

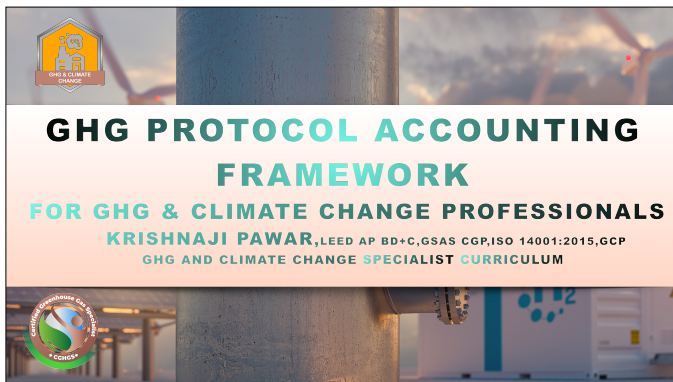


BEYOND
SMART CITIES

**URBAN GREENHOUSE GAS INVENTORY
SPECIALIST TRAINING COURSE**

KRISHNAJI PAWAR, LEED AP BD+C, GSAS CGP, ISO 14001:2015, GCP
GHG AND CLIMATE CHANGE SPECIALIST CURRICULUM

Logo: GHG AND CLIMATE CHANGE SPECIALIST CURRICULUM

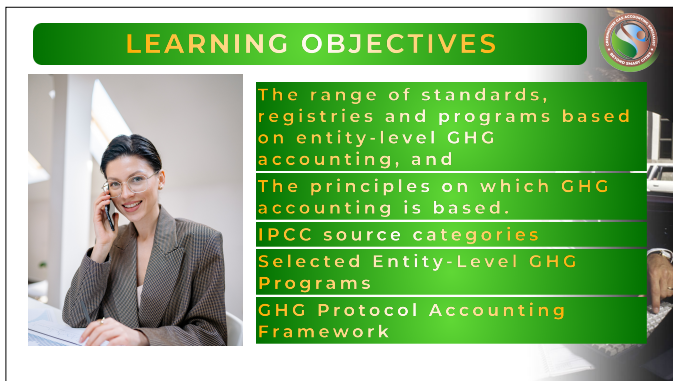


**GHG PROTOCOL ACCOUNTING
FRAMEWORK**

FOR GHG & CLIMATE CHANGE PROFESSIONALS

KRISHNAJI PAWAR, LEED AP BD+C, GSAS CGP, ISO 14001:2015, GCP
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LEARNING OBJECTIVES

The range of standards, registries and programs based on entity-level GHG accounting, and

The principles on which GHG accounting is based.

IPCC source categories

Selected Entity-Level GHG Programs

GHG Protocol Accounting Framework

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IPCC SOURCE CATEGORIES -ENERGY

Carbon Dioxide Emissions from Fossil Fuel Combustion (IPCC Source Category 1A) 3-3

Carbon Emitted from Non-Energy Uses of Fossil Fuels (IPCC Source Category 1A) 3-19

Stationary Combustion (excluding CO₂) (IPCC Source Category 1A) 3-24

Mobile Combustion (excluding CO₂) (IPCC Source Category 1A) 3-29

Coal Mining (IPCC Source Category 1B1a) 3-36

Abandoned Underground Coal Mines (IPCC Source Category 1B1a) 3-39

Natural Gas Systems (IPCC Source Category 1B2b) 3-43

Petroleum Systems (IPCC Source Category 1B2a) 3-47

Municipal Solid Waste Combustion (IPCC Source Category 1A5) 3-50

Wood Biomass and Ethanol Consumption (IPCC Source Category 1A) 3- 59

IPCC SOURCE CATEGORIES-INDUSTRIAL PROCESSES

Cement Manufacture (IPCC Source Category 2A1) 4-4

Iron and Steel Production (IPCC Source Category 2C1) 4-6

Ammonia Manufacture and Urea Application (IPCC Source Category 2B1) 4-10

Lime Manufacture (IPCC Source Category 2A2) 4-13

Limestone and Dolomite Use (IPCC Source Category 2A3) 4-17

Soda Ash Manufacture and Consumption (IPCC Source Category 2A4) 4- 20

Titanium Dioxide Production (IPCC Source Category 2B5) 4-23

Ferroalloy Production (IPCC Source Category 2C2) 4-25

Phosphoric Acid Production (IPCC Source Category 2B5) 4-27

Carbon Dioxide Consumption (IPCC Source Category 2B5) 4-31

Zinc Production (IPCC Source Category 2C5) 4-33

IPCC SOURCE CATEGORIES-INDUSTRIAL PROCESSES +

Lead Production (IPCC Source Category 2C5) 4-36

Petrochemical Production (IPCC Source Category 2B5) 4-38

Silicon Carbide Production (IPCC Source Category 2B4) and Consumption 4-41

Nitric Acid Production (IPCC Source Category 2B2) 4-43

Limestone and Dolomite Use (IPCC Source Category 2A3) 4-17

Soda Ash Manufacture and Consumption (IPCC Source Category 2A4) 4- 20

Adipic Acid Production (IPCC Source Category 2B3) 4-44

Substitution of Ozone Depleting Substances (IPCC Source Category 2F) 4-47

HCFC-22 Production (IPCC Source Category 2E1) 4-49

Electrical Transmission and Distribution (IPCC Source Category 2F7) 4- 51

IPCC SOURCE CATEGORIES-INDUSTRIAL PROCESSES +

Semiconductor Manufacture (IPCC Source Category 2F6) 4-55

Aluminum Production (IPCC Source Category 2C3) 4-59

Magnesium Production and Processing (IPCC Source Category 2C4) 4-64

This screen and the next provide a more detailed list of GHG source categories as identified and classified by the Intergovernmental Panel on Climate Change.

Solvent and other product use

Nitrous Oxide Product Usage (IPCC Source Category 3D) 5-1

Agriculture

Enteric Fermentation (IPCC Source Category 4A) 6-2

Manure Management (IPCC Source Category 4B) 6-6

Rice Cultivation (IPCC Source Category 4C) 6-12

IPCC SOURCE CATEGORIES-AGRICULTURE +

Agricultural Soil Management (IPCC Source Category 4D) 6-16

Field Burning of Agricultural Residues (IPCC Source Category 4F) 6-29

Land use, land-use change,& forestry

Forest Land Remaining Forest Land 7-3

Land Converted to Forest Land (IPCC Source Category 5A2) 7-17

Cropland Remaining Cropland (IPCC Source Category 5B1) 7-17

Land Converted to Cropland (IPCC Source Category 5B2) 7-26

Grassland Remaining Grassland (IPCC Source Category 5C1) 7-30

Land Converted to Grassland (IPCC Source Category 5C2) 7-34

Settlements Remaining Settlements 7-37

Land Converted to Settlements (Source Category 5E2) 7-42

IPCC SOURCE CATEGORIES-WASTE

Landfills (IPCC Source Category 6A1) 8-21

Wastewater Treatment (IPCC Source Category 6B

Sections	Description of Activities Included
1 ENERGY	Total emission of all greenhouse gases from stationary and mobile energy activities (fuel combustion as well as fugitive fuel emissions).
2 INDUSTRIAL PROCESSES	Emissions within this sector comprise by-product or fugitive emissions of greenhouse gases from industrial processes. Emissions from fuel combustion in industry should, whenever possible, be reported according to the ISC Group or Class within which they occur.
3 SOLVENT AND OTHER PRODUCT USE	This category pertains mainly to NMVOC emissions resulting from the use of solvents and other products containing volatile compounds.
4 AGRICULTURE	Describes all anthropogenic emissions from this sector, except for fuel combustion emissions and sewage emissions, which are covered in Energy and Waste modules.
5 LAND-USE CHANGE & FORESTRY	Total emissions and removals from forest and land-use change activities.
6 WASTE	Total emissions from waste management.
7 OTHER	Any other anthropogenic source or sink not referred to above (must be appropriately documented).

SELECTED ENTITY-LEVEL GHG PROGRAMS

International standards/guidance

✓GHG Protocol Corporate Standard

✓ISO 14064-1

Voluntary emissions trading exchanges

✓Chicago Climate Exchange

Regulatory cap-and-trade programs

✓EU Emissions Trading Scheme

✓UK Emissions Trading System

✓Regional GHG Initiative

SELECTED ENTITY-LEVEL GHG PROGRAMS+

Industry-specific calculation and reporting protocols and tools

✓IPIECA

Corporate reporting/commitment programs

✓Government-sponsored

■USEPA Climate Leaders

■California Climate Action Registry

■USDOE 1605(b)

■Mexico GHG Program

■Philippine GHG Accounting & Reporting Program

✓Non-government-sponsored

■Carbon Disclosure Project

■Dow Jones Sustainability Index

■Global Reporting Initiative

■Business Leaders Initiative for Climate Change

■World Wildlife Fund Climate Savers [link]

GHG PROTOCOL ACCOUNTING FRAMEWORK

Just as with financial accounting, a common accounting framework is needed in order to ensure that reported information is consistent and reliable.

For greenhouse gas accounting, that common framework is the Greenhouse Gas Protocol – and specifically, for corporate GHG accounting, the Greenhouse Gas Protocol Corporate Standard. This framework forms the foundation for other GHG standards (such as ISO 14064-1), GHG inventories prepared by individual companies, and GHG registries and programs.

GHG PROTOCOL CORPORATE STANDARD



The GHG Protocol Corporate Standard consists of three components: standards and guidance, which can be found in the Corporate Standard publication, and calculation tools, which you can download free of charge at www.ghgprotocol.org.

Components of the GHG Protocol

Standards : Accounting principles , Organizational , Boundaries , Operational Boundaries , Tracking emissions over time , Reporting GHG emissions

Guidance : Business goals , Accounting for GHG reductions , Identifying GHG sources , Managing inventory quality , Verifying GHG emissions and Setting GHG targets

Calculation tools : Web-based, user-friendly, step-by-step guidance , Based on IPCC methodologies & industry best practice , Available at www.ghgprotocol.org



GHG STANDARDS & GUIDANCE



There are currently two standards for accounting for and reporting corporate (or entity) GHG emissions. These are the GHG Protocol Corporate Standard and International Standards Organization (ISO) 14064-1. Fortunately, the two standards are mutually compatible – in fact, the ISO standard explicitly identifies the GHG Protocol Corporate Standard as being the basis for its accounting framework.

The ISO standard is more prescriptive (i.e., defines activities using “shall”) so as to provide a verifiable standard upon which to verify against. While the GHG Protocol provides detailed guidance, calculation tools, and examples that are not available from ISO.



ENTITY-LEVEL GHG INVENTORY



An entity-level (or corporate-level) GHG inventory is a quantified list of a company's or organization's GHG emissions and sources. It is compiled at the corporate level, and includes all 6 GHG categories (CO₂, CH₄, N₂O, HFCs, PFCs, & SF₆). It also covers both direct emissions from an entity's own facilities and operations, as well as indirect emissions from the production of purchased electricity, heat or steam.

The calculation and reporting of other “indirect” emissions that occur “upstream or downstream” of your entity's operation (e.g., emissions embedded in purchased products or in from the sale of your products) is optional.



ENTITY-LEVEL GHG INVENTORY +

An entity-level GHG inventory

...can	Cannot
Determine an organization's overall GHG emissions	Determine the reductions generated by a GHG project
Help identify organization-wide GHG reduction opportunities	Directly reduce GHG emissions
Help "ground truth" a national GHG inventory	Contribute directly to a national GHG inventory

ENTITY-LEVEL GHG INVENTORY+

Determine an organization's overall GHG emissions

This is exactly what a corporate GHG inventory is designed to do. Following the steps outlined in the GHG Protocol Corporate Standard, a company can identify, quantify, and report its GHG emissions according to an internationally accepted standard.

Help identify organization-wide GHG reduction opportunities

To identify opportunities to reduce GHG emissions, you need to know where they are coming from in the first place. This is what a corporate GHG inventory can help you determine. After preparing an initial inventory, you can also engage in benchmarking exercises to compare emissions across facilities, business units or companies to determine which are operating more or less efficiently. The more detailed and wider a net you cast in preparing your inventory, the more likely you are to identify cost-effective reduction opportunities.

ENTITY-LEVEL GHG INVENTORY+

Help 'ground truth' a national inventory)

If enough companies in a given industrial sector create GHG inventories and make them available to the agency or ministry charged with preparing your national inventory, the collective results of the inventories can serve as a sort of "reality check" for the sectoral emissions estimated through the national inventory process. To facilitate this, it helps if companies disaggregate their emissions by the source type used in the national inventories - that is, mobile combustion, stationary combustion, process emissions, and fugitive emissions.

ENTITY-LEVEL GHG INVENTORY+

Determine the reductions generated by a GHG project

In order to determine by how much a given project reduces GHG emissions, it is necessary to create a "counter-factual baseline scenario" – that is, to determine what the GHG emissions otherwise would have been in the absence of the GHG reduction project. This can be accomplished following the guidance provided by the GHG Protocol for Project Accounting, or in any of the methodologies established under the Clean Development Mechanism. If, on the other hand, a company does implement one or more projects to reduce its emissions, the collective effects of those projects will be seen in comparing the company's corporate inventories from one year to the next. To learn more about GHG accounting for emission reduction projects, see our courses on this topic.

GHG REGISTRIES

A GHG registry provides a database for receiving and storing GHG data. Registries can cover corporate inventories and/or GHG reduction projects, and their inputs are usually verified by a third party.

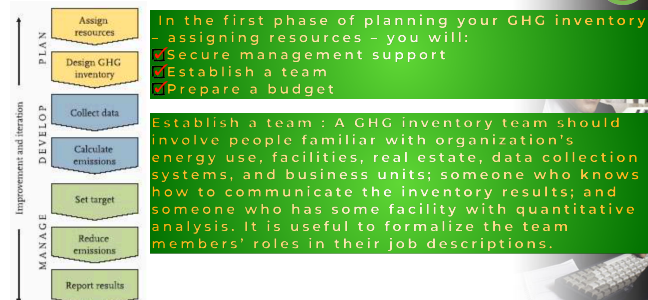
Examples of GHG registries include the California Climate Action Registry and World Economic Forum Register.

GHG Program

GHG programs apply GHG inventories in order to:

- ✓Set GHG reduction targets,
- ✓Enable trading in GHG credits,
- ✓Make GHG information available to investors and other stakeholders, and
- ✓Establish baseline of historical GHG emissions and performance

CREATING A GHG INVENTORY



PLAN

Assign resources

Design GHG inventory

DEVELOP

Collect data

Calculate emissions

Set target

MANAGE

Reduce emissions

Report results

Improvement and iteration

↑

↓

CREATING A GHG INVENTORY +

In the second phase of planning your GHG inventory – designing the inventory – you will:

- ✓ Consider guiding principles
- ✓ Consider business goals
- ✓ Define inventory boundary
- ✓ Determine sources of emissions
- ✓ Factor in emissions from leased assets

The guiding principles are covered in this session, while you will learn how to implement the remaining steps later in the course. Guiding principles

GUIDING PRINCIPLES

The following principles should guide the development of a entity-level GHG inventory from start to finish:

- ✓ Relevance refers to the need for the inventory to reflect the organization's emissions and decision-making needs
- ✓ Completeness means accounting for all sources and activities within the inventory boundary, and justifying any exclusions
- ✓ Transparency necessitates full disclosure of all assumptions; citation of methodologies; and leaving an audit trail
- ✓ Accuracy refers to the need to provide a reasonable assurance of the information's integrity

The remaining steps -

- ✓ Designing the GHG inventory
- ✓ Collecting data and calculating emissions
- ✓ Applying the GHG inventory to set a reduction target or meet other business objectives will be covered in subsequent lessons in this course

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