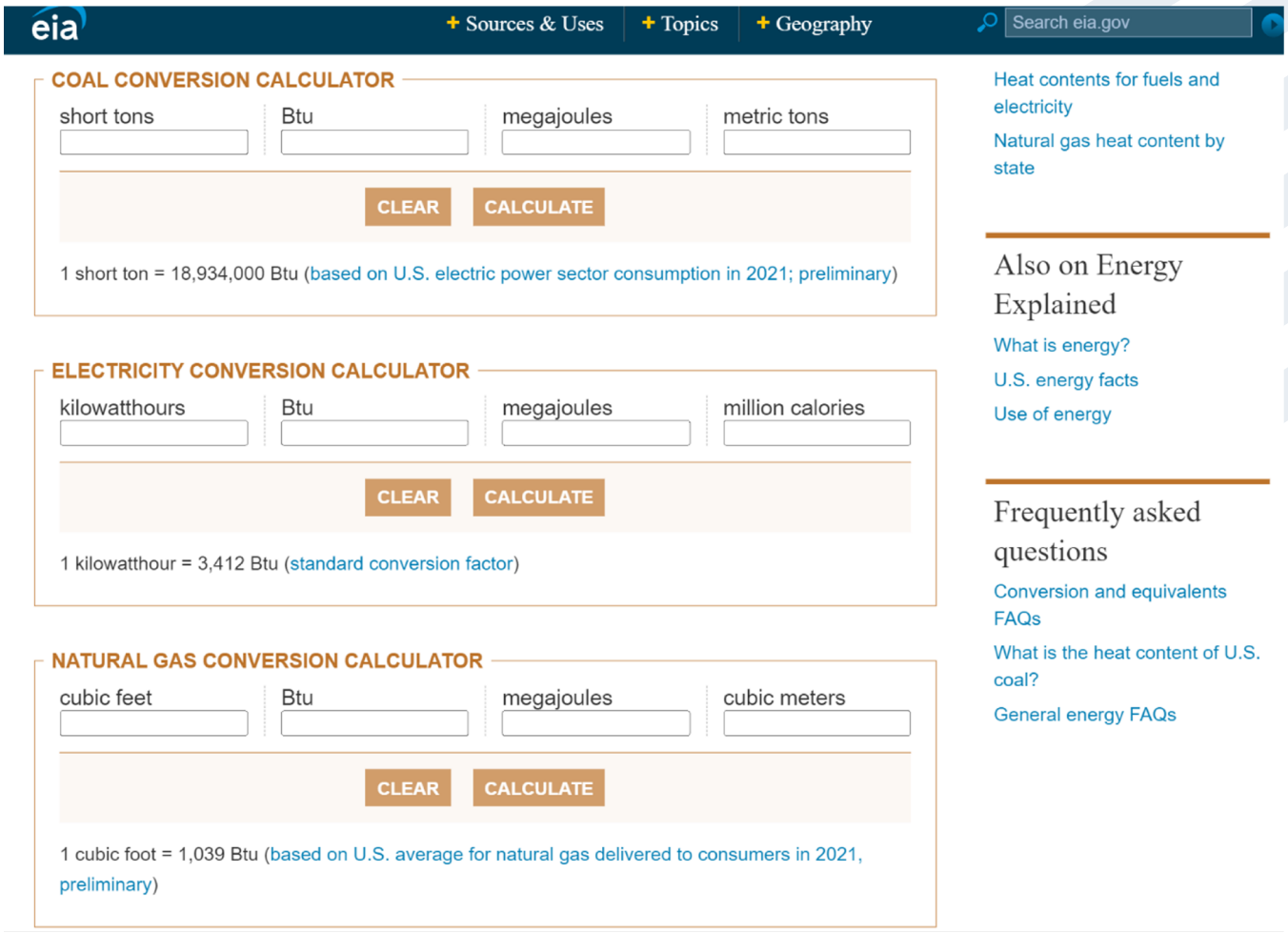

# **Activity** Data

Activity data is a critical input to calculate GHG emissions. It refers to data about activities that generate GHG emissions, such as gallons of gasoline consumed from your company's trucks. Activity data is captured in energy units (therms) or in physical units (gallons) which are then combined with an emissions factor and their relevant greenhouse gas GWP value to calculate C02. Each reporting organization is responsible for collecting its activity data. To be successful, organizations will need to develop robust data collection procedures along with training for all those involved in the process.[7]

The following process steps will help to ensure quality data collection:

1. Convert fuel consumption data from physical to energy units. (The Energy Information Administration has a conversion tool to easily convert different fuels to energy contents. Energy conversion calculators - U.S. Energy Information Administration (EIA))
2. Create data collection procedures as part of your Inventory Management Plan (IMP) to help simplify and standardize collection practices.
3. Compare the current year's data with your historical trends to flag inconsistent changes over 10 percent. Significant inconsistencies should be investigated.
4. Compare activity data from industry reference sources with your organization's data whenever possible. Look for and learn from best practices in the industry.[8]

This is a sample from the EIA's Energy Conversion Calculators



# Scope 1: Direct GHG **Emission Reporting**

Scope 1 GHG emissions are caused directly from sources that are controlled or owned by an organization. The US Environmental Protection Agency (EPA) provides methods to calculate and report GHG emissions from these sources.[9] "Direct GHG emissions are principally the result of the following types of activities:

**Generation of electricity, heat, or steam.** These emissions result from combustion of fuels in stationary sources, e.g., boilers, furnaces, turbines

**Physical or chemical processing.** Most of these emissions result from manufacture or processing of chemicals and materials, e.g., cement, aluminum, adipic acid, ammonia manufacture, and waste processing

**Transportation of materials, products, waste, and employees.** These emissions result from the combustion of fuels in company owned/controlled mobile combustion sources (e.g., trucks, trains, ships, airplanes, buses, and cars)

**Fugitive emissions.** These emissions result from intentional or unintentional releases, e.g., equipment leaks from joints, seals, packing, and gaskets; methane emissions from coal mines and venting; hydrofluorocarbon (HFC) emissions during the use of refrigeration and air conditioning equipment; and methane leakages from gas transport." [10]

Organizations are not allowed to deduct emissions associated with the sale of own-generated electricity to another company. For example, emissions from the production of sold clinker by a cement company or the production of scrap steel by an iron and steel company are not subtracted from their scope 1 emissions.[11]

A PDF of the 32 Page Dairy Industry guidance to Scope 1 and 2 can be found at Guidance_Handbook_2019_FINAL.pdf (ghgprotocol.org)

# Scope 2: Electricity indirect **GHG Emission Reporting**

Under Scope 2 Organizations are required to report emissions from purchased electricity consumed in its controlled or owned equipment or operations. Scope 2 emissions are a special category of indirect emissions. This may represent one of the largest sources of GHG emissions and one of the largest opportunities to reduce these emissions.

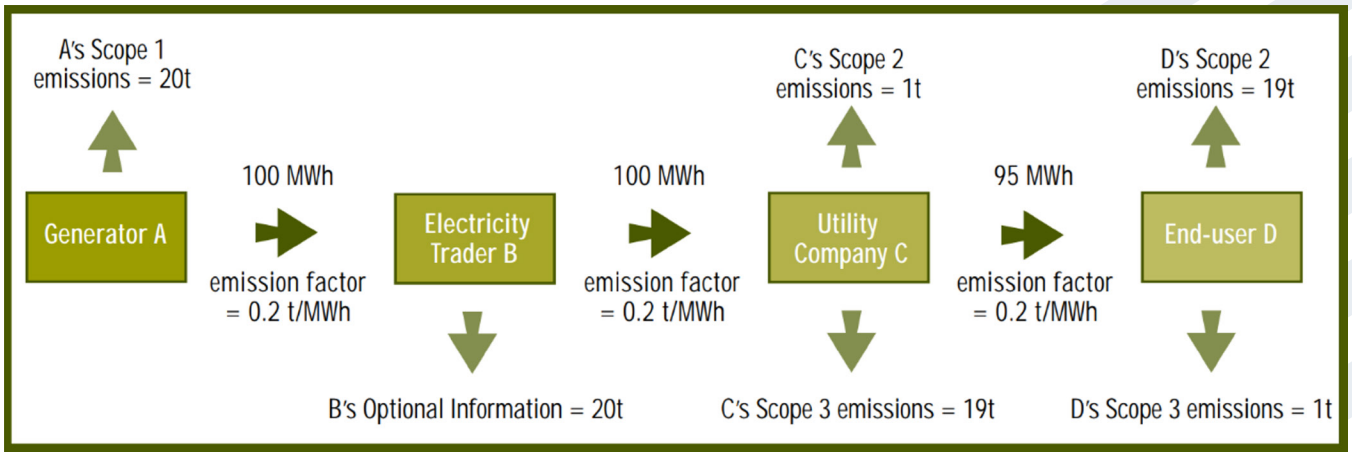
The GHG Protocol requires "organizations to quantify emissions from the generation of acquired and consumed electricity, steam, heat, or cooling (collectively referred to as "electricity"). These emissions are termed "scope 2" and are considered an indirect emissions source (along with Scope 3), because the emissions are a consequence of activities of the reporting organization but actually occur at sources owned or controlled by another organization (here, they are owned or controlled by an electricity generator or utility).[12]

Scope 2 emissions are one of the largest global sources of GHG emissions, accounting for at least one third of global GHG emissions. The methods an organization uses to report scope 2 emissions have a critical impact on how it assesses its performance and what mitigation actions it incentivizes.

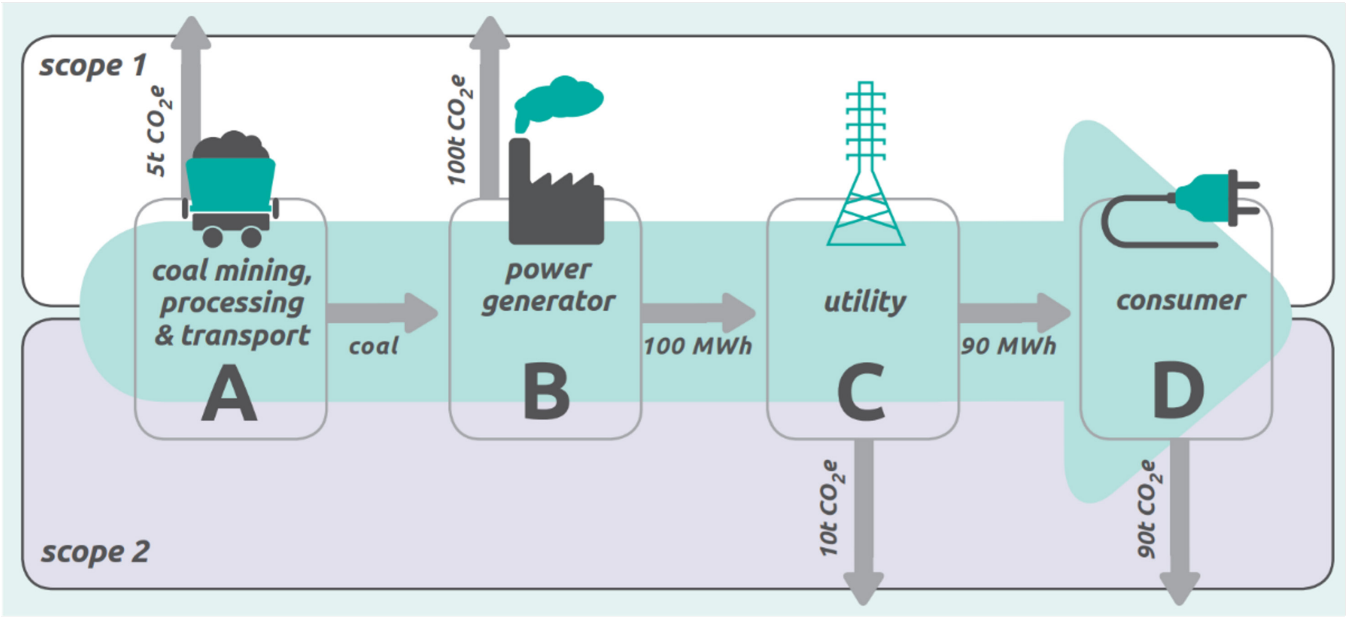
To calculate scope 2 emissions, it is recommended to multiply "activity data (MWhs of electricity consumption) by source and supplier-specific emission factors to arrive at the total GHG emissions impact of electricity use. It also emphasizes the role of green power programs in reducing emissions from electricity use. Only if these forms of information about electricity supply are unavailable are companies advised to use statistics such as local or national grid emission factors."[13]

Indirect emissions from upstream activities by an organization's electricity provider (e.g., exploration, drilling, flaring, transportation) are reported under Scope 3. Emissions from the generation of electricity that has been purchased for resale to end-users are reported in Scope 3.

The following chart is from the GHG Protocol showing the GHG accounting from the sale and purchase of electricity.




The following chart is from the Scope 3 Guidance showing emissions across the electrical supply and value chain.




## Accounting for Scope 2 Emissions – Location-Based vs. Market-Based[14]

**Location-based emission factors.** The emission factors needed for location-based Scope 2 emissions include the GHG emission intensity factors for energy production in a defined national or local region. In situations where real-time information or robust emission studies are available, organizations may report scope 2 estimations

separately where they can be compared to location-based grid average estimation. Organizations need to be aware that location-based emission factors are not supplier-specific. Therefore location-based grid average emission factors need to be distinguished from supplier-specific information, even where the electrical utility supplier is the sole energy provider for the region.

**Market-based emission factors.** Using the market-based method, different contractual instruments become carriers of GHG-emission rate data that acts as emission factors used to calculate GHG emissions. To ensure their accuracy, instruments need to include the GHG emission rate attribute. If companies have access to multiple market-based emission factors for each energy consuming operation, they should use the most precise for each operation based on the list in the table below.[15]

The following chart is from the GHG Protocol showing the GHG accounting from the sale and purchase of electricity.

| Emission factors | Indicative examples | Precision |
|---|---|---|
| **Energy attribute certificates** or equivalent instruments (unbundled, bundled with electricity, conveyed in a contract for electricity, or delivered by a utility) | • Renewable Energy Certificates (U.S., Canada, Australia and others)<br>• Generator Declarations (U.K.) for fuel mix disclosure<br>• Guarantees of Origin (EU)<br>• Electricity contracts (e.g. PPAs) that also convey RECs or GOs<br>• Any other certificate instruments meeting the Scope 2 Quality Criteria | Higher |
| **Contracts** for electricity, such as power purchase agreements (PPAs)[a] and contracts from specified sources, where electricity attribute certificates do not exist or are not required for a usage claim | • In the U.S., contracts for electricity from specified nonrenewable sources like coal in regions other than NEPOOL and PJM<br>• Contracts that convey attributes to the entity consuming the power where certificates do not exist<br>• Contracts for power that are silent on attributes, but where attributes are not otherwise tracked or claimed | |
| **Supplier/Utility emission rates,** such as standard product offer or a different product (e.g. a renewable energy product or tariff), and that are disclosed (preferably publicly) according to best available information | • Emission rate allocated and disclosed to retail electricity users, representing the entire delivered energy product (not only the supplier's owned assets)<br>• Green energy tariffs<br>• Voluntary renewable electricity program or product | |
| **Residual mix** (subnational or national) that uses energy production data and factors out voluntary purchases | • Calculated by EU country under RE-DISS project [b, c] | |
| **Other grid-average emission factors** (subnational or national) – see location-based data | • eGRID total output emission rates (U.S.).[d] In many regions this approximates a consumption-boundary, as eGRID regions are drawn to minimize imports/exports<br>• Defra annual grid average emission factor (UK)<br>• IEA national electricity emission factors[e] | Lower |

A PDF of the 120 page Scope 2 Guidance can be found at Scope 2 Guidance.pdf (ghgprotocol.org)

# Scope 3: Other **indirect GHG emissions**

Scope 3 is optional in the US but provides an opportunity to be innovative in GHG management. Organizations may want to focus on accounting for and reporting those activities that are relevant to their business and goals, and for which they have reliable information. Since companies have discretion over which categories they choose to report, Scope 3 may not lend itself well to benchmarking across peer or competitor organizations.

To determine if an activity falls within scope 1 or Scope 3, the company should refer to the selected consolidation approach (equity or control) used in setting its organizational boundaries.

These are the 15 major categories of Scope 3 GHG emissions. [16]

## Upstream Scope 2 Emissions

1. Purchased goods and services
2. Capital goods
3. Fuel- and energy-related activities (not included in scope 1 or scope 2)
4. Upstream transportation and distribution
5. Waste generated in operations
6. Business travel
7. Employee commuting
8. Upstream leased assets

## Downstream scope 3 emissions

9. Downstream transportation and distribution
10. Processing of sold products
11. End-of-life treatment of sold products
12. Downstream leased assets
13. Franchises
14. Investments

# Accounting for **Scope 3 Emissions**

A comprehensive and exhaustive accounting for Scope 3 emissions is not realistic or even possible. A good way to start is to focus on one or two major GHG-generating activities, especially those that offer opportunities to demonstrate emission reductions over time. Even this limited approach will require the participation and cooperation of suppliers and such internal departments as:

- **Procurement**
- **Energy**
- **Manufacturing**
- **Marketing**
- **Research and Development**
- **Product design**
- **Logistics**
- **Accounting**

## Organizing and Prioritizing Scope 3 Data Collection

Organizations need to collect data of a quality level to accurately measure its GHG emissions, to support the organizations goals, and to direct reduction efforts. Data collection should be prioritized around activities that generate the greatest GHG emissions, which offer major GHG reduction opportunities, and are most relevant to the company's business goals.

Companies may use any combination of primary and secondary data to calculate Scope 3 emissions. As a general rule, organizations should collect high quality, primary data for their high priority activities. In some cases, primary data may not be available or may not be of sufficient quality. In such cases, secondary data can be used.

The following table shows the advantages and disadvantages of primary and secondary data.[17]

| | *Primary data (e.g., supplier-specific data)* | *Secondary data (e.g., industry-average data)* |
|---|---|---|
| **Advantages** | • Provide better representation of the company's specific value chain activities<br>• Enables performance tracking and benchmarking of individual value chain partners by allowing companies to track operational changes from actions taken to reduce emissions at individual facilities/companies and to distinguish between suppliers in the same sector based on GHG performance<br>• Expands GHG awareness, transparency, and management throughout the supply chain to the companies that have direct control over emissions<br>• Allows companies to better track progress toward GHG reduction targets (see chapter 9) | • Allows companies to calculate emissions when primary data is unavailable or of insufficient quality<br>• Can be useful for accounting for emissions from minor activities<br>• Can be more cost-effective and easier to collect<br>• Allows companies to more readily understand the relative magnitude of various scope 3 activities, identify hot spots, and prioritize efforts in primary data collection, supplier engagement, and GHG reduction efforts |
| **Disadvantages** | • May be costly<br>• May be difficult to determine or verify the source and quality of data supplied by value chain partners | • Data may not be representative of the company's specific activities<br>• Does not reflect operational changes undertaken by value chain partners to reduce emissions<br>• Could be difficult to quantify GHG reductions from actions taken by specific facilities or value chain partners<br>• May limit the ability to track progress toward GHG reduction targets (see chapter 9) |

A PDF of the 152 Page Scope 3 Guidance can be found at Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf (ghgprotocol.org)

# Challenges with and **Limitations in Current Data Collection** and Reporting

Carbon accounting in general and GHG emission reporting in particular are challenging even to large organizations. For smaller organizations with only small accounting and sustainability staffing, the challenges with exceed most in-house capabilities. Using manual methods of data collection and reporting will aggravate these challenges and frustrate their auditors. Manual methods will lead to errors in calculations, omission of data, incorrect emissions boundaries, and a lack of standardization around the GHG Protocol. The challenges can be summarized as follows

## 1. Lack of Standardization

While the GHG Protocol provides solid guidance and an overarching framework, there is still a lack of one definitive calculation model of one emissions data collection procedure, and one method of determining scope boundaries. There are accounting recommendations and guidance rather than firm requirements such as GAAP (Generally Accepted Accounting Practices) that are in force in the US, EU, and other major economies. Guidance ambiguity opens "the possibility of greenwashing down the line and possible legal troubles as regulations begin to crack down on the reporting of these metrics, but the rampant body of carbon inventories built mainly on estimates leads to results that are incomparable."[18]

## 2. Lack of GHG Emission Accounting Boundaries

It can be challenging to determine the boundaries as to what is included and excluded from carbon reporting as emissions can occur along a variety of points in an organization's supply chain and who is responsible for reporting them. "There are significant differences between the definition of organizational boundaries required by US GAAP (Generally Accepted Accounting Principles) relative to those required by the GHG Protocol (e.g., financial control, operational control, or equity share)." [19]

## 3. Collecting Accurate Source Data

The manual collection of emission data is labor-intensive, prone to errors, and lacks standardization. Manual methods make it unrealistic to consistently collect data in real-time and to accurately calculate initial baseline emissions. While these issues may not be significant for Scope 1 accounting, they can be a

challenge for Scope 2 and Scope 3 accounting. Organizations have few controls over their access to emission data from their suppliers. Line-item accounting detail will be extremely difficult to obtain for many Scope 3 emissions. [20]

## 4. Errors in Calculations and Reporting

Carbon accounting can suffer from high levels of uncertainty and errors. The models deployed may not be representative of accurate emissions inventory. The problems are compounded by the use of spreadsheets used for accounting calculations. In 2021, Robert Kaplan and Karthik Ramanna writing in the Harvard Business Review noted: "ESG in its current form is more a buzzword than a solution. Each of its three domains presents different measurement opportunities and challenges, a fact not adequately addressed by existing disclosure standards. As a consequence, few ESG reports engage meaningfully with the moral trade-offs within the three domains and with the company's profits." [21]

The article went on to warn that companies are selectively presenting favorable metrics, known as greenwashing. As a result, audits of these companies can only speculate the accuracy of their GHG emission reporting with comments like, "We found no evidence of misreporting in the company's ESG report"—and the reports themselves have had little impact on either corporate actions or external stakeholders." [22]

Finally, Kaplan and Ramanna point out the problems in the GHG Protocol used by 92% of Fortune 500 organizations. "The protocol has serious conceptual errors: The same emissions are reported multiple times by different companies, while some entities entirely ignore emissions from their supply and distribution chains. Indeed, the poor accountability of ESG reports stems partly from the flaws in the GHG Protocol... Scope 3 emissions are the fatal flaw in GHG reporting. The protocol's creators included them to encourage companies to exert influence over emissions that they don't control directly... But the difficulty of tracking emissions from multiple suppliers and customers across multitier value chains makes it virtually impossible for a company to reliably estimate its Scope 3 numbers." [23]

The major limitations and ambiguities in Scope 3 accounting could also encourage organizations to outsource production to reduce their mandatory Scope 1 and 2 GHG emission reporting.

## 5. Lack of a Uniform Audit Standard

The Sarbanes Oxley Act of 2003 was a law enacted by the US Congress to improve transparency in financial reporting. A series of regulations were enacted to implement the law, but it is the Public Company Accounting Oversight Board's (PCAOB) audit standard, especially Audit Standard No. 5, that is what public companies must follow and which all auditors use. Unfortunately, there is no carbon reporting equivalent to the PCAOB's Audit Standard 5. Without a concrete audit standard, there will always be a lack of creditability in GHG emission reporting.

## 6. Incompatibility in Complying with US and Other National GAAPs

Shivaram Rajgopal writing in Forbes notes that there are major differences between how US GAAP and the GHG Protocol define organizational boundaries required relative to operational and financial control. Many users of financial statements may not be aware of these differences. "It might be helpful to require a reconciliation between what GHG emissions might look like if we follow the definition of "control" under US GAAP relative to the definition of control used by the firm complying with GHG protocol."[24]

The *Forbes* article goes on to describe the problems with the GHG Protocol's method of pooling assets impacted by mergers and acquisitions. "Under U.S. GAAP, firms must disclose separately, either on the balance sheet or in the footnotes, the major classes of assets and liabilities of a discontinued operation for all periods presented." Under the GHP Protocol's pooling method which is no longer allowed under U.S. GAAP, liabilities and assets of a parent company and its target company are simply combined. [25]

The *Forbes* article discusses the issues around executive compensation in which corporate boards are starting to link GHG emission reductions to CEO compensation. This will become an obvious opportunity to game the system to report favorable emission reductions as there are few details about the definition of these targeted emissions. It would be helpful for the GHG Protocol to be updated with a requirement to "reconcile the GHG number promised in these contracts with emissions as per the GHG protocol and U.S. GAAP's definition of control. Otherwise, we will increase observe 'emissions management' where slippery definitions of control will be used to argue that the firm has fulfilled its GHG reduction pledge." [26]

For a deeper dive into the limitations of the GHG Protocol and compatibility issues with US GAAP see the Forbes article by Shivaram Rajpopal. What Are the Limitations of The GHG Protocol? (forbes.com)

# Automating **Data Collection** and **Reporting** to Support an Activity Based **Accounting Method**

PWC's 2021 Investor Survey found that investors will look more favorably on audited carbon emission reporting. This will become important as financial analysts and portfolio managers look to demonstrate they are recommending companies championing sustainability. The chart below is from the PWC survey.[27]

As organizations work to lower their GHG emissions, the largest challenges will lie in their Scope 3 emissions, which are only voluntary in the US at this stage but represent the lion's share of emissions. While still voluntary, investors will continue to increase pressure on organizations of all sizes and types to report their efforts to reduce Scope 3 emissions.[28]

**Investors are more likely to trust fully audited ESG reports**

**79%**

of investors surveyed place more trust in ESG information when it has been assured.

**73%**

of investors think companies' disclosures of ESG metrics and KPIs should be assured at the same level as financial statement audits (i.e. reasonable assurance).

**70%**

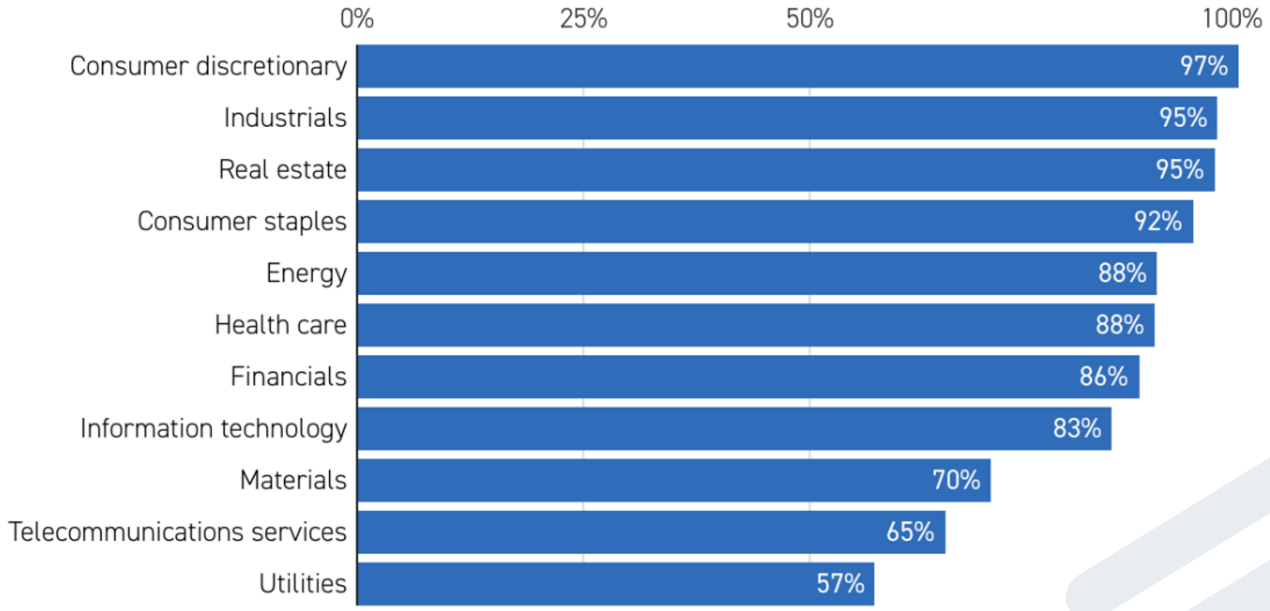
of investors think companies should be required to obtain assurance on all material ESG information, not on a subset that the company chooses. In other words, no cherry-picking.

Source: *PwC's 2021 Global Investor Survey*

The chart below is from Morningstar and POLITICO, 23 February 2023, demonstrating why Scope 3 plays such a major role in reducing carbon emissions.

## Scope 3 makes up 87 percent of emissions across all industries

Scope 3 emissions as a percentage of total reported pollution, by industry




Source: Morningstar Sustainalytics
Jordan Wolman/POLITICO

Morningstar reports that the number of companies reporting Scope 1 and 2 is growing and hit 40% in fiscal 2021, up from 33% the prior year. The same report noted the low level of Scope 3 reporting in fiscal 2021 at only 24%. But the pressure to report Scope 3 is growing. "The International Sustainability Standards Board announced it had finished the bulk of its sustainability and climate-related disclosure standards and that countries could adopt the rules as early as Jan. 1. Those standards mandate Scope 3 emission disclosures but allow companies to use estimations and delay those disclosures by one year from the reporting dates for scopes 1 and 2." [29]

Bob Kaplan's and Karthik Ramanna's Harvard Business Review article makes a compelling case for what they term as an E-liability method that follows an activity-based costing accounting methodology for Scope 3 emissions. In short, the idea is to treat Scope 3 emissions in which work-in-process or raw materials move from one upstream node of your supply chain to the downstream version. [30]

Kaplan and Ramanna use car door manufacturing as an example to make their case:

1. The Scope 3 GHG Protocol requires the manufacturer to track all GHG emissions of its upstream suppliers, "including the extraction of metallurgical coal and iron ore, the transport of those minerals to a steel producer, the production of sheet steel from the coal, iron ore, and other inputs, and the transport of that steel to its own production facility."
2. The car-door manufacturer is also required to estimate downstream GHG activities such as car door transportation to its customer, typically the vehicle assembly facility, plus the finished car manufacture, plus the car's transportation to the showroom, and the operation of the vehicle itself, for up to 15 years, by the end-use consumer. [31]
3. Accurately calculating all these upstream and downstream emissions, especially for manufacturers with complex, multi-jurisdictional supply chains will be very challenging and may be impossible. It will also be tempting for organizations to game the reporting process to show unrealistic reductions in GHG emissions. Each company in the supply chain is required to go through the same process which invites double counting.[32]

Kaplan and Ramanna propose a fix to these problems by using an activity-based accounting method used in financial reporting, applied to GHG emission reporting:

1. When the car-door manufacturer calculates its value added, each supplier in its supply chain only records what it pays for services and goods from its immediate suppliers and what it receives from sales to its immediate customers. Unlike the GHG Protocol for Scope 3, the car-door maker does not calculate all the prices paid by all its suppliers and customers across all the phases of its supply chain.
2. The car-door manufacturer only adds its own fabrication, assembly, and indirect costs to the acquisition costs to calculate the total manufacturing cost of the door when sold and transferred to the automotive-assembly company.
3. The process continues down the value chain until the car's eventual purchase by a consumer.

# The Advantages in Using an **Automated Tool:** ThinkIQ's **Manufacturing Information Platform**

Whether an organization follows an activity-based accounting method or continues to follow the GHG protocol, the EPA strongly recommends using an automated tool. The alternative of using error-prone and labor-intensive spreadsheets or home-grown solutions will be unacceptable to most investors, regulators and auditors. A Boston Consulting Group (BCG) Survey found "respondents estimate that their emissions measurements are subject to an average error rate of 25% to 30%. And although 92% of all emissions are Scope 3, according to the Carbon Disclosure Project (CDP), just 12% of organizations surveyed consider Scope 3 their top priority." [33]

BCG argues that organizations need to invest in automation tools, that rigorously measure, track, and reduce their environmental footprint at scale. "Such automated digital solutions pull data from sources across the business, promoting transparency and providing a single source of truth. They can support informed decision making, automate CO2 emissions reporting, and design a roadmap for emissions reduction going forward." BCG's survey found that those organizations that adopted an automated digital solutions tool for emissions reporting "are 2.2 times as likely as their peers to measure their emissions comprehensively and 1.9 times as likely to reduce emissions in line with their ambitions." [34]

ThinkIQ Empowers Manufacturing Energy Transformation ThinkIQ understands the challenges Energy Transformation initiatives present to manufacturers and provides the granular and highly contextualized view of data across time and the extended supply chain to identify trends and anomalies. The ThinkIQ processing engine include a semantic model, vision pipeline, material ledger and next gen historian that provides data visualizations, material flow explorer, product traceability, and data analysis to support decarbonization, energy and waste compliance reporting requirements.

ThinkIQ delivers the necessary granular and contextualized data to understand, plan, manage and report on the SEC climate-related disclosure initiatives: specifically, Scope 1, 2, and 3 GHG Emissions Reporting, so manufactures can maintain and report on compliance. Through intelligent analytics, ThinkIQ can identify relationships between subjects that can be pre-defined or generated dynamically based on actual activity data.

Tracking ongoing interactions can bring valuable new insights into the behaviors, causes and effects in the ecosystem. For energy transformation initiatives this insight is invaluable to identify and remediate direct greenhouse (GHG) emissions as well as indirect GHG emissions associated with the purchase of electricity, steam, heat, or cooling. With ThinkIQ, you can learn what happened, why it happened, predict future events, and then share this intelligence with other systems and workgroups. This will drive energy and waste efficiency and provide broader decision support impacting issues across your company. Once you have this level of energy and waste insight, you can confidently take the next step in your journey toward Industry 4.0 Smart Manufacturing.

# Case Studies

## Case Study 1: Kraft Foods Collecting Scope 3 Data

Kraft Foods found that Scope 3 emissions comprise more than 90 percent of the company's combined scope 1, scope 2, and Scope 3 emissions

For its first Scope 3 inventory, Kraft Foods, a U.S.-based global food products company, focused on achieving a complete inventory of all Scope 3 emissions, with the goal of supporting high-level strategic evaluations and internal understanding of its value chain GHG emissions.

To accomplish this goal, the company obtained industry average life cycle inventory data from various public and commercial sources. Kraft Foods matched the emission factors with its own internal data on activities and purchases. For the company's supply chain, the secondary data approach allowed the company to understand its total Scope 3 emissions with reasonable accuracy, cost, and speed, and with the ability to update as more precise secondary data became available. Using secondary data also fit Kraft Foods' needs given that a large portion of its purchased commodities are produced in a global market where tracking the agricultural source of origin is challenging.

Kraft Foods found that Scope 3 emissions comprise more than 90 percent of the company's combined scope 1, scope 2, and Scope 3 emissions. Within Scope 3, the company found that emissions from category 1 (Purchased goods and services), including raw materials, comprised 70 percent of its total Scope 3 emissions, while transportation and distribution, energy-related activities, and the use of sold products accounted for the majority of the remaining 30 percent. Kraft Foods included an estimated uncertainty range for each Scope 3 category in order to provide additional transparency.

Kraft Foods plans to continuously improve the quality of its GHG inventory to better understand the company's influence on climate change. Using the inventory results, the company will continue to expand and enhance it.

## Case Study 2: Ocean Spray, Setting the Scope 3 Boundary

**A complete inventory showed Ocean Spray the full picture of its value chain GHG emissions, revealed the greatest reduction opportunities, and enabled effective decision making**

Ocean Spray, a leading producer of bottled juice drinks and dried fruit in North America, developed its first Scope 3 inventory with the goal of informing an effective GHG reduction strategy. At the outset, Ocean Spray identified a tension between the completeness of the inventory and the specificity of data used to calculate emissions. Ocean Spray decided that to best inform the company's GHG-reduction strategy, it should develop a Scope 3 inventory by focusing on completeness over precision, and to disclose the sources and uncertainty of data used. A complete inventory showed Ocean Spray the full picture of its value chain GHG emissions, revealed the greatest reduction opportunities, and enabled effective decision making, which would have been hindered by excluding Scope 3 activities from the inventory. To develop a complete inventory, Ocean Spray first identified all Scope 3 activities, such as growing and processing fruit, transforming fruit into food and beverage products, distributing products to customers, and use and disposal by consumers. Ocean Spray then collected primary data for activities such as the economic value of upstream ingredients, materials, and services. The company used economic input-output assessment to calculate emissions using the cost data on upstream suppliers. Where primary data was not available, the company calculated estimates based on assumptions, especially for downstream activities such as consumer disposal. Through the Scope 3 inventory process, Ocean Spray learned that Scope 3 emissions account for most of its total scope 1, scope 2, and Scope 3 emissions. The company's largest source of GHG emissions came from category 1 (Purchased goods and services) which accounted for more than half of combined scope 1, scope 2, and Scope 3 emissions, driven primarily by raw material inputs. [35]

## Case Study 3: How the UK implements EU supplier disclosure requirements

"In the EU system, the Fuel Mix Disclosure regulations require all suppliers to disclose the emissions associated with the power that they supply. To do so, U.K. suppliers present renewable energy guarantees of origin (REGOs) and Generator Declarations to the regulator for the jurisdiction, the Department for Energy and Climate Change (DECC). DECC then removes all claimed generation from the overall national average, which leads to the production of a 'residual' energy mix—with an associated emissions factor. This is issued to all suppliers so that they can complete their calculations for any of their suppliers without certificates. This combination of verified supplier claims and allocation of the remaining emissions back to suppliers ensures consistency across suppliers and accounting for all generation emissions." [36]

For more on U.K. requirements, see: https://www.ofgem.gov.uk/ofgem-publications/57972/12340-28205.pdf and https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/82783/Fuelmixdisclosure2013.pdf

## Case Study 4: Abengoa: Business objectives of Scope 3 supplier engagement

**Abengoa believes that working closely with its suppliers is the best way to encourage broader GHG measurement and management.**

"For Abengoa - a global technology and engineering company operating in over 70 countries - engaging with its suppliers to build its greenhouse gas inventory is a key component of the company's overall sustainability goals. Abengoa believes that working closely with its suppliers is the best way to encourage broader GHG measurement and management and to calculate its Scope 3 GHG inventory. Abengoa utilizes a number of methods that support the completion of their Scope 3 inventory. All suppliers must agree to introduce a GHG reporting system for the products and services purchased by Abengoa. Abengoa then provides detailed guidelines for suppliers to determine emissions, based on the GHG Protocol standards, and includes calculation guidance, databases and guidance on emissions factors. The guidance also includes data collection templates for suppliers to send to their suppliers further upstream, which introduces GHG emissions management throughout the overall Abengoa value chain. Abengoa also requires that supplier emissions data are verified by a third party or accompanied by the data used for calculating the GHG inventory. Finally, the company requires that all suppliers adhere to its Social Responsibility Code of Conduct, to ensure suppliers' senior management is committed to Abengoa's sustainability practices and objectives.

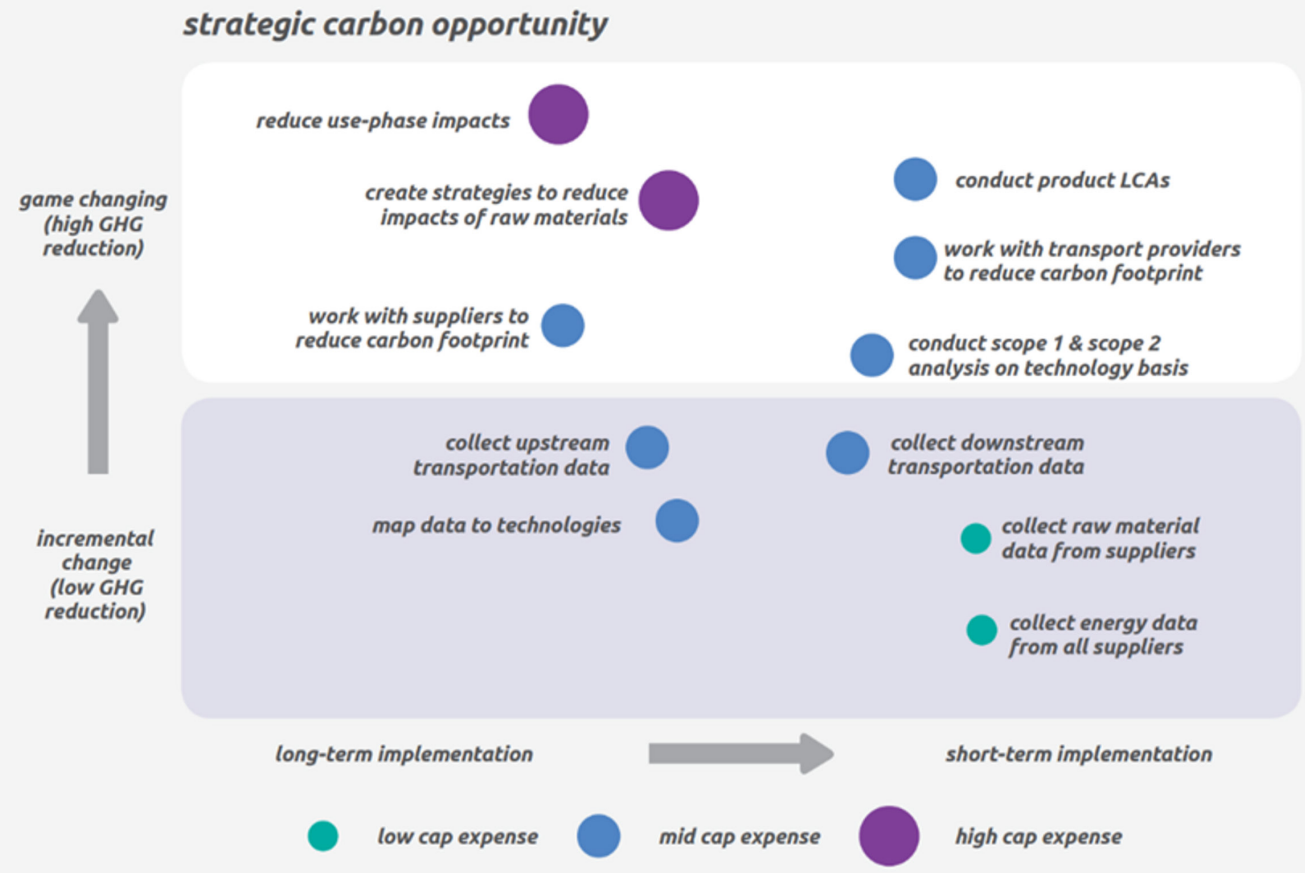
## Case Study 5: SC Johnson: Assessing Scope 3 reduction opportunities

Making life better for people and the planet is a core mission at SC Johnson. The company completed a Scope 3 inventory to better understand its Scope 3 impacts and to provide input for the development of sustainability objectives in support of its core commitment to environmental leadership. Specific objectives of this effort were to:

- Gain a full understanding of the company's global carbon footprint to reveal potential hot spots and opportunities
- Provide a common carbon "currency" throughout the value chain to identify the highest-impact GHG reduction strategies and programs (See Figure 2.1 below.)
- Develop a framework to engage government, NGOs, supply chain partners, retailers, and consumers and to drive the innovation necessary to foster GHG improvements throughout the value chain

As a result of the Scope 3 inventory effort, SC Johnson has initiated a process to incorporate Scope 3 results into its sustainability program objective development and has initiated outreach programs with its suppliers to help foster GHG improvements.

Figure [2.1] SC Johnson's framework to assess reduction opportunities along the value chain




## Case Study 6: Citi: Scope 3 emissions from project finance

"Citi, a global financial services company, annually reports GHG emissions from power plants it finances through its project finance business worldwide. Citi reports these emissions to provide transparency in GHG emissions from its project finance portfolio. Citi's reporting includes emissions from closed (i.e., completed) project financing of new capacity only, including expansions of existing plants, but not re-financing of existing plants. Emissions data are derived from the power plant's capacity and heat rate, the carbon content of the fuel, and projected capacity utilization. Citi accounts for the total estimated lifetime emissions of projects financed in the reporting year and calculates project-specific emissions for both a 30- and 60-year assumed plant lifetime. To allocate power plant emissions to

Citi, total emissions are multiplied by the ratio of Citi's project finance loan to total project costs (total debt plus equity). In 2009, Citi financed one thermal power project via project finance with an estimated lifetime emissions of 8.7 to 17.4 million metric tons of CO2 e. (The lower end of the range represents a 30-year plant life, and the higher number represents a 60-year plant life.) In 2008, Citi reported zero emissions from power plants, since Citi did not finance any fossil-fuel fired power plants in 2008." [37]

## Case Study 7: Levi Strauss & Company: Allocating Scope 3 emissions

"Levi Strauss & Co. (LS&Co.) used multiple allocation methods within its Scope 3 inventory depending on the types and granularity of data available.

Category 1: Purchased goods and services (upstream): LS&Co. collected primary data from a sample of suppliers throughout its supply chain, including fabric mills (facilities that create denim fabric from cotton fiber) and garment manufactures (facilities that assemble and finish final denim products). Allocation was necessary because both types of suppliers provided aggregated data at the facility level on total material use, energy use, production throughput, and waste streams for their full annual production. GHG emissions per product could be reasonably allocated by dividing total facility emissions by facility throughput, since both types of suppliers produce relatively uniform outputs (i.e., denim products). LS&Co. allocated emissions from the fabric mills by mass, since mass is one of the main quantifiable determinants of material and energy inputs during the milling process and best reflects the causal relationship between production and emissions. LS&Co. allocated emissions from the garment manufacturers by the number of products produced at a facility, since assembly and finishing are similar across a variety of denim products and emissions per unit are expected to be similar. Emissions per product were multiplied by the total number of units purchased by LS&Co. per facility to obtain total Scope 3 emissions attributable to LS&Co.

Category 9: Downstream transportation and distribution: Distribution Centers: After production, jeans are sent to a distribution center that packages and ships various products. LS&Co. estimated emissions per product by collecting primary data for total energy and materials used, allocated by total units of product shipped during a year. This method assumes that all units shipped result in the same emissions, which LS&Co. considered reasonable since all products go through the same processes at the distribution center.

Retail: Jeans are shipped from distribution centers to retail stores. Each retail store sells a variety of products, which requires allocating total store emissions to each product type. LS&Co. allocated emissions according to the retail floor space occupied by each product compared to the entire store. LS&Co. determined the average floor space and emissions of a retail store and the floor area (physical space) occupied by each product to determine emissions per individual unit from retail." [38]

# Conclusion

While automating carbon data collection and reporting will not address all the issues highlighted in this white paper, it will go a long way to reducing labor-intensive and error-prone manual processes and will be a welcome improvement to an organization's investors, auditors, and regulators.

ThinkIQ's manufacturing data platform is the market leader in providing detailed yield, safety, quality, and compliance data in-plant and across the supply chain. The platform is now expanded to provide GHG emission reporting in compliance with Scope 1, 2, and 3 reporting.

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# End Notes


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