The Institute of Chartered Accountants of Pakistan

CA PAKISTAN

The Essentials of GHG Accounting

Under IFRS Sustainability Disclosure Standards

From the Desk of Technical Services

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Preamble

Welcome to our first publication on greenhouse gas emissions accounting and reporting – The Essentials of GHG Accounting under IFRS Sustainability Disclosure Standards. This resource has been crafted to serve as a comprehensive guide for industry professionals and members seeking basic clarity and guidance in the application of IFRS S2 *Climate-related Disclosures* in the area of greenhouse gas emissions accounting and reporting.

With the growing urgency to address climate change and the increasing regulatory scrutiny on carbon emissions, it has become imperative for businesses to adopt transparent and standardized practices in area of greenhouse gas emissions accounting and reporting. IFRS S2 provides a robust framework for this purpose, offering principles-based guidelines to accurately measure, disclose, and manage climate related financial and non-financial disclosures.

Recognizing the challenges and complexities inherent in implementing IFRS S2, this guide aims to demystify basic key concepts, address common queries, and enhance basic understanding on Greenhouse Gas Emissions. The concepts covered in this guide are by and large those already explained in existing GHG Protocol documents and IFRS S2 *Climate-related disclosures* standard and this document in no way would constitute the replacement of actual reading of these standards / documents. We hope that this guide would serve as a valuable reference tool, fostering understanding on GHG emissions and related requirements enshrined in IFRS S2 Climate-related disclosures, driving positive change in the journey towards a low-carbon economy.

This guide is the first publication of the series prepared in the context of IFRS Sustainability Disclosure Standards, which we plan to issue in the forthcoming months. Notably, we plan to issue a separate publication covering more detailed aspects of Scope 3 GHG Emissions and Financed Emissions.

Historical Background

At the outset it is important to briefly understand the historical background around the GHG emissions reporting. During the 1970s and 1980s there was emergence of international discussions around atmospheric CO_2 concentrations and the increase in CO_2 levels over time. The United Nations Environmental Program (UNEP) and the World Meteorological Organization (WMO) established the Intergovernmental Panel on Climate Change (IPCC) in 1988, which the UN General Assembly endorsed, to assess scientific evidence on climate change. The IPCC's First Assessment Report in 1990 highlighted the need for better understanding and monitoring of GHG emissions to informed policy decisions and played a decisive role in the creation of the United Nations Framework Convention on Climate Change (UNFCCC), the key international treaty to reduce global warming and cope with the consequences of climate change.

The International Organization for Standardization (ISO) published the ISO 14000 series in the mid-1990s, which included standards for environmental management systems, including guidelines for GHG accounting (ISO 14064).

The GHG Protocol was developed in the late 1990s by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) to provide a standardized methodology for measuring and managing GHG emissions. The first edition of the GHG Protocol Corporate Standard, was published in 2001, which has been updated overtime with additional guidance to help companies measure and report GHG emissions.

The Kyoto Protocol, an international treaty under the UNFCCC, was adopted in 1997, setting legally binding emissions reduction targets for developed countries for the period 2008-2012. The Kyoto Protocol introduced the concept of emissions trading and Clean Development Mechanism (CDM) projects to incentivize emissions reductions in developing countries.

The Paris Agreement which was adopted within the UNFCC in December 2015, committed all participating countries to limit global temperature rise, adapt to changes already occurring, and regularly increase efforts over time. GHG Protocol is developing standards, tools and online training that helps countries and cities track progress towards their climate goals.

IFRS Sustainability Disclosure Standard S2 – *Climate related disclosures* issued by the International Sustainability Standards Board in June 2023 specifically refers to the GHG Protocol for the accounting and reporting of greenhouse gas emissions under the IFRS SDS.

Greenhouse gas emissions foundational concepts

GHG emissions are gases that trap heat in the Earth's atmosphere, contributing to the greenhouse effect and global warming. The primary sources of GHG emissions include burning fossil fuels for energy, industrial processes, agriculture, deforestation, and waste management.

GHG emissions accounting refers to the processes required to consistently measure the amount of Greenhouse Gases (GHGs) generated, avoided, or removed by an entity, allowing it to track and report these emissions over time.

The emissions measured are the seven gases mandated under the Kyoto Protocol and to be included in national inventories under the UNFCCC as stated below:

i. Carbon dioxide (CO_2),
ii. Methane (CH_4),
iii. Nitrous oxide (N_2O),
iv. Hydrofluorocarbons (HFCs),
v. Perfluorocarbons (PFCs),
vi. Sulphur hexafluoride (SF_6) and
vii. Nitrogen trifluoride (NF_3).

To standardize the measurement and make it comparable globally in one unit, these gases are usually converted to and expressed as carbon dioxide equivalents (CO_2e) using Global warming potential [i.e., a factor describing the radiative forcing impact (degree of harm to the atmosphere) of one unit of a given greenhouse gas relative to one unit of CO_2].

GHG accounting is mostly used by governments, companies, and other entities to measure the direct and indirect emissions that occur throughout their value chains because of organizational and business activities.

As stated above, IFRS Sustainability Disclosure Standard – S2 Climate related disclosures refers to the Greenhouse Gas Protocol – A Corporate Accounting and Reporting Standard [here-in-after referred to as GHG Protocol]. Based on GHG Protocol, the Greenhouse gas accounting and reporting is to be based on the following principles:

Relevance:

- Ensure the GHG inventory appropriately reflects the GHG emissions of the entity and serves the decision-making needs of users – both internal and external to the entity.

Completeness:

- Account for and report on all GHG emission sources and activities within the chosen inventory boundary. Disclose and justify any specific exclusions.

Consistency:

- Use consistent methodologies to allow for meaningful comparisons of emissions over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.

Transparency:

- Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.

Accuracy:

- Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.

These principles are intended to underpin all aspects of GHG accounting and reporting. Their application will ensure that the GHG inventory constitutes a true and fair representation of the entity's GHG emissions.

Other information

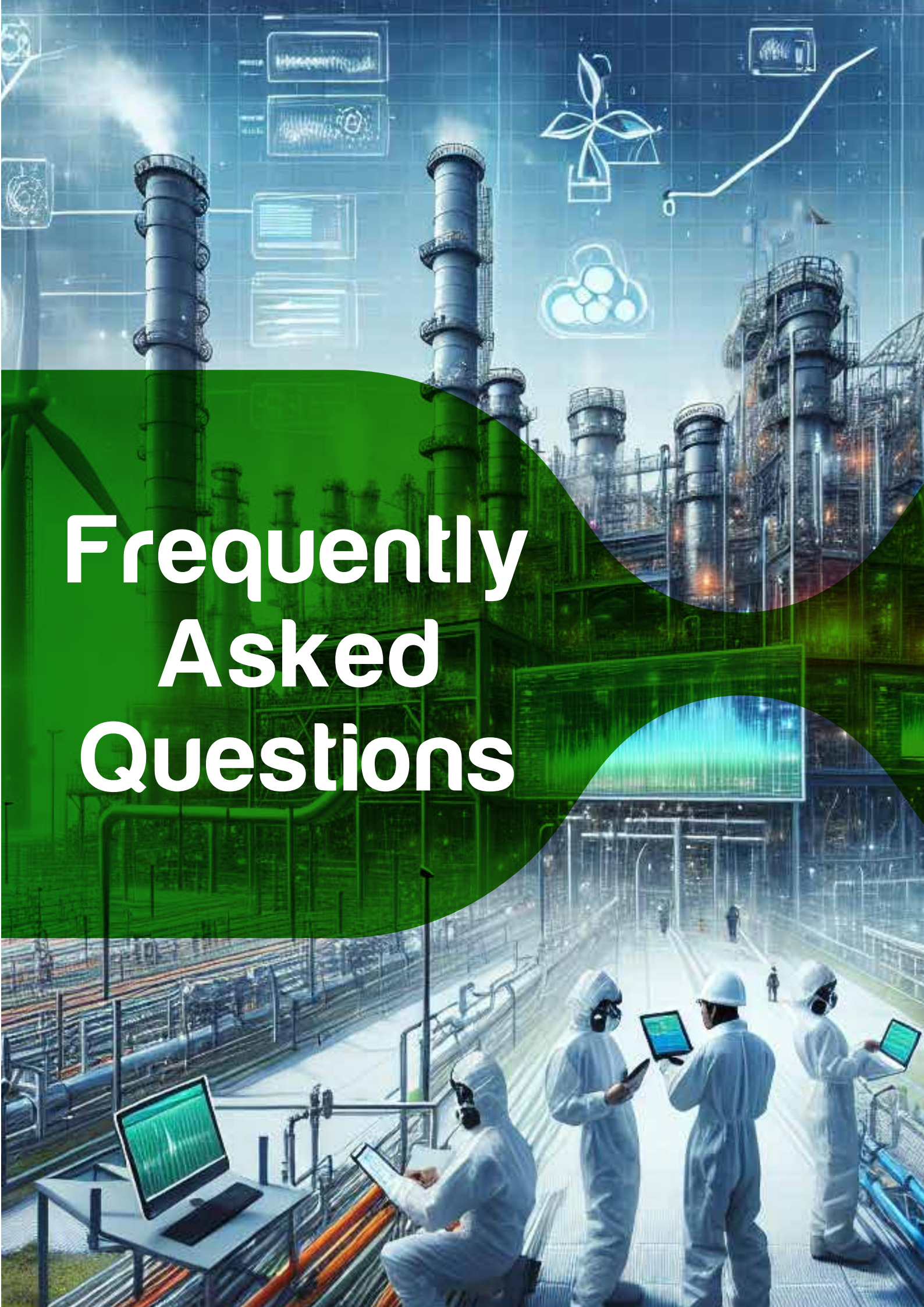
IT tools for GHG emissions accounting

There are many IT tools (software) available for GHG emissions accounting and reporting in market which provide organizations with a comprehensive solution to measure, monitor, and report their carbon emissions.

These tools integrate advanced data analytics and reporting functionalities, allowing businesses to track their environmental impact accurately. By streamlining GHG emissions accounting processes, organizations can enhance transparency, meet regulatory requirements, and make informed decisions to reduce their carbon footprint. These tools often offer real-time insights, enabling entities to identify areas for improvement, set emission reduction targets, and contribute to sustainable practices. With user-friendly interfaces and robust features, these IT tools empower businesses to navigate the complexities of GHG emissions accounting and reporting efficiently, fostering a more environmentally conscious and responsible approach to operations. Please refer page # 26 for list of some of IT tools available in market.

FAQs on GHG emissions accounting and reporting

In the following section, we have covered certain frequently asked questions (FAQs) on GHG emissions accounting and reporting in order to provide readers an understanding of the basic concepts underlying GHG emissions accounting and reporting in the context of IFRS S2 Climate-related disclosures.



Frequently Asked Questions

Q 1 - Do IFRS Sustainability Disclosure Standards require disclosure of Greenhouse Gas Emissions?

Yes, IFRS S2 – Climate related disclosures standard requires an entity to disclose its **absolute gross greenhouse gas emissions** generated during a reporting period, expressed as metric tonnes of **CO_2 equivalent**, classified as:

(1) Scope 1 greenhouse gas emissions;
(2) Scope 2 greenhouse gas emissions; and
(3) Scope 3 greenhouse gas emissions

[Refer IFRS S2 Paragraph 29a(i)]

Q 2 - Explain the terms: i) Absolute gross greenhouse gas emissions ii) CO_2 equivalent iii) Global warming potential?

i. Absolute gross greenhouse gas emissions

Absolute gross greenhouse gas emissions metric indicates the total amount of greenhouse gases emitted into the atmosphere over a specific period, expressed as metric tonnes of CO_2 equivalent. For this, the entity aggregates the seven constituent greenhouse gases into CO_2 equivalent values.

The seven constituent greenhouse gases (refer page 3) are converted into a CO_2 equivalent value using global warming potential values based on a 100-year time horizon using AR6 version, from the latest Intergovernmental Panel on Climate Change assessment available at the reporting date.

[Refer Paragraph B20 and B21, Appendix B, Application Guidance of IFRS S2]

ii. CO_2 equivalent

CO_2 equivalent is defined as the universal unit of measurement to indicate the global warming potential of each greenhouse gas, expressed in terms of the global warming potential of one unit of carbon dioxide. This unit is used to evaluate releasing (or avoiding releasing) different greenhouse gases against a common basis.

[Refer Appendix A Defined terms of IFRS S2]

iii. Global warming potential

This is a factor describing the radiative forcing impact (degree of harm to the atmosphere) of one unit of a given greenhouse gas relative to one unit of CO_2.

[Refer Appendix A Defined terms of IFRS S2]

Relevant conversion factors of GWP (relevant to 100-years period) are stated below:

Relevant Conversion Factors[1]

GHG	GWP
CO_2	1
CH_4	27.9 Fossil-origin CH_4: GWP-100 = 29.8 Biogenic-origin CH_4: GWP-100 = 27.2
N_2O	273
HFCs	140 – 12,400
PFCs	6,500 – 10,200
SF_6	25,200

Q 3 - What is meant by term "the GHG Protocol" referred to in IFRS S2 – Climate Related Disclosures?

The Greenhouse Gas Protocol Initiative is a multi-stakeholder partnership of businesses, non-governmental organizations (NGOs), governments, and others convened by the World Resources Institute (WRI), a U.S.-based environmental NGO, and the World Business Council for Sustainable Development (WBCSD), a Geneva-based coalition of 170 international companies. Launched in 1998, the Initiative's mission is to develop internationally accepted greenhouse gas (GHG) accounting and reporting standards for business and to promote their broad adoption. The GHG Protocol Initiative comprises two separate but linked standards:

- GHG Protocol: A Corporate Accounting and Reporting Standard[2]
- GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard (2011)

These standards provide step-by-step guidance for entities to use in quantifying and reporting their GHG emissions.

These two standards are referred to, and required to be followed for measuring GHG emissions in view of requirements contained in paragraph 29 of IFRS S2.

Q 4 - What is the concept of categorizing the greenhouse gas emissions as Scope 1, Scope 2 and Scope 3?

For effective and innovative greenhouse gas management, setting operational boundaries that are comprehensive to cover direct and indirect emissions helps an entity better manage the full spectrum of greenhouse gas risks and opportunities that exist along its value chain. Direct and indirect GHG emissions are as follows:

[1] https://catalog.data.gov/dataset/ipcc-ar4-ar5-and-ar6-20-100-and-500-year-gwps
[2] https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf

- Direct GHG emissions are emissions from sources that are owned or controlled by the entity.
- Indirect GHG emissions are emissions that are a consequence of the activities of the entity but occur at sources owned or controlled by another entity.

To help describe direct and indirect emission sources, improve transparency, and provide utility for different types of organizations and different types of climate policies and business goals, three “scopes” (scope 1, scope 2, and scope 3) are defined for greenhouse gas emissions accounting and reporting purposes, which are as follows:

Scope 1 greenhouse gas emissions cover:

Direct greenhouse gas emissions that occur from sources that are owned or controlled by an entity.

Scope 2 greenhouse gas emissions cover:

Indirect greenhouse gas emissions from the generation of purchased or acquired electricity, steam, heating or cooling consumed by an entity. Purchased and acquired electricity is electricity that is purchased or otherwise brought into an entity’s boundary. Scope 2 greenhouse gas emissions physically occur at the facility where electricity is generated.

Scope 3 greenhouse gas emissions cover:

Indirect greenhouse gas emissions (not included in Scope 2 greenhouse gas emissions) that occur in the value chain of an entity, including both upstream and downstream emissions. Scope 3 greenhouse gas emissions include the Scope 3 categories in the Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard (2011).

Scope 3 categories (i.e., sources of Scope 3 GHG emissions):

Scope 3 greenhouse gas emissions are categorized into these 15 categories—as described in the Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard (2011):

Upstream Activities	Downstream Activities
(1) purchased goods and services;	(9) downstream transportation and distribution;
(2) capital goods;	(10) processing of sold products;
(3) fuel- and energy-related activities not included in Scope 1 greenhouse gas emissions or Scope 2 greenhouse gas emissions;	(11) use of sold products;
	(12) end-of-life treatment of sold products;
(4) upstream transportation and distribution;	(13) downstream leased assets;
(5) waste generated in operations;	(14) franchises; and
(6) business travel;	(15) investments.
(7) employee commuting;	
(8) upstream leased assets;	

[Refer ‘Appendix A Defined terms’ of IFRS S2]

Appendix D to GHG Protocol lists GHG sources and activities along the value chain by scopes for various industry sectors, which has been attached to this Guide as **Annexure A.**

Q 5 - What is the concept of boundaries under the GHG Protocol referred to in IFRS S2?

Boundaries represent imaginary lines encompassing emissions emerging from/representing an entity's emission sources.

A boundary reflects more than just an entity's legal form; it should reflect the organization's 'substance and economic reality'. Factors for consideration include:

- The organizational structures, including control and ownership, legal structure and joint ventures
- Any operational boundaries – on-site and off-site activities, processes, services and the impacts, and
- Business context – including the nature of activities, location, sector, as well as the purpose and users of the information.

There are two types of boundaries i.e., organizational boundaries and operational boundaries.

The concept of organizational and operational boundary is discussed in Question # 6 & 8 below.

Q 6 - What is the concept of "GHG inventory" and "Organizational boundaries" in context of GHG emissions accounting?

GHG Inventory

[3]A greenhouse gas (GHG) inventory is a list of emission sources and the associated emissions quantified using standardized methods.

Organizational boundaries

Organizational boundaries are the boundaries that determine the operations owned or controlled by the reporting entity, depending on the consolidation approach taken (equity or control approach).

Organizational boundaries are essential for complex business structures (e.g. group structures) to ensure consistency of emissions measurement across the entity and is the same as a consolidation approach.

In selecting an approach for consolidating GHG emissions, entities (within group structure) must consistently define which businesses and operations constitute the entity to provide a complete picture when reporting the carbon footprint.

The steps to determine organizational boundaries comprise of:

- Determine which entity or entities operations to include in GHG inventory (this identification is important when there is a complex organizational structure).

Based on above, consolidation of GHG emissions is performed to determine overall GHG emissions.

[3] https://www.epa.gov/climateleadership/scopes-1-2-and-3-emissions-inventorying-and-guidance

There are two consolidation approaches:

- Equity Share Approach
- Control Approach
  a) Financial Control
  b) Operational Control

Equity Share Approach: This approach requires to account for emissions according to the entity's equity share in the operations independent of financial or operational control in such operations.

Control Approach: This approach requires to account for 100% of emissions from operations under the entity's control without regard to level of entity's equity share in such operations.

There are two further categories of control approach i.e. financial control approach and operational control approach.

a) **Financial Control:** This approach requires to account for 100 percent of emissions from entities on which the entity has control to direct their financial and operational policies with a view to gaining economic benefits from their activities. This criterion is consistent with international financial accounting standards; therefore, an entity has financial control over an operation for GHG accounting purposes if the operation is considered as a group entity or subsidiary for the purpose of financial consolidation, i.e., if the operation is fully consolidated in financial accounts. If this criterion is chosen to determine control, emissions from joint ventures where partners have joint financial control are accounted for based on the equity share approach.

b) **Operational Control:** This approach requires to account for 100% of emissions from each operation over which entity or its subsidiaries has operational control. Operational control exists where an entity has authority to introduce and implement operating policies.

[Source: Chapter 3 GHG Protocol: A Corporate Accounting and Reporting Standard]

Generally, if the entity is the operator of a facility, it will have the full authority to introduce and implement its operating policies and thus has operational control.

The approaches, discussed above, are outlined below in tabular form for your ease:

Summary of consolidation approaches

Approach	Definition	GHG Accounting
Equity Share	Percentage of ownership	% Owned
Financial Control	Directs financial and operational policies to gain economic benefits	If Yes: 100% If No: 0% If Joint: % Owned
Operational Control	Authority to introduce and implement operating policies	If Yes: 100% If No: 0%

Selecting a consolidation approach requires consideration of the following:

- Control – assessed through the financial management (aligned to accounting) or the operational control. Under this criterion, the economic substance of the relationship between the entity and the operation takes precedence over the legal ownership status, so that the entity may have financial control over the operation even if it has less than a 50 percent interest in that operation.
- The equity share of the ownership of the entity, which is then reflected in the emissions.

If there are joint owners, they should ensure that a consistent consolidation approach is applied to avoid over or under-calculation of emissions, and consideration should also be given to the relevant financial reporting principles i.e. those contained in *IFRS 10 Consolidated Financial Statements.*

Q 7 - Why are Organizational boundaries important in GHG emissions accounting?

Organizational boundaries play a crucial role in GHG emissions accounting for several reasons such as:

1. **Complex Business Structures:** Many companies operate within complex organizational structures that include subsidiaries, joint ventures, franchises, and other entities. Each of these entities may have its own operations, emissions sources, and reporting requirements. Without clearly defined organizational boundaries, it becomes difficult to accurately attribute emissions to the appropriate entity. For instance, emissions from a subsidiary may be mistakenly attributed to the parent entity if boundaries are not clearly delineated. This decision of boundary selection and staying consistent with it, helps to avoid double counting.

2. **Consistent Measurement:** Establishing clear organizational boundaries ensures that emissions are measured consistently throughout the entity. Consistency is key for accurate tracking and reporting of emissions over time. Without consistent measurement practices, it becomes challenging to assess progress towards emission reduction goals, identify areas for improvement, and compare performance across different parts of the organization.

In summary, establishing clear organizational boundaries is essential for accurately measuring and reporting emissions in GHG emissions accounting. It helps businesses allocate emissions to the appropriate entities within complex business structures and ensure consistency in measurement practices, enabling effective management of emissions and progress towards sustainability goals.

Q 8 - What is the concept of "Operational boundaries" in context of GHG emissions accounting?

Operational boundary

[4] An operational boundary defines the scope of direct and indirect emissions for operations that fall within an entity's established organizational boundary. The operational boundary (scope 1, scope 2, and scope 3) is decided at the corporate level after setting the organizational boundary. The selected operational boundary is then uniformly applied to identify and categorize direct and indirect emissions at each operational level. The established organizational and operational boundaries together constitute an entity's GHG inventory.

The steps to determine operational boundaries comprise of:

- Determine which activity data to include
- Determine how to categorize emissions

[4] https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf

Setting Operational boundaries

This involves following steps:

- Identify emission sources / hotspots within the selected organizational boundary
- Classify emissions as direct or indirect
- Categorize the "scope" of emissions

[5]Illustration

Entity X is a parent entity that has full ownership and financial control of operations A and B, but only a 30% non-operated interest and no financial control in operation C.

Setting Organizational Boundary: X would decide whether to account for GHG emissions by equity share or financial control. If the choice is equity share, X would include A and B, as well as 30% of C's emissions. If the approach chosen is financial control, X would count only A and B's emissions as relevant and subject to consolidation. Once this has been decided, the organizational boundary has been defined.

Setting Operational Boundary: Once the organizational boundary is set, X then needs to decide, on the basis of its business goals, whether to account only for scope 1 and scope 2, or whether to include relevant scope 3 categories for its operations. Operations A, B and C (if the equity approach is selected) account for the GHG emissions in the scopes chosen by X, i.e., they apply the corporate policy in drawing up their operational boundaries.

[Source: Chapter 4 GHG Protocol: A Corporate Accounting and Reporting Standard]

Q 9 - Why are Operational boundaries important in GHG emissions accounting?

Setting operational boundaries are important for the following reasons:

- **Inclusion of Emission Sources:** Operational boundaries define which emission sources should be considered in the accounting process, ensuring a comprehensive assessment of the organization's environmental impact.

- **Avoiding Double-Counting:** Operational boundaries help classify emission sources to prevent duplication, ensuring accuracy and reliability in reporting emissions.

- **Informing Stakeholders:** Clear operational boundaries provide stakeholders with transparent and relevant information about an organization's direct and indirect emissions, aiding informed decision-making and enhancing trust.

- **Managing GHG Risks:** Establishing operational boundaries facilitates the identification and management of GHG risks and opportunities throughout the organization's value chain, supporting effective mitigation strategies.

[5] https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf

Q 10 - What will be the categorization of GHG emissions in case of Leased Assets?

The categorization of GHG emissions from leased assets can be different based on approach of organizational boundary followed by an entity. This is further explained in table below.

Emissions from Leased Assets: Leasing Agreements and Boundaries (Lessee's Perspective)

Approach	Finance Lease	Operating Lease
Equity Share or Financial Control Approach Used	Lessee does have ownership and financial control, therefore emissions associated with fuel combustion are scope 1 and with use of purchased electricity are scope 2.	Lessee does not have ownership or financial control, therefore emissions associated with fuel combustion are scope 3 and with use of purchased electricity are scope 3.
Operational Control Approach Used	Lessee does have operational control, therefore emissions associated with fuel combustion are scope 1 and with use of purchased electricity are scope 2.	Lessee does have operational control, therefore emissions associated with fuel combustion are scope 1 and with use of purchased electricity are scope 2.

Emissions from Leased Assets: Leasing Agreements and Boundaries (Lessor's Perspective)

Approach	Finance Lease	Operating Lease
Equity Share or Financial Control Approach Used	Lessor does not have ownership or financial control, therefore emissions associated with fuel combustion are scope 3 and with use of purchased electricity are scope 3.	Lessor does have ownership and financial control, therefore emissions associated with fuel combustion are scope 1 and with use of purchased electricity are scope 2.
Operational Control Approach Used	Lessor does not have operational control, therefore emissions associated with fuel combustion are scope 3 and with use of purchased electricity are scope 3.	Lessor does not have operational control, therefore emissions associated with fuel combustion are scope 3 and with use of purchased electricity are scope 3.

[Source: [6]Appendix F to GHG Protocol Corporate Standard]

[6] https://ghgprotocol.org/sites/default/files/2022-12/Categorizing%20GHG%20Emissions%20from%20Leased%20Assets.pdf

Q 11 - What is the concept of baseline, base year and inventory boundary in the context of GHG emissions accounting?

Making meaningful comparisons of emissions data over time is an integral part of any corporate GHG report that aims to be credible, transparent and useful to stakeholders.

A prerequisite for such meaningful comparisons is a consistent data set over time, or in other words comparisons of like with like overtime. In order for this condition to be fulfilled, the inventory boundary must be held consistent between those data sets that are used for a direct comparison over time.

A **baseline** is a reference state or the values against which we measure change and is defined by the absence of a recognized intervention.

A **base year** is a reference point in the past with which current emissions can be compared. In order to maintain the consistency between data sets, base year emissions need to be recalculated when structural changes occur in the entity that change the inventory boundary (such as acquisitions or divestments).

The established **organizational** and **operational boundaries together constitute** an entity's **GHG inventory.**

Q 12 - What are the steps involved in identifying and calculating GHG emissions?

Once the inventory boundary has been established, companies will generally calculate GHG emissions using the following five steps:

1) Identify GHG emissions sources

GHG emissions typically occur from the following source categories:

- **Stationary combustion:** combustion of fuels in stationary equipment such as boilers, furnaces, burners, turbines, heaters, incinerators, engines, flares, etc.
- **Mobile combustion:** combustion of fuels in transportation devices such as automobiles, trucks, buses, trains, airplanes, boats, ships, barges, vessels, etc.
- **Process emissions:** emissions from physical or chemical processes such as CO_2 from the calcination step in cement manufacturing, CO_2 from catalytic cracking in petrochemical processing, PFC emissions from aluminum smelting, etc.
- **Fugitive emissions:** intentional and unintentional releases such as equipment leaks from joints, seals, packing, gaskets, as well as fugitive emissions from coal piles, wastewater treatment, pits, cooling towers, gas processing facilities, etc.
- Categorize emissions from the above sources into Scope 1, Scope 2 and Scope 3.

2) Select a GHG emissions calculation approach

- Direct measurement of GHG emissions by monitoring concentration and flow rate is not common. More often, emissions may be calculated based on a mass balance or stoichiometric basis specific to a facility or process.

- The most common approach for calculating GHG emissions is through the application of documented emission factors. These factors are calculated ratios relating to GHG emissions to a proxy measure of activity at an emissions source. The IPCC guidelines [(IPCC, 1996), referred by GHG Protocol] refer to a hierarchy of calculation approaches and techniques ranging from the application of generic emission factors to direct monitoring.

3) Collect activity data and choose emission factors

- For most small to medium-sized entities and for many larger entities, scope 1 GHG emissions will be calculated based on the purchased quantities of commercial fuels (such as natural gas and heating oil) using published emission factors. Scope 2 GHG emissions will primarily be calculated from metered electricity consumption using supplier-specific, local grid, or other published emission factors. Scope 3 GHG emissions will primarily be calculated from activity data (i.e. value chain specific data) such as fuel use or passenger miles using published or third-party emission factors. In most cases, if source or facility specific emission factors are available, they are preferable to more generic or general emission factors.

- Industrial entities may be faced with a wider range of approaches and methodologies. They should seek guidance from the sector-specific guidelines on the GHG Protocol website (if available) or from their industry associations.

4) Apply calculation tools

There are two main categories of calculation tools:

- **Cross-sector tools** that can be applied to different sectors. These include stationary combustion, mobile combustion, HFC use in refrigeration and air conditioning, and measurement and estimation uncertainty.
- **Sector-specific tools** that are designed to calculate emissions in specific sectors such as aluminum, iron and steel, cement, oil and gas, pulp and paper, office-based organizations.

Please refer page # 26 for list of IT tools available in the market.

5) Roll-up GHG emissions data to corporate level

- To report total GHG emissions, entities will usually need to gather and summarize data from multiple facilities, possibly in different countries (refer to organizational boundary Question # 6 and operational boundary Question # 8) and business divisions. It is important to plan this process carefully to minimize the reporting burden, reduce the risk of errors that might occur while compiling data, and ensure that all facilities are collecting information on an approved, consistent basis. Ideally, entities will integrate GHG reporting with their existing reporting tools and processes, and take advantage of any relevant data already collected and reported by facilities to division or offices, regulators or other stakeholders.

[Source: Chapter 6 GHG Protocol: A Corporate Accounting and Reporting Standard]

Approaches for rolling up GHG emissions data to corporate level

There are two basic approaches for gathering data on GHG emissions from an entity's facilities:

- **Centralized:** individual facilities report activity/fuel use data (such as quantity of fuel used) to the entity level, where GHG emissions are calculated.
- **Decentralized:** individual facilities collect activity/fuel use data, directly calculate their GHG emissions using approved methods, and report this data to the entity level.

Q 13 - What are the steps involved in calculating GHG Emissions and relevant conversion factors?

GHG emissions are calculated by using the following formulae:

Calculations of Emissions:

Activity Data X Emission Factor = GHG emissions (Tonnes)

Calculations of CO_2e Emissions:

[GHG Emissions (tonnes) X Global Warming Potential (GWP) = Carbon dioxide equivalent (CO_2e) of emissions.]

Hence, calculating GHG emissions involve determining following components:

- Activity data
- Emission factor
- Relevant GWP

Activity Data:

Activity data is a key input for the calculation of GHG emissions and refers to the data associated with an activity that generates GHG emissions, for example gallons of gasoline consumed from entity's cars. This activity data is collected in physical units (gallons) or energy units (therms).

Emission Factors:

An emission factor represents amount of emission generated as a result of usage of one unit of fuel or gases used in activity. It is used to calculate the GHG emissions for a given source, relative to units of activity. Emission factors reflect average values by sector, technology type, and/or fuel type.

Global Warming Potential (GWP):

GHGs released into the atmosphere have different radiative effects depending on the unique qualities of the gas. The factor describing the radiative forcing impact of one unit of a given GHG relative to one unit of CO_2 is known as the Global Warming Potential (GWP).

Relevant Conversion Factors (Factor numbers based on AR 6 of IPCC)[7]

GHG	GWP
CO_2	1
CH_4	27.9
N_2O	273
HFCs	140 – 12,400
PFCs	6,500 – 10,200
SF_6	25,200

[Source: Chapter 6 GHG Protocol: A Corporate Accounting and Reporting Standard]

Q 14 - How is GHG emissions accounting for indirect emissions from purchased electricity performed?

Emissions associated with the generation of purchased electricity that is consumed by the reporting entity are reported in scope 2. Scope 2 only accounts for the portion of the direct emissions from generating electricity that is actually consumed by the entity. A utility entity that purchases electricity and transports it in a transmission and distribution (T&D) system that it owns or controls reports the emissions associated with T&D losses under scope 2 of that utility entity. However, if the reporting entity owns or controls the T&D system but generates (rather than purchases) the electricity transmitted through its wires, the emissions associated with T&D losses are not reported under scope 2, as they would already be accounted for under scope 1. This is the case when generation, transmission, and distribution systems are vertically integrated and owned or controlled by the same entity.

Purchased electricity for resale to end-users:

Emissions from the generation of purchased electricity for resale to end-users, for example purchases by a utility entity, may be reported under scope 3 “fuel- and energy-related activities”. This reporting category is particularly relevant for utility companies that purchase wholesale electricity supplied by independent power producers for resale to their customers. Since utility companies and electricity suppliers often exercise choice over where they purchase electricity, this provides them with an important GHG reduction opportunity [(see Seattle City Light case study in Chapter 4 of GHG Protocol: A Corporate Accounting and Reporting Standard]. Since scope 3 is optional under GHG Protocol: A Corporate Accounting and Reporting Standard, entities that are unable to track their electricity sales in terms of end users and non-end users can choose not to report these emissions in scope 3. Instead, they can report the total emissions associated with purchased electricity that is sold to both end- and non-end-users under optional information in the category “generation of purchased electricity, heat or steam for resale to non-end users”.

[7] https://catalog.data.gov/dataset/ipcc-ar4-ar5-and-ar6-20-100-and-500-year-gwps

Purchased electricity for resale to intermediaries:

Emissions associated with the generation of purchased electricity that is resold to an intermediary (e.g., trading transactions) may be reported under optional information under the category "generation of purchased electricity, heat, or steam for resale to non-end users". Examples of trading transactions include brokerage/trading room transactions involving purchased electricity or any other transaction in which electricity is purchased directly from one source or the spot market and then resold to an intermediary (e.g., a non-end user). These emissions are reported under optional information separately from scope 3 because there could be a number of trading transactions before the electricity finally reaches the end-user. This may cause duplicative reporting of indirect emissions from a series of electricity trading transactions for the same electricity.

GHG emissions upstream of the generation of electricity:

Emissions associated with the extraction and production of fuels consumed in the generation of purchased electricity may be reported in scope 3 under the category "extraction, production, and transportation of fuels consumed in the generation of electricity." These emissions occur upstream of the generation of electricity. Examples include emissions from mining of coal, refining of gasoline, extraction of natural gas, and production of hydrogen (if used as a fuel).

Choosing electricity emission factors:

To quantify scope 2 emissions, the GHG Protocol Corporate Standard recommends that companies obtain source/supplier specific emission factors for the electricity purchased. If these are not available, regional or grid emission factors should be used. For more information on choosing emission factors, see the relevant GHG Protocol calculation tools available on the GHG Protocol website (www.ghgprotocol.org).

GHG emissions associated with the consumption of electricity in T&D:

Emissions from the generation of electricity that is consumed in a T&D system may be reported in scope 3 under the category "generation of electricity that is consumed in a T&D system" by end-users. Published electricity grid emission factors do not usually include T&D losses. To calculate these emissions, it may be necessary to apply supplier or location specific T&D loss factors. Companies that purchase electricity and transport it in their own T&D systems would report the portion of electricity consumed in T&D under scope 2.

Accounting for indirect emissions associated with T&D losses:

There are two types of electricity emission factors: Emission factor at generation (EFG) and Emissions factor at consumption (EFC). EFG is calculated from CO_2 emissions from generation of electricity divided by amount of electricity generated. EFC is calculated from CO_2 emissions from generation divided by amount of electricity consumed.

[Source: GHG Protocol A Corporate Accounting and Reporting Standard, [8]Appendix A 'Accounting for indirect emissions from electricity']

[8] https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf

Q 15 - What is the difference between approach given in GRI and IFRS S2 Standards on GHG emissions accounting?

GRI 305-specific requirements (not explicitly required by IFRS S2)

GRI 305 requires an entity to disclose gross market-based Scope 2 GHG emissions in metric tonnes of CO_2e, if applicable. While IFRS S2 does not require an entity to disclose market-based emissions, the entity might disclose this information in accordance with other requirements in IFRS S2 (see 'IFRS S2-specific requirements' for more information on requirements in IFRS S2 that might result in disclosure of market-based Scope 2 GHG emissions).

GRI 305 requires an entity to disclose Scope 1 and Scope 3 biogenic CO_2 emissions (see below for definition of biogenic emissions) separately from the total gross emissions and includes compilation requirements to specify how an entity is to disclose this information. IFRS S2 does not require separate disclosure of biogenic CO_2 emissions. However, paragraph 32 of IFRS S2 requires an entity to disclose industry-specific information. When an entity refers to the industry-based Guidance on Implementing IFRS S2, it may find metrics related to biogenic emissions would be applicable to its activities.

GRI 305 requires an entity to disclose the gases included in its calculation of Scope 1, Scope 2 and Scope 3 GHG emissions. If the entity applies the GRI Sector Standards, it may find recommendations to disaggregate GHG emissions by specific gases relevant to a sector.

IFRS S2 does not explicitly require an entity to report the gases included in its calculation; however, the entity would be required to disaggregate GHG emissions by constituent gases if such information were material in accordance with the principles of aggregation and disaggregation in IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information (paragraphs B29–B30).

GRI 305 requires an entity to disclose the Scope 3 activities included in its calculation of Scope 3 GHG emissions. The entity is also required to disclose any calculation tools used and information about the base year, such as the rationale for choosing the base year, emissions in the base year and the context for any significant changes in emissions that triggered recalculations of base year emissions.

The GRI Sector Standards include sector disclosures and sector recommendations for disclosures from GRI Topic Standards. These recommendations might result in an entity disclosing information related to Scope 1, Scope 2 and Scope 3 GHG emissions that is not required by IFRS S2.

Although these GRI 305-specific requirements are not explicitly required by IFRS S2, an entity's impacts on resources and relationships are identified in IFRS S1 as giving rise to sustainability-related risks and opportunities, and there is a general requirement in IFRS S1 to disclose information about an entity's sustainability-risks and opportunities that is material to investors. IFRS S1 also requires an entity to disclose additional information if compliance with the applicable requirements in ISSB Standards is insufficient to enable investors to understand the effects of sustainability-related risks and opportunities on the entity's prospects (IFRS S1, B26).

IFRS S2-specific requirements (not explicitly required by GRI 305)

IFRS S2 requires an entity to disaggregate its Scope 1 and Scope 2 GHG emissions between the consolidated accounting group and other investees.

IFRS S2 requires an entity to provide information about any contractual instruments that would inform investors' understanding of the entity's Scope 2 GHG emissions. The Standard notes that an entity might disclose information about its market-based Scope 2 GHG emissions as part of its disclosures.

IFRS S2 requires an entity that participates in one or more financial activities associated with asset management, commercial banking or insurance to disclose additional information about the financed emissions associated with those activities as part of its Scope 3 GHG emissions disclosures.

IFRS S2 includes various reliefs and requirements related to the measurement of GHG emissions including, for example, requirements when reassessing the scope of the value chain, using different reporting periods within the value chain and using emission factors that best represent the entity's activity. For Scope 3 GHG emissions, there are requirements on the use of a specific measurement framework to measure Scope 3 GHG emissions, and for reassessing Scope 3 categories and entities throughout the entity's value chain in case of a significant event or change in circumstances.

IFRS S2 requires an entity to disclose why it chose the measurement approach taken and how that approach relates to the objective of the disclosures.

IFRS S2 requires an entity to refer to and consider the applicability of the industry-based metrics associated with disclosure topics described in the industry-based Guidance on Implementing IFRS S2. This requirement may result in entities disclosing information related to Scope 1, Scope 2 and/or Scope 3 GHG emissions that would otherwise not be required by GRI 305.

The GRI Standards require an entity to disclose information about its most significant impacts. The information covered by these IFRS S2-specific requirements can be used for the purpose of GRI reporting where it provides relevant information about an entity's most significant impacts.

Biogenic Emissions:

Biogenic CO_2 refers to carbon in wood, paper, grass trimmings, and other biofuels that was originally removed from the atmosphere by photosynthesis and, under natural conditions, would eventually cycle back to the atmosphere as CO_2 due to degradation processes.
(refer https://unhsimap.org/cmap/resources/biogenic)

Please refer to document published by IFRS Foundation on this matter in following link:

https://www.ifrs.org/content/dam/ifrs/supporting-implementation/ifrs-s2/interoperability-considerations-for-ghg-emissions-when-applying-gri-standards-and-issb-standards.pdf

Q 16 - What transition reliefs, in the context of GHG emissions accounting, are available in IFRS S2 in first year of application of IFRS Sustainability Disclosure Standards?

In respect of GHG emissions reporting, IFRS S2 provides following transition reliefs in the first year of application:

- Scope 3 GHG emissions—IFRS S2 provides a transition relief in the first annual reporting period from disclosing Scope 3 GHG emissions.

- the GHG Protocol—IFRS S2 requires entities to use the GHG Protocol: A Corporate Accounting and Reporting Standard, to measure GHG emissions (unless the entity is required by regulation to use a different measurement method). However, IFRS S2 allows an entity already using a different measurement method to continue to use that method in the first year it applies IFRS S2.

[Refer Paragraph C4 of IFRS S2]

Q 17 - For the purpose of an entity's carbon reporting, can there be different reporting periods in its value chain?

An entity might have a different reporting period from some or all of the entities in its value chain. Such a difference would mean that greenhouse gas emissions information from these entities in its value chain for the entity's reporting period might not be readily available for the entity to use for its own disclosure. In such circumstances, the entity is permitted to measure its greenhouse gas emissions using information for reporting periods that are different from its own reporting period if that information is obtained from entities in its value chain with reporting periods that are different from the entity's reporting period, on the condition that:

(a) the entity uses the most recent data available from those entities in its value chain without undue cost or effort to measure and disclose its greenhouse gas emissions;

(b) the length of the reporting periods is the same; and

(c) the entity discloses the effects of significant events and changes in circumstances (relevant to its greenhouse gas emissions) that occur between the reporting dates of the entities in its value chain and the date of the entity's general purpose financial reports.

[Refer Paragraph B19 of IFRS S2]

Q 18 - Are the entities required to disclose emission factors used in calculating GHG emissions under IFRS S2?

Yes, as part of an entity's disclosure of the measurement approach, inputs and assumptions, the entity is required under IFRS S2 to disclose information to enable users of general-purpose financial reports to understand which emission factors the entity uses in its measurement of its greenhouse gas emissions. IFRS S2 does not specify emission factors an entity is required to use in measurement of its greenhouse gas emissions but requires an entity to use emission factors that best represent the entity's activity as its basis for measuring its greenhouse gas emissions.

[Refer Paragraph B29 of IFRS S2]

Q 19 - What are the requirements of IFRS S2 on disclosure of Greenhouse gas emissions targets?

If an entity has a greenhouse gas emissions target, the entity is required to specify whether the target is a gross greenhouse gas emissions target or a net greenhouse gas emissions target. Gross greenhouse gas emissions targets reflect the total changes in greenhouse gas emissions planned within the entity's value chain.

Net greenhouse gas emissions targets are the entity's targeted gross greenhouse gas emissions minus any planned offsetting efforts (for example, the entity's planned use of carbon credits to offset its greenhouse gas emissions). For the avoidance of doubt, if the entity discloses a net greenhouse gas emissions target, this target cannot obscure information about its gross greenhouse gas emissions targets.

[Refer Paragraph B68 and B69 of IFRS S2]

Q 20 - Can you explain measurement approach, inputs and assumptions for greenhouse gas emissions calculation?

Direct measurement of GHG emissions by monitoring concentration and flow rate is not common. More often, emissions may be calculated based on a mass balance or stoichiometric basis specific to a facility or process. However, the most common approach for calculating GHG emissions is through the application of published emission factors (such as those issued by IPCC and DEFRA) by utilizing the emission factor databases. These factors are calculated ratios relating GHG emissions to a proxy measure of activity at an emissions source.

The IPCC guidelines (IPCC, 1996) refer to a hierarchy of calculation approaches and techniques ranging from the application of generic emission factors to direct monitoring. In many cases, particularly when direct monitoring is either unavailable or prohibitively expensive, accurate emission data can be calculated from fuel use data. Even small users usually know both the amount of fuel consumed and have access to data on the carbon content of the fuel through default carbon content coefficients or through more accurate periodic fuel sampling. Entities should use the most accurate calculation approach available to them and that is appropriate for their reporting context.

For most small to medium-sized entities and for many larger entities, scope 1 GHG emissions will be calculated based on the purchased quantities of commercial fuels (such as natural gas and heating oil) using published emission factors (such as those issued by IPCC and DEFRA). Scope 2 GHG emissions will primarily be calculated from metered electricity consumption and supplier-specific, local grid, or other published emission factors. Scope 3 GHG emissions will primarily be calculated from activity data available in value chain such as fuel use or passenger miles and published or third-party emission factors. In most cases, if source- or facility specific emission factors are available, they are preferable to more generic or general emission factors. Industrial entities may be faced with a wider range of approaches and methodologies. They should seek guidance from the sector-specific guidelines on the GHG Protocol website (if available) or from their industry associations (e.g., International Aluminum Institute, International Iron and Steel Institute, American Petroleum Institute, WBCSD Sustainable Cement Initiative, International Petroleum Industry Environmental Conservation Association).

[Source: Chapter 6 GHG Protocol: A Corporate Accounting and Reporting Standard]

Q 21 - What is the concept of 'Greenwashing'?

Greenwashing is a form of corporate misrepresentation where an entity will present a green public image and publicize green initiatives that are false or misleading. It is the practice of misrepresenting the extent to which a product or strategy is environmentally friendly, sustainable or ethical.

Q 22 - What is concept of Zero emissions or Net Zero?

'Zero emissions' is also referred to as 'Net Zero' or 'Gross Zero'. Net zero means an entity cutting its GHG emissions across its entire value chain to as close to zero as possible, with any remaining emissions balanced by permanent removal from the atmosphere. The most widely used time frame world-wide for Net Zero is by 2050. (Source: https://www.un.org/en/climatechange/net-zero-coalition)

Entities can achieve their net Zero emissions, through following broad steps:

- Reduce value-chain emissions to a level consistent with what science requires for the world to limit warming to i.e. 1.5°C by 2050 (this involves reducing emissions by a minimum of 90 to 95 per cent from an entity's baseline year) through steps such as setting up renewable energy projects.
- Neutralize the impact of any source of residual emissions (that it's unfeasible to eliminate) by permanently removing an equivalent amount of atmospheric carbon dioxide through steps such as plantation and sequestration.

Q 23 - What is concept of Carbon Neutral? Is Carbon Neutral similar to Net Zero?

Carbon neutral means an entity has committed to balance its carbon dioxide emissions to zero, by finding ways to reduce those emissions, and compensating for the carbon dioxide it does emit by preventing or reducing emissions elsewhere and/or by removing an equivalent amount of carbon dioxide from the atmosphere. The balancing practice is known as carbon offsetting and could include activities such as planting trees.

Carbon neutral differs from net zero in the following ways:

- Carbon neutral does not necessarily mean an entity considers emission sources across its whole value chain. The carbon neutral boundary may be a building, event, product, service or the entire entity. Net zero requires consideration of emissions across an entity's entire value chain; scope 1, 2 and 3 emissions.
- Carbon neutral means considering only carbon dioxide and no other GHG. Net zero means considering and measuring all GHG emissions, not just carbon dioxide.
- Carbon neutral can be achieved without cutting emissions, or cutting emissions but without achieving cuts deep enough to achieve net zero at the sector or global level. Achieving net zero means reducing emissions by an amount consistent with what science requires for the world to keep global warming to i.e. 1.5°C.

Q 24 - What are carbon credits?

Carbon credit - An emission unit that is issued by a carbon crediting program and represents an emission reduction or removal of greenhouse gases. Carbon credits are uniquely serialized, issued, tracked and cancelled by means of an electronic registry.

[Source: IFRS S2 Appendix A Defined Terms]

Carbon credits, also known as carbon allowances, work like permission slips for emissions. Carbon credits are a type of market-based instrument that allow companies, governments, and other organizations to address their greenhouse gas emissions. When an entity buys a carbon credit, usually from the government, they gain permission to generate one ton of CO_2 emissions. With carbon credits, carbon revenue flows vertically from entities to regulators, though entities who end up with excess credits can sell them to other entities.

Q 25 - What is meant by carbon offsets?

Offsets are discrete GHG reductions used to compensate for (i.e., offset) GHG emissions elsewhere, for example to meet a voluntary or mandatory GHG target or cap. Offsets are calculated relative to a baseline that represents a hypothetical scenario for what emissions would have been in the absence of the project.

[Source: Chapter 8 GHG Protocol: A Corporate Accounting and Reporting Standard]

Carbon credits and carbon offsets are used as interchangeable terms, but they are not the same. An offset is compensation, and a credit is allowed quantity. Carbon offsets are a type of carbon credit that are specifically used to offset an organization's own emissions by funding projects / investing in an equivalent removal of such emissions from the atmosphere. Carbon offsets are generated by projects that remove (sequester) GHG from the atmosphere, for example through projects like reforestation, renewable energy, methane combustion/collection, and energy conservation. Carbon offsets involve the horizontal trade of carbon revenue between entities. When one entity removes a unit of carbon from the atmosphere as part of their normal business activity, it can generate a carbon offset. Other entities can buy these offsets to reduce their own carbon footprint. Carbon offsets are usually traded in the voluntary market.

Q 26 - What is meant by Carbon Market? How many types of carbon markets are there?

Marketplaces or exchanges where carbon credits can be traded to compensate for or to offset greenhouse gases emitted through commercial operations. The carbon market is a trading system in which carbon credits are sold and bought. Entities or individuals can use carbon markets to compensate for their greenhouse gas emissions by purchasing carbon credits from entities that remove or reduce greenhouse gas emissions.

A carbon credit represents one tonne of Carbon Dioxide (CO_2) or equivalent greenhouse gases that have been reduced, avoided, or removed by a mitigation activity. A carbon credit represents an amount that a business is legally allowed to pollute.

Two types of carbon market exist; the compliance market and the voluntary markets.

- The regulatory compliance market is used by entities and governments that by law have to account for their GHG emissions. It is regulated by mandatory national, regional or international carbon reduction regimes.
- On the voluntary market, the trade of carbon credits is on a voluntarily basis. These are not government-regulated but are guided by the efforts and associated credibility of carbon offset standard providers. Like Verra and Gold Standard.

The regulatory markets are established by governments to regulate and reduce greenhouse gas emissions. The regulators set a limit on carbon emissions 'the cap', also called 'Cap-and-Trade Model'. Each entity operating under a cap-and-trade program is issued a certain number of carbon credits each year. Some of these entities produce less emissions than the number of credits they're allotted, giving them a surplus of carbon credits.

Q 27 - What is a GHG emissions accounting tool?

A GHG emissions accounting tool is a software application or platform designed to measure, track, and manage an organization's carbon emissions and environmental impacts. It helps businesses and institutions calculate their greenhouse gas emissions, often using data from various sources such as energy consumption, transportation, and production processes. The tool provides insights and reports to support sustainability efforts, set emission reduction targets, and comply with environmental regulations.

To complement the standard and guidance, a number of cross-sector and sector-specific calculation tools are available on the GHG Protocol Initiative website (www.ghgprotocol.org), including a guide for small office-based organizations. These tools provide step-by-step guidance and electronic worksheets to help users calculate GHG emissions from specific sources or industries. The tools are consistent with those proposed by the Intergovernmental Panel on Climate Change (IPCC) for compilation of emissions at the national level (IPCC, 1996). They have been refined to be user-friendly for non-technical entity staff and to increase the accuracy of emissions data at an entity level.

Q 28 - List the names of GHG emissions accounting software available worldwide and what features should a proper GHG emissions accounting software possess?

As the GHG emissions accounting space evolves, so does its list of vendors[9]. Below is current list of the some of the software providing IT tools for GHG emissions accounting and reporting.

	Consultancy?	Does it analyze spend data?	Does it record emissions under Scope 1 or Scope 2?	Does it record emissions under Scope 3?	Accounting software integrations
Cogo	No	Yes	Yes	Yes	Xero
Ecologi	No	Yes	Yes	Yes	Xero
Emitwise	No	Yes	Yes	Yes	N/A
Greenly	No	Yes	Yes	Yes	Freshbooks, Zoho Books, Sage
Net Zero Now	No	Yes	Yes	Yes	Xero, Quick Books, Sage
Persefoni	No	Yes	Yes	Yes	N/A
Sage Earth	No	Yes	Yes	Yes	Sage, Xero, Intuit QuickBooks
Sinai Technologies	No	Yes	Yes	Yes	N/A
Sphera	No	Yes	Yes	Yes	N/A
Sumday	No	Yes	Yes	Yes	Xero
Trace	No	Yes	Yes	Yes	Xero
Trellis	No	Yes	Yes	Yes	N/A

[9] https://www.acuitymag.com/technology/carbon-accounting-software

Things to be aware of before using the services of a GHG emissions accounting software provider.

If a provider offers a service designed for a specific sector, a case-by-case basis for appropriateness would still apply. For instance, an accounting firm may engage in activities that aren't typically associated with accounting. These activities may not be included under their services because they deviate from the norm for accounting firms.

Following are the features[10] a GHG emissions accounting software should possess:

- **Accuracy of Data**

The accuracy of the carbon footprint calculated by the software depends on the quality of the data input. It's important to ensure that all relevant data is accurately and completely recorded.

- **Continuous Improvement**

Achieving net zero is not a one-time event, but a continuous process of measuring, reducing, and off-setting emissions. Regularly reviewing and updating the data input into the software will help ensure the most accurate and up-to-date results.

- **Accounting Platform Integration**

Some providers offer integration with accounting platforms like Xero. These are online tools that simplify the accounting process, making it easier for businesses to manage their finances. This integration allows the users of carbon software to access this financial data, which can then be used to calculate the carbon footprint for the business activities. Therefore, integrating traditional accounting platforms with GHG emissions accounting software allows businesses to automate the process of inputting their financial data. This means they won't have to manually enter this information into the GHG emissions accounting software. Providers like Sage, Trace and Cogo are examples of such services that offer Xero integration. It's important to note that the level of integration and the specific features offered can vary between different carbon software providers.

- **Mobile Availability**

When speaking with a software provider it's always good to ask whether their software works on a mobile phone and if you can access your data and get insights at any time of the day.

- **Accessibility**

It's important to ask software providers whether the software can be accessed by multiple users, so that book-keepers or accountants can access the accounts.

[10] https://charteredaccountantsworldwide.com/carbon-footprint-guide/#1709911098243-c3eb4313-b38e

Annexure A

Industry Sectors and Scopes

Below table shows sources of emissions falling under scope 1, 2 and 3 for certain industries. This has been extracted from Appendix D to GHG Protocol: A Corporate Accounting and Reporting Standard.

SECTOR	SCOPE 1 EMISSION SOURCES	SCOPE 2 EMISSION SOURCES	SCOPE 3 EMISSION SOURCES
Energy			
Energy Generation	• Stationary combustion (boilers and turbines used in the production of electricity, heat or steam, fuel pumps, fuel cells, flaring). • Mobile combustion (trucks, barges and trains for transportation of fuels). • Fugitive emissions (CH_4 leakage from transmission and storage facilities, HFC emissions from LPG storage facilities, SF_6 emissions from transmission and distribution equipment)	• Stationary combustion (consumption of purchased electricity, heat or steam)	• Stationary combustion (mining and extraction of fuels, energy for refining or processing fuels) • Process emissions (production of fuels, SF_6 emissions) • Mobile combustion (transportation of fuels/waste, employee business travel, employee commuting) • Fugitive emissions (CH_4 and CO_2 from waste landfills, pipelines, SF_6 emissions
Oil and Gas	• Stationary combustion (process heaters, engines, turbines, flares, incinerators, oxidizers, production of electricity, heat and steam) • Process emissions (process vents, equipment vents, maintenance/turnaround activities, non-routine activities) • Mobile combustion (transportation of raw materials/products/waste; entity owned vehicles) • Fugitive emissions (leaks from pressurized equipment, wastewater treatment, surface impoundments	• Stationary combustion (consumption of purchased electricity, heat or steam)	• Stationary combustion (product use as fuel or combustion for the production of purchased materials) • Mobile combustion (transportation of raw materials/products/waste, employee business travel, employee commuting, product use as fuel) • Process emissions (product use as feedstock or emissions from the production of purchased materials) • Fugitive emissions (CH_4 and CO_2 from waste landfills or from the production of purchased materials)

SECTOR	SCOPE 1 EMISSION SOURCES	SCOPE 2 EMISSION SOURCES	SCOPE 3 EMISSION SOURCES
Energy			
Coal Mining	• Stationary combustion (methane flaring and use, use of explosives, mine fires) • Mobile combustion (mining equipment, transportation of coal) • Fugitive emissions (CH_4 emissions from coal mines and coal piles)	• Stationary combustion (consumption of purchased electricity, heat or steam)	• Stationary combustion (product use as fuel) • Mobile combustion (transportation of coal/waste, employee business travel, employee commuting) • Process emissions (gasification)
Metals			
Aluminum	• Stationary combustion (bauxite to aluminum processing, coke baking, lime, soda ash and fuel use, on-site CHP) • Process emissions (carbon anode oxidation, electrolysis, PFC) • Mobile combustion (pre- and post-smelting transportation, ore haulers) • Fugitive emissions (fuel line CH_4, HFC and PFC, SF_6 cover gas)	• Stationary combustion (consumption of purchased electricity, heat or steam)	• Stationary combustion (raw material processing and coke production by second party suppliers, manufacture of production line machinery) • Mobile combustion (transportation services, business travel, employee commuting) • Process emissions (during production of purchased materials) • Fugitive emissions (mining and landfill CH_4 and CO_2, outsourced process emissions
Iron and Steel	• Stationary combustion (coke, coal and carbonate fluxes, boilers, flares) • Process emissions (crude iron oxidation, consumption of reducing agent, carbon content of crude iron/ferroalloys) • Mobile combustion (on-site transportation) • Fugitive emission (CH_4,N_2O)	• Stationary combustion (consumption of purchased electricity, heat or steam)	• Stationary combustion (mining equipment, production of purchased materials) • Process emissions (production of ferroalloys) • Mobile combustion (transportation of raw materials/products/waste and intermediate products) • Fugitive emissions (CH_4 and CO_2 from waste landfills

SECTOR	SCOPE 1 EMISSION SOURCES	SCOPE 2 EMISSION SOURCES	SCOPE 3 EMISSION SOURCES
Chemicals			
Nitric acid, Ammonia, Adipic acid, Urea, and Petrochemicals	• Stationary combustion (boilers, flaring, reductive furnaces, flame reactors, steam reformers) • Process emissions (oxidation/reduction of substrates, impurity removal, N_2O byproducts, catalytic cracking, myriad other emissions individual to each process) • Mobile combustion (transportation of raw materials/products/waste) • Fugitive emissions (HFC use, storage tank leakage)	• Stationary combustion (consumption of purchased electricity, heat or steam)	• Stationary combustion (production of purchased materials, waste combustion) • Process emissions (production of purchased materials) • Mobile combustion (transportation of raw materials/products/waste, employee business travel, employee commuting) • Fugitive emissions (CH_4 and CO_2 from waste landfills and pipelines)
Minerals			
Cement and Lime	• Process emissions (calcination of limestone) • Stationary combustion (clinker kiln, drying of raw materials, production of electricity) • Mobile combustion (quarry operations, on-site transportation)	• Stationary combustion (consumption of purchased electricity, heat or steam)	• Stationary combustion (production of purchased materials, waste combustion) • Process emissions (production of purchased clinker and lime) • Mobile combustion (transportation of raw materials/products/waste, employee business travel, employee commuting) • Fugitive emissions (mining and landfill CH_4 and CO_2, outsourced process emissions)
Waste			
Landfills, Waste combustion, Water services	• Stationary combustion (incinerators, boilers, flaring) • Process emissions (sewage treatment, nitrogen loading) • Fugitive emissions (CH_4 and CO_2 emissions from waste and animal product decomposition) • Mobile combustion (transportation of waste/products)	• Stationary combustion (consumption of purchased electricity, heat or steam)	• Stationary combustion (recycled waste used as a fuel) • Process emissions (recycled waste used as a feedstock) • Mobile combustion (transportation of waste/products, employee business travel, employee commuting)

SECTOR	SCOPE 1 EMISSION SOURCES	SCOPE 2 EMISSION SOURCES	SCOPE 3 EMISSION SOURCES
Pulp and Paper			
Pulp and Paper	• Stationary combustion (production of steam and electricity, fossil fuel-derived emissions from calcination of calcium carbonate in lime kilns, drying products with infrared driers fired with fossil fuels) • Mobile combustion (transportation of raw materials, products, and wastes, operation of harvesting equipment) • Fugitive emissions (CH_4 and CO_2 from waste)	• Stationary combustion (consumption of purchased electricity, heat or steam)	• Stationary combustion (production of purchased materials, waste combustion) • Process emissions (production of purchased materials) • Mobile combustion (transportation of raw materials/products/waste, employee business travel, employee commuting) • Fugitive emissions (landfill CH_4 and CO_2 emissions)
HFC, PFC, SF6 & HCFC 22 PRODUCTION			
HCFC 22 production	• Stationary combustion (production of electricity, heat or steam) • Process emissions (HFC venting) • Mobile combustion (transportation of raw materials / products / waste) • Fugitive emissions (HFC use)	• Stationary combustion (consumption of purchased electricity, heat or steam)	• Stationary combustion (production of purchased materials) • Process emissions (production of purchased materials) • Mobile combustion (transportation of raw materials/products/waste, employee business travel, employee commuting) • Fugitive emissions (fugitive leaks in product use, CH_4 and CO_2 from waste landfills)

SECTOR	SCOPE 1 EMISSION SOURCES	SCOPE 2 EMISSION SOURCES	SCOPE 3 EMISSION SOURCES
Semiconductor production			
Semi conductor production	• Process emissions (C_2F_6, CH_4, CHF_3, SF_6, NF_3, C_3F_8, C_4F_8, N_2O used in wafer fabrication, CF_4 created from C_2F_6 and C_3F_8 processing) • Stationary combustion (oxidation of volatile organic waste, production of electricity, heat or steam) • Fugitive emissions (process gas storage leaks, container remainders/heel leakage) • Mobile combustion (transportation of raw materials/products/waste	• Stationary combustion (consumption of purchased electricity, heat or steam)	• Stationary combustion (production of imported materials, waste combustion, upstream T&D losses of purchased electricity) • Process emissions (production of purchased materials, outsourced disposal of returned process gases and container remainder/heel) • Mobile combustion (transportation of raw materials/products/waste, employee business travel, employee commuting) • Fugitive emissions (landfill CH_4 and CO_2 emissions, downstream process gas container remainder/ heel leakage)
Other Sectors			
Service sector/ Office based organizations	• Stationary combustion (production of electricity, heat or steam) • Mobile combustion (transportation of raw materials/waste) • Fugitive emissions (mainly HFC emissions during use of refrigeration and air-conditioning equipment)	• Stationary combustion (consumption of purchased electricity, heat or steam)	• Stationary combustion (production of purchased materials) • Process emissions (production of purchased materials) • Mobile combustion (transportation of raw materials/ products/ waste, employee business travel, employee commuting)

[Source: Appendix D to GHG Protocol: A Corporate Accounting and Reporting Standard]