

B=YOND
SMART CITIES

**FUNDAMENTALS OF ORGANIZATIONAL GHG
ACCOUNTING**

FOR ENVIRONMENTAL AND GHG SPECIALISTS

KRISHNAJI PAWAR, LEED AP BD+C, GSAS CGP, ISO 14001:2015, GCP
ENVIRONMENTAL SPECIALIST CURRICULUM





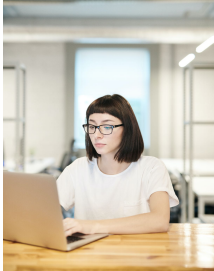
**GHGS AND GLOBAL WARMING
POTENTIAL**

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LEARNING OBJECTIVES



- The six main greenhouse gas categories
- GHGs and Global Warming Potential
- GHG emission sources in the context of entity-level operations,
- What an entity-level GHG inventory is and how it relates to other types of GHG emissions accounting,

THE GREENHOUSE GASES -CARBON DIOXIDE (CO₂)

In nature, carbon is cycled between various atmospheric, oceanic, land biotic, marine biotic, and mineral reservoirs (e.g., limestone). The largest fluxes of CO₂ occur between the atmosphere and terrestrial biota, and between the atmosphere and surface water of the oceans. In the atmosphere, carbon predominantly exists in its oxidized form as CO₂.

Atmospheric carbon dioxide is part of this global carbon cycle, and therefore its fate is a complex function of geochemical and biological processes. Carbon dioxide concentrations in the atmosphere increased from approximately 280 parts per million by volume (ppmv) in pre-industrial times to 380 ppmv today.

The IPCC notes that "[t]his concentration has not been exceeded during the past 420,000 years, and likely not during the past 20 million years. The rate of increase over the past century is unprecedented, at least during the past 20,000 years." The IPCC definitively states that "the present atmospheric CO₂ increase is caused by human-caused emissions of CO₂" (IPCC 2001). Forest clearing, other biomass burning, and some non-energy production processes (e.g., cement production) also emit notable quantities of carbon dioxide.



METHANE (CH₄)

Methane is primarily produced through anaerobic (i.e., without oxygen) decomposition of organic matter in biological systems. Agricultural processes such as wetland rice cultivation, enteric fermentation in animals (i.e., burps and farts), and the decomposition of animal wastes emit CH₄, as does the decomposition of trash.

Methane is also emitted during the production and distribution of natural gas and petroleum, and is released as a by-product of coal mining and incomplete fossil fuel combustion. Atmospheric concentrations of methane have increased by about 150 percent since pre-industrial times.



NITROUS OXIDE (N₂O)

Anthropogenic sources of N₂O emissions include agricultural soils, especially the use of fertilizers; fossil fuel combustion, especially from mobile combustion; industrial adipic (nylon) and nitric acid production; wastewater treatment and waste combustion; and biomass burning.

The atmospheric concentration of nitrous oxide (N₂O) has increased by 18 percent since 1750, a concentration that has not been exceeded during the last thousand years.



HALO-FLUOROCARBONS, PERFLUOROCARBONS, AND SULFUR HEXAFLUORIDE (SF₆)

Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆) are powerful greenhouse gases. HFCs—primarily used as replacements for ozone depleting substances but also emitted as a by-product of the HCFC-22 manufacturing process—currently have a small global impact; however, it is anticipated that their emissions will increase in the future.

PFCs and SF₆ are predominantly emitted from various industrial processes including aluminum smelting, semiconductor manufacturing, electric power transmission and distribution, and magnesium casting. Currently, the global impact of PFCs and SF₆ is also small; however, they have a significant growth rate, extremely long atmospheric lifetimes, and are strong absorbers of infrared radiation, and therefore have the potential to influence climate far into the future (IPCC 2001).

GHGS AND GLOBAL WARMING POTENTIAL

Because GHGs vary in their ability to trap heat in the atmosphere, some are more harmful to the climate than others. Each GHG has a "global warming potential" (GWP), which refers to its heat-trapping ability relative to that of CO₂. For example, methane is 21 times more potent than CO₂, so methane has a GWP of 21.

GHG	GWP
CO ₂	1
CH ₄	21
N ₂ O	310
HCFCs	140 - 11,700
PFCs	6,500 - 9,200
SF ₆	23,900

The GWPs shown in the table to the right are 100-year GWPs, referring to their effect relative to CO₂ over a 100- year timeframe. Source: U.S. Environmental Protection Agency, Greenhouse Gases and Global Warming Potential Values, 2002.

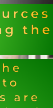
GLOBAL WARMING POTENTIAL

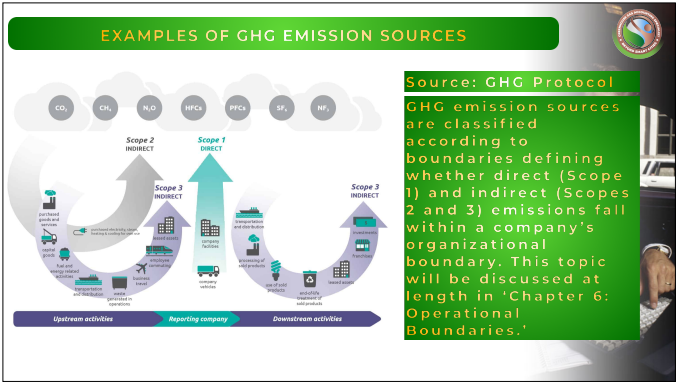
Global Warming Potentials (GWPs) are intended as a quantified measure of the globally averaged relative radiative forcing impacts of a particular greenhouse gas. It is defined as the cumulative radiative forcing—both direct and indirect effects—integrated over a period of time from the emission of a unit mass of gas relative to some reference gas (IPCC 1996). Carbon dioxide (CO₂) was chosen as this reference gas.

Direct effects occur when the gas itself is a greenhouse gas. Indirect radiative forcing occurs when chemical transformations involving the original gas produce a gas or gases that are greenhouse gases, or when a gas influences other radiatively important processes such as the atmospheric lifetimes of other gases.



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GHG ACCOUNTING

GHG accounting attempts to quantify and organize information about GHG emissions based on common standards and protocols, and to attribute emissions correctly to a facility, company, nation, or other entity.

This course focuses specifically on corporate- or entity-level GHG accounting, which is the basis for developing a company's or organization's GHG inventory and developing a GHG management strategy.

You may also be familiar with terms such as GHG offsets and carbon neutrality. These terms relate to project-level GHG accounting and are not addressed in detail in this course.

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

Carbon neutrality – "Carbon neutrality" refers to reducing or offsetting the carbon impact of a given entity, product, or activity so that it results in no net carbon emissions to the atmosphere.

Beyond SMART CITIES

THANK YOU

THE WORLD'S 1ST GREEN TECHNOLOGY MARKETPLACE

The advertisement features a person in a white lab coat holding a glowing blue globe. Inside the globe is a detailed city skyline at night. The text 'Beyond SMART CITIES' is at the top, 'THANK YOU' is in the middle, and 'THE WORLD'S 1ST GREEN TECHNOLOGY MARKETPLACE' is at the bottom. A circular logo on the right side reads 'GREENHOUSE GAS ACCOUNTING SOCIETY' and 'BEYOND SMART CITIES'.
