

Implementing the GHG Protocol - advantages of implementation

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Abstract

Climate change has become a major global concern, and companies across all industries are facing increasing pressure to reduce their greenhouse gas (GHG) emissions. The Greenhouse Gas Protocol is a voluntary international standard widely used to measure and report organizations' GHG emissions. Essentially, the GHG Protocol provides a “common language” and a set of clear methodologies by which companies can calculate their carbon footprint consistently and transparently, dividing emissions into Scope 1 (direct, from owned/operated sources), Scope 2 (indirect from purchased electricity and heating and cooling) and Scope 3 (all other indirect emissions in the value chain). This seemingly bureaucratic reporting standard can become a valuable tool for corporate efficiency, innovation and sustainability.

Keywords: GHG Protocol, sustainability, greenhouse gas emissions, climate change

I. Introduction

Climate change is a global issue, and companies operate in a global environment. Value chains – and the risks and opportunities associated with GHG emissions – span national borders. Companies operating in a global economy need a single, consistent, harmonized approach. As the new standards take a value chain approach to measuring and managing emissions that cross national borders, the need for a global standard is even more important.

The Greenhouse Gas (GHG) Protocol is the result of a partnership supported by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) and involving multiple stakeholders: companies, non-governmental organizations (NGOs), governments, etc.

Launched in 1998, the GHG Protocol aims to develop internationally accepted GHG accounting and reporting. To date, the GHG Protocol has released four standards that address how corporate GHG emissions should be inventoried [1, 2].

The overall benefits of adopting this protocol are quickly apparent. First, companies can more easily identify their main sources of emissions and thus take targeted reduction measures. Once you start closely monitoring emissions, you become even more motivated/organized to reduce them.

Numerous studies confirm that companies that consistently reduce their carbon emissions end up having better financial performance – for example, an international study of almost 1,800 companies found that reducing GHG emissions led to increased return on assets (ROA), equity (ROE) and profit margin, without negative effects on the value of the company [3]. These findings are supported by other research showing that less polluting companies tend to have better profitability and lower costs of capital, in part because they become more energy efficient and more attractive to investors and lenders concerned about climate risks.

Another general advantage of the GHG Protocol is that it provides transparency and credibility. The fact that a company reports its emissions according to a globally recognized standard inspires trust among stakeholders – be they customers, investors or authorities. This transparency is not just a facade: standardized data allows comparisons across companies and sectors, highlighting who is making progress and who is lagging behind. And consistency in methodology makes it possible to track progress over time and then measure it annually.

Implementing the GHG Protocol also prepares companies for the future. Regulations are becoming increasingly strict around the world. The EU already requires large companies to report emissions, and discussions about carbon taxes and carbon neutrality obligations are increasingly frequent. A company that already has a GHG inventory in place can more easily participate in mandatory reporting schemes or carbon markets and can avoid shocks when legal requirements suddenly arise. Thus, a company that has the GHG Protocol implemented better manages its risks – both regulatory risk and image risks or even physical risks related to climate change.

Greenhouse gases can be emitted at every stage of a product or process's life cycle, from raw materials to end-of-life destruction, reuse or recycling.

The sources of emissions are found in:

a. **Fuels:** Emissions from the mining and subsequent combustion of fossil fuels such as coal and oil. These fuels are used in power plants that provide electricity for buildings and in equipment such as boilers that provide heating for buildings and steam for industrial processes. The use of fuels in plants and vehicles plays an important role in calculating the carbon footprint.

b. **Agriculture:** The IPCC Special Report on Climate Change and Land (2019) estimates that agriculture is directly responsible for up to 8.5% of total greenhouse gas emissions, with another 14.5% coming from land-use change (mainly deforestation in developing countries to clear land for food production).

c. **Chemicals:** Used not only in manufacturing processes but also for building materials such as concrete. Some industries are heavier users of chemicals in their processes than others – sulfuric acid leads the list as the number one chemical produced worldwide. The major use of sulfuric acid is in the production of fertilizers – ammonium sulfate and superphosphate.

d. **Gases:** Industrial gases are gaseous materials that are manufactured for use in industry. The main gases supplied are nitrogen, oxygen, carbon dioxide, argon, hydrogen, helium and acetylene, although many other gases and mixtures are also available in gas cylinders.

e. **Waste:** Waste is generated at the company's facilities and also from end-of-life processes for products.

2. Carbon footprint calculation methods according to the GHG Protocol

2.1 General elements for the GHG protocol

Under the GHG Protocol, a company's greenhouse gas emissions are classified into three scopes or scopes. Scopes 1 and 2 are mandatory for reporting, while Scope 3 is voluntary and the most difficult to monitor.

The areas/purposes on which GHG emissions are classified according to the GHG Protocol Corporate Standard are:

- a. Scope 1 emissions are direct emissions from emission sources owned or controlled by the company. Thus, Scope 1 covers emissions from sources that an organization directly owns or controls – for example, from fuel combustion in a fleet of vehicles (if they are not electrically powered).
- b. Scope 2 emissions are indirect emissions from the generation of purchased energy. Thus, Scope 2 are emissions that a company causes indirectly and come from where the energy it purchases and uses is produced. For example, emissions caused by the generation of electricity that is used in its own buildings would fall into this category.
- c. Scope 3 emissions are all indirect (not included in scope 2) emissions that occur in the value chain of the reporting company, both upstream and downstream. Thus, Scope 3 includes emissions that are not produced by the company itself and are not the result of activities in assets it owns or controls, but for which it is indirectly responsible up and down its value chain.

It is somewhat easier to quantify emissions for Scopes 1 and 2. For energy use, for example, companies can obtain the data needed to convert direct purchases of gas and electricity into a value for the associated greenhouse gases. However, for many organizations, Scope 3 emissions represent by far the largest proportion of total emissions. Unfortunately, these are usually the hardest to reduce. Some of the actions a company can take to reduce them are to work with existing suppliers and their customers to reduce these emission.

In order to calculate the carbon footprint, the following steps are taken:

Step 1: Identify sources and emissions from operations

Step 2: Classify emissions as direct or indirect

Step 3: Organize emissions for reporting into areas or categories based on the reporting protocol

Step 4: Identify and justify any exclusions

2.2 Calculation of carbon emissions

a) Calculation of carbon emissions for Goal/Scope 1

Among the most well-known calculation methods for emissions related to goals/scopes 1 and 2, are:

- Direct measurement – e.g. continuous emission monitoring systems. Several EU directives and national legislation in European countries set requirements for continuous monitoring of flue gas emissions from waste incinerators, power plants, cement plants and other industrial installations. The demand for emission measurement has increased and limit values have tightened in recent years, and the trend will undoubtedly continue. A number of suppliers operate in the market for the provision of such monitoring equipment, which represents a high cost.
- Mass Balance Accounting - Mass balance accounting is one of the most well-known chain of custody approaches used in the chemical industry, which was designed to track the flow of materials through a complex value chain. For the mass balance approach to work and be widely applicable, it is essential that the calculation basis and allocation rules are generally applicable and robust.

Scope 1 emissions are direct emissions from resources controlled and owned by the company. In other words, emissions released into the atmosphere as a direct result of a set of activities, at the company level. For example, all fuels that produce GHG emissions must be included in Scope 1.

Then, mobile combustion is represented by all vehicles owned or controlled by a firm that burn fuel (e.g. cars, vans, trucks). The increasing use of “electric” vehicles means that some of the organization’s fleets could fall into Scope 2 emissions.

Scope 1 emissions are:

- Fugitive emissions - are leaks of greenhouse gases. It is important to remember that refrigerant gases are a thousand times more dangerous than CO₂ emissions. Companies are encouraged to report these emissions.
- Process emissions are released during industrial processes and on-site production.

Thus, Scope 1 emissions include carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) which are emitted from stationary and mobile combustion and from involuntary fugitive emissions. Fugitive emissions may also include hydrofluorocarbons (HFCs), perfluorinated compounds (PFCs), sulphur hexafluoride (SF₆) and nitrogen trifluoride (NF₃). Where the heat content of the fuel is unknown, the following equation shall be used to calculate emissions:

$$\text{Emissions} = \text{Fuel (Mass or volume of fuel)} \times \text{Emission factor} \quad (1)$$

If the heat content of the fuel is known, the following equation is used to calculate emissions:

$$\text{Emissions} = \text{Fuel (Mass or volume of fuel)} \times \text{Fuel heat content} \times \text{Emission factor} \quad (2)$$

b) Calculation of carbon emissions for Goal/Scope 2

Once the inventory limit has been established, companies generally calculate GHG emissions using the following step:

- Identify GHG emission sources for Scope 2 emissions
- Determine if the market-based approach applies
- Collect activity data and choose emission factors for the methods used: location-based and market-based calculation
- Calculate emissions
- Accumulate GHG emission data at corporate level.

To calculate Scope 2 emissions, the following procedure applies:

- Multiply the activity data from each operation by the emission factor for that activity for each applicable GHG. Some sets of electricity emission factors may include emission rates for CO₂, CH₄, and N₂O; others may only provide CO₂ emission rates
- Multiply the Global Warming Potential (GWP) values by the Total GHG emissions to calculate the total emissions in CO₂ equivalent (CO₂e).
- Report final scope 2 for each method in metric tons of each GHG (if available) and in metric tons of CO₂e

c) Calculation of carbon emissions for Goal/Scope 3

Companies can use the following methods to calculate their carbon footprint: supplier-specific method, hybrid method, and expense-based method.

The supplier-specific method assumes that supplier-specific product-level data is the most accurate because it refers to the specific good or service purchased by the reporting company.

Supplier-specific emission factors for the goods or services purchased (e.g. whether the supplier has conducted a reliable GHG inventory from the factory floor to the gate using the GHG Protocol product standard). Data can be collected by companies by sending questionnaires to each relevant supplier or other value chain partner, requesting data on the life cycle GHG emissions of the product according to the GHG Protocol product standard, a description of the methodologies used to quantify emissions and a description of the data sources used (including emission factors and GWP values), whether the data has been verified, any other relevant information.

To the extent possible, the data provided by the supplier should be for the same time frame as the company's inventory reporting scope 3 and preferably attention should be paid to verified data.

When collecting emission factors from suppliers, it is recommended that companies also request information on the ratio of primary to secondary data used to calculate the emission factor. This information will provide transparency on the amount of primary data used by the supplier to calculate the emission factor for its product. As suppliers become more sophisticated in their GHG assessments, the percentage of primary data used to calculate emission factors for their products is likely to increase. Collecting information on the ratio of primary to secondary data will allow this ratio to be measured and tracked over time.

Hybrid method involves collecting data from each supplier's activity. Reporting companies should collect as much data on the purchased good or service as is available (if data is not available for certain activities, secondary data can be used to fill the gaps). This data is reported on:

- Data allocated for Scope 1 and Scope 2 (including emissions from electricity and fuel use and any process and fugitive emissions).
- Quantity or volume of material inputs (e.g. bill of materials), mass or volume of fuel inputs used and distance from the origin of the raw materials input to the supplier.
- Waste quantities because they produce other emissions.

To the extent possible, the data provided by the supplier should be for the same time frame as the company's inventory reporting scope 3 and preference should be given to verified data. If it is not feasible for the company to collect data from all its suppliers for all purchased goods, the company may use extrapolation and sampling techniques.

If a supplier cannot submit data, the reporting company can combine available supplier-specific data with secondary data for the other activities.

The expenditure-based method is used if the supplier-specific method, the hybrid method and the average data method are not feasible, companies should apply the average expenditure-based method by collecting data on the economic value of purchased goods and services and multiplying them by the relevant EEIO emission factors.

Emission factors needed to calculate emissions in the previous situation should use life cycle emission factors but exclude combustion emissions, as emissions from combustion are accounted for in scope 1 (in the case of fossil fuels) or in a separate form (in the case of direct CO₂ emissions from biomass or biofuel combustion).

If the supplier-specific method is used, companies should use fuel supplier-specific emission factors for the extraction, production and transport of fuels per unit of fuel consumed (e.g. kg CO_{2e}/kWh), depending on the fuel type and country/region. If the average data method is used, companies should use average emission factors for upstream emissions per unit of consumption (e.g. kg CO_{2e}/kWh).

3. The impact of implementing the GHG protocol in industry

The application of the GHG Protocol in four areas – services, logistics, construction and education – needs to be analyzed due to the complexity of these areas and the specificities of implementing the GHG Protocol in each of them. Thus, the four industrial areas in which the application of the GHG Protocol is analyzed are: services, logistics and construction.

Table no. 1 Impact of the application of the GHG Protocol in industry

Economic sector name	Sources of greenhouse gases	Benefits of implementing the GHG Protocol	Challenges	Long-term impact
Services	energy consumption of office buildings (Scope 2); fuels used for heating or own car fleets (Scope 1); emissions from employee travel for work (Scope 3);	risk management; compliance with future requirements; reduce consumption;	quality data collection;	cleaner services provided; example effect propagation;
Logistics	transport: own cars ((Scope 1); electricity for a warehouse (Scope 2); subcontract air or sea transport (Scope 3, because they are carried out by third parties);	reducing fuel costs; optimizing loads; aligning with customer expectations; entrepreneurship and innovation;	logistics chain complexity; data traceability; unit standardization; technological challenge;	urban freight transport will become less polluting and quieter; global emissions will decrease;
Construction	fuel consumption of construction equipment, generators, own vehicles (Scope 1); electricity used (Scope 2); “embodied emissions” in materials, transportation of materials from suppliers, waste management on site, possibly use of constructed buildings (Scope 3);	decrease in emissions; reduce the amount of waste;	lack of data and a unified methodology for embodied emissions;	nearly zero-energy buildings; cleaner construction processes;

Source: Own contribution

The industries analyzed are diverse – services, logistics and construction – and have a large impact on the environment. Some analyses show that, overall (including indirect emissions from supply chains), the service sector can be responsible for about 17–24% of a national economy’s

GHG emissions, contradicting the perception that it is a “negligible” polluting sector [4]. It is therefore not surprising that more and more service companies are adopting the GHG Protocol.

For logistics, transport – trucks, ships, planes – and warehouses or distribution hubs are of major importance. The logistics sector is a fossil fuel intensive sector, and therefore a major contributor to GHG emissions. Globally, transport (road, rail, shipping, aviation) is responsible for approximately 15% of total GHG emissions and over 20% of CO₂ emissions from fuel combustion [5], a huge proportion. And logistics is more than just transport, it also includes warehouses, logistics centers, goods handling operations – which in turn consume electricity (lighting, cold for cold storage), fuels for equipment (diesel or LPG forklifts), etc. So the need to measure and manage emissions in logistics is clear: not only for the sake of the environment, but also for economic efficiency, given that fuel is a major cost component in this sector.

The construction sector is estimated to be responsible for about 37% of global CO₂ emissions and about 36% of global energy consumption [6]. Buildings are, in fact, a huge consumer of resources and emitter of GHGs, through: the production of construction materials (cement, steel, bricks – all have “encapsulated” emissions), the construction site itself (heavy machinery, material transport), and then decades of use (heating, air conditioning, lighting). Therefore, the application of the GHG Protocol in this sector is both a great opportunity and a great challenge.

4. Conclusions

In recent years, discussions about climate change and reducing greenhouse gas emissions have become increasingly frequent. In this context, companies in the industry are increasingly hearing about the GHG Protocol and the importance of adopting it.

Adopting the GHG Protocol in industry is not just a bureaucratic requirement and represents a fundamental step towards a sustainable future. This standard brings clarity and accountability to an organization's processes.

For companies, the GHG Protocol translates into benefits, directly or indirectly – from efficiency and savings to a better image and access to business opportunities. For the environment and society, the benefits are even more valuable: a more stable climate, cleaner air, innovation and green jobs, plus reduced risks that would affect us all.

The benefits of implementing the GHG Protocol are: financial efficiency, improved reputation and competitive advantage, access to markets and implicitly to capital, avoidance of losses and anti-violence of legal regulations.

Sustainable transformation of industry is undoubtedly the great challenge of this generation. Adopting the GHG Protocol is not just about reporting data, it demonstrates a genuine commitment to a sustainable future.

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