Strategic Carbon Accounting & Decarbonization Approaches for Serbia

Module 3

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03

Key steps in carbon emissions accounting and reporting

Basics of GHG accounting

Methodologies & estimation of GHG emission & reductions

Carbon accounting

Definition: Framework or system to measure and track greenhouse gas (GHG) emissions from an organization, a policy, a project, an investment…. over a specific period of time

- Allows to quantify the environmental impact

- Allows to comply with international and or national regulations

- Allows to enables a strategic planning towards reduction of emissions

Key terminologies

Net zero emissions / carbon neutrality

Means cutting carbon emissions to a small amount of residual emissions that can be absorbed and durably stored by nature and other carbon dioxide removal measures, leaving zero in the atmosphere.

Carbon offsettings

way to compensate for carbon emissions that are difficult or impossible to eliminate by investing in projects that reduce or remove emissions elsewhere

Carbon footprint

Measure of the exclusive total amount of emissions of carbon dioxide (CO_2) that is directly and indirectly caused by an activity or accumulated over the life stages of a product (Wiedmann and Minx, 2008).

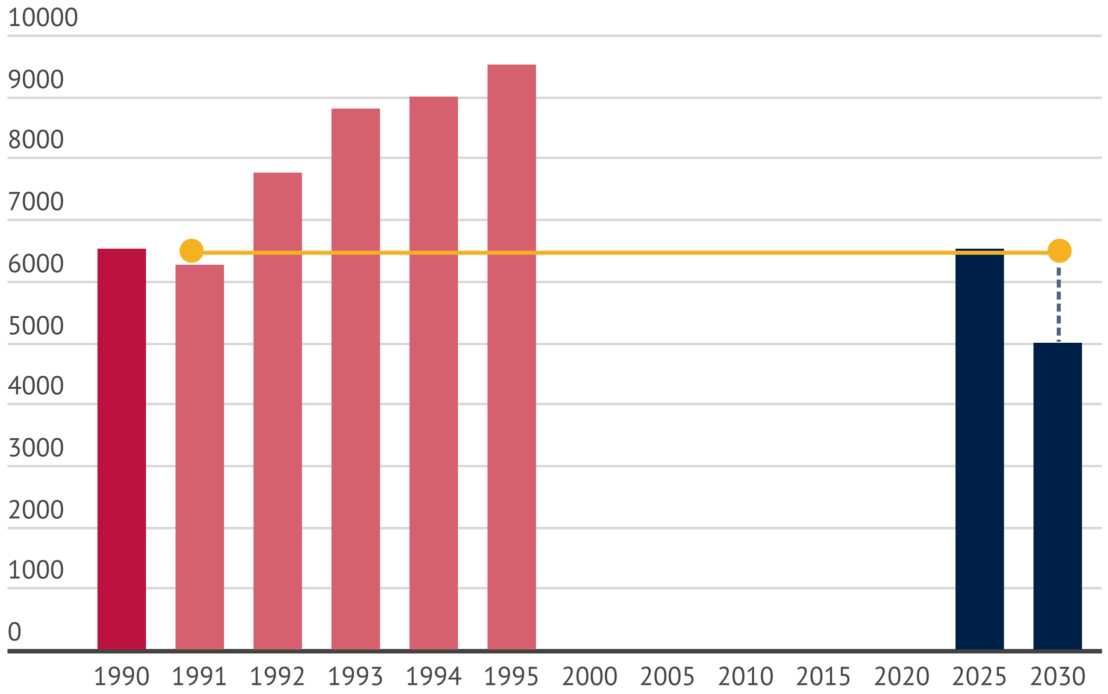
Carbon intensity

The amount of emissions of CO_2 released per unit of another variable such as gross domestic product, output energy use or transport, (1.5C report)

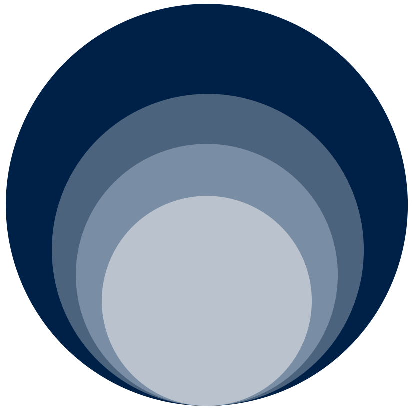
Article 4. Paris agreement

In order to achieve the long-term temperature goal set out in Article 2, Parties aim to **reach global peaking of greenhouse gas emissions as soon as possible**, recognizing that peaking will take longer for developing country Parties, and to u**ndertake rapid reductions** thereafter in accordance with best available science, so as to **achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century**, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty.

Type of goals



Absolute targets: reduce GHG emissions by XX percent or by a certain amount in a specific year as compare to a base year

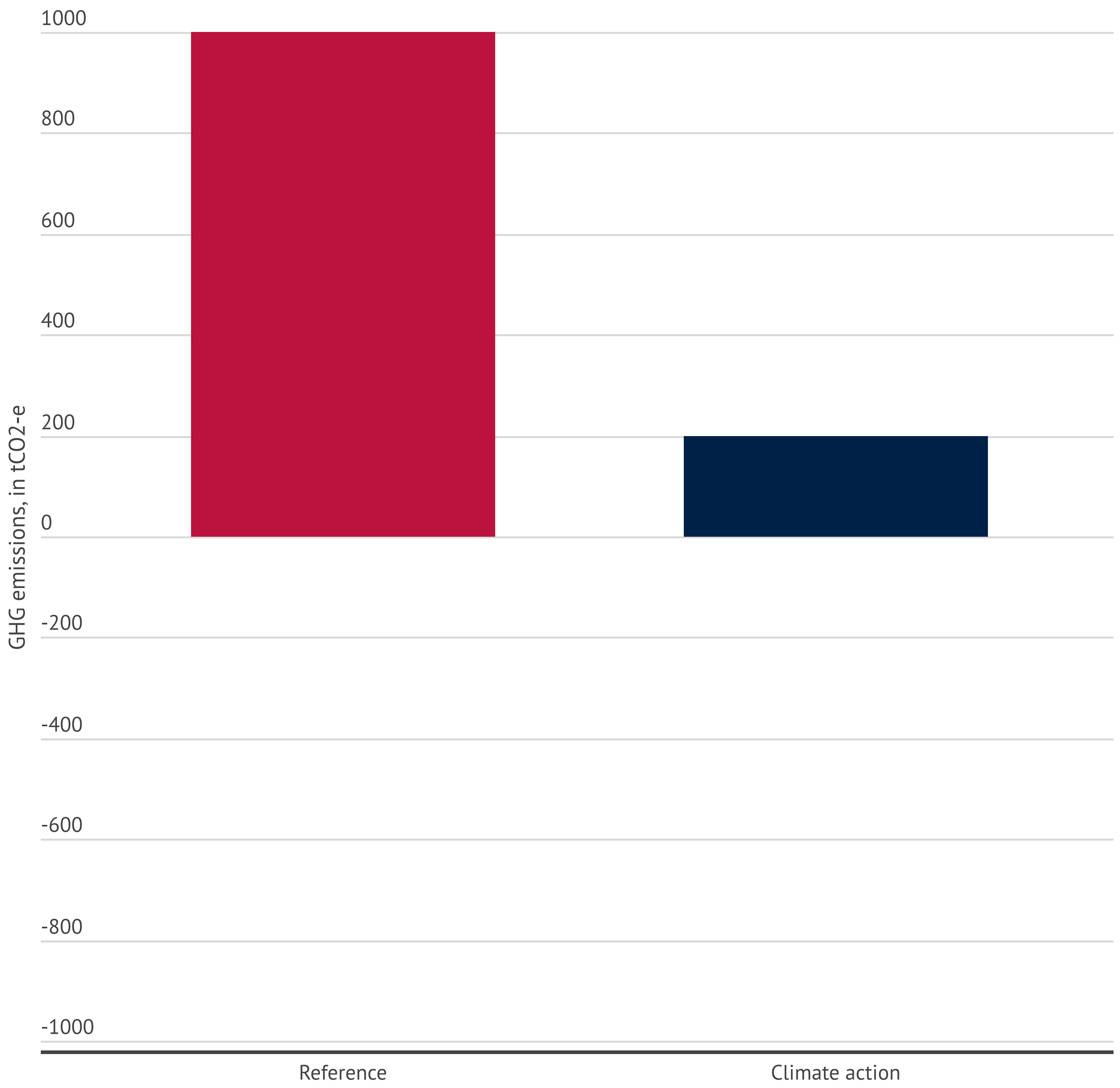


Intensity targets: reduce GHG emissions per unit of output (product, commodity, revenue, GDP...)

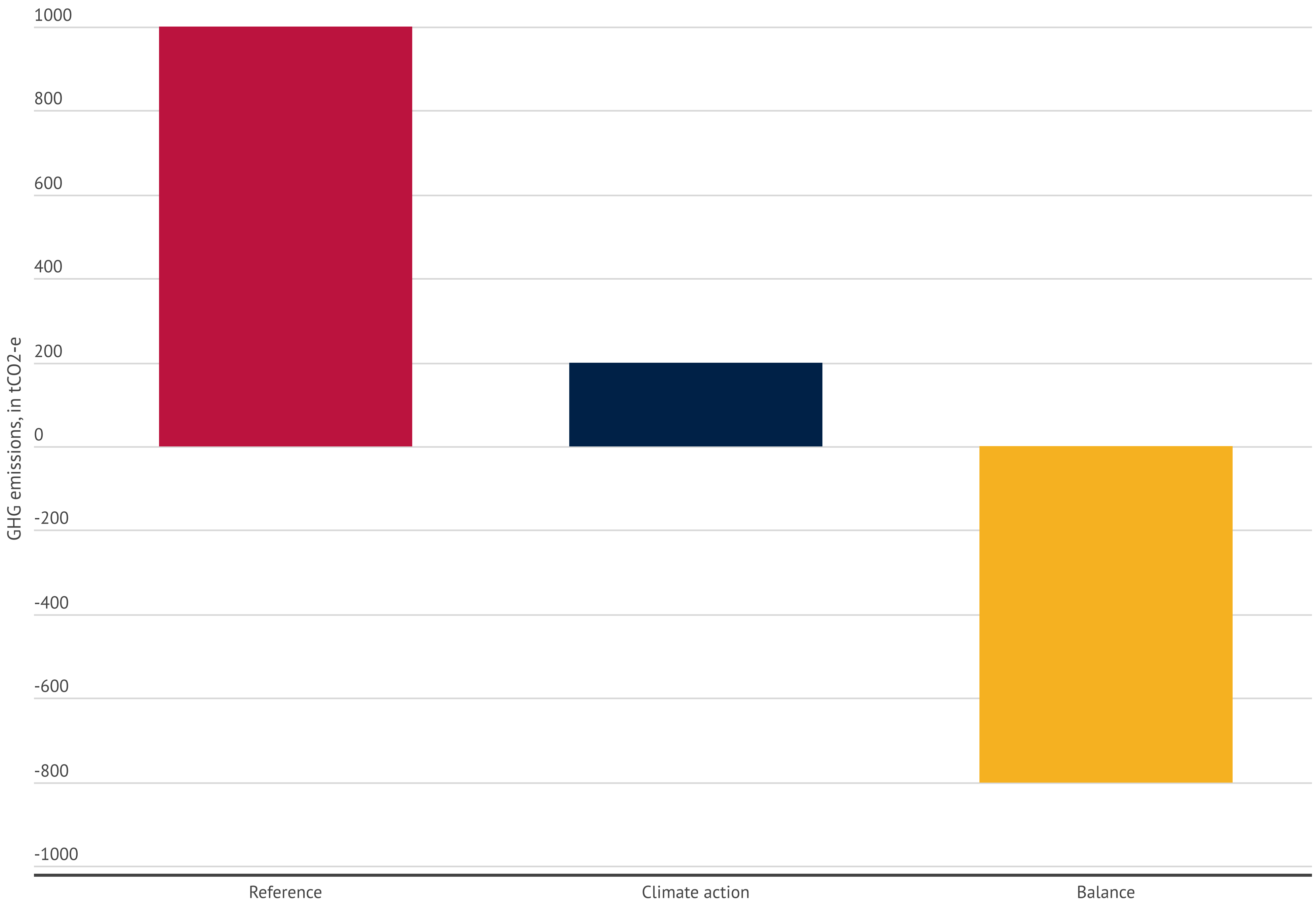
Net zero goal: neutralize emissions, i.e. offset GHG emissions with carbon removals

Carbon balance

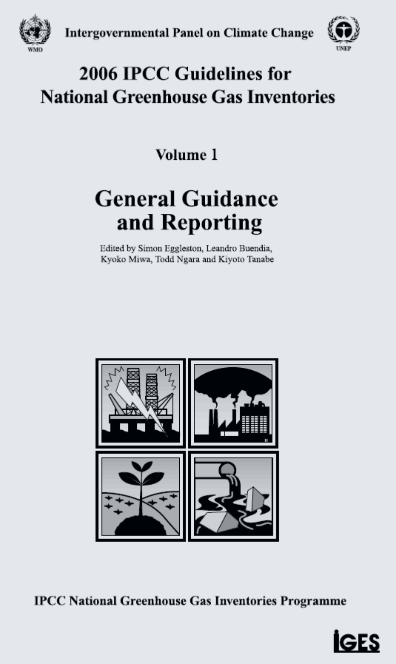
The carbon balance is a measure of the emissions of a climate action in relation to a reference (baseline, no-action scenario, etc.).

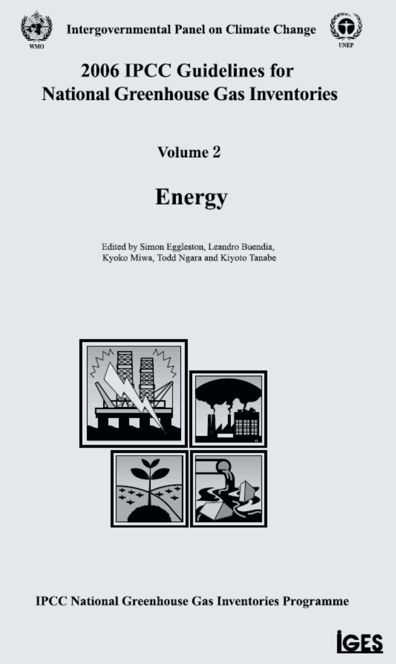


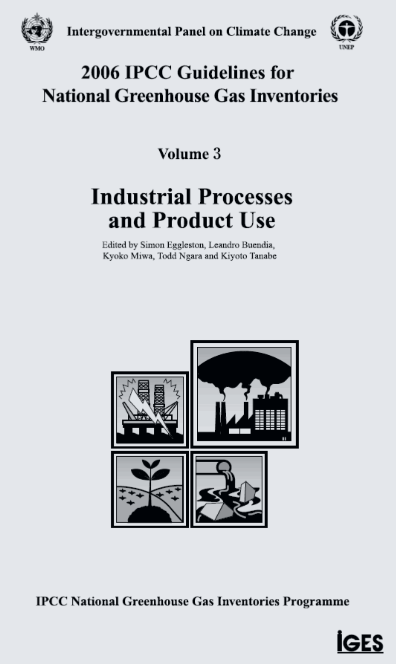
Carbon balance

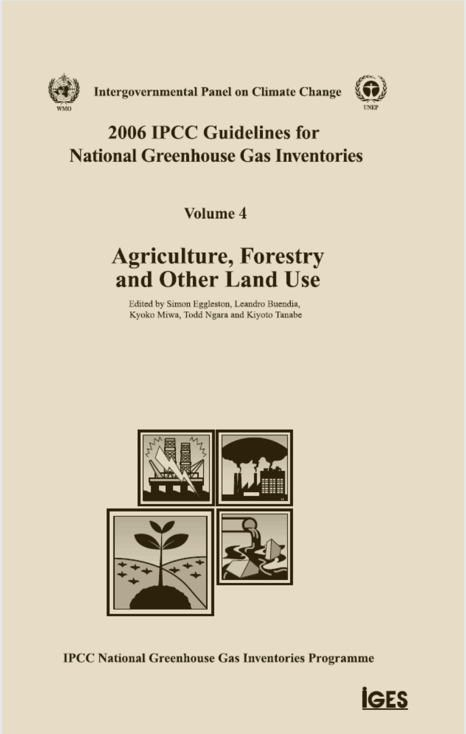


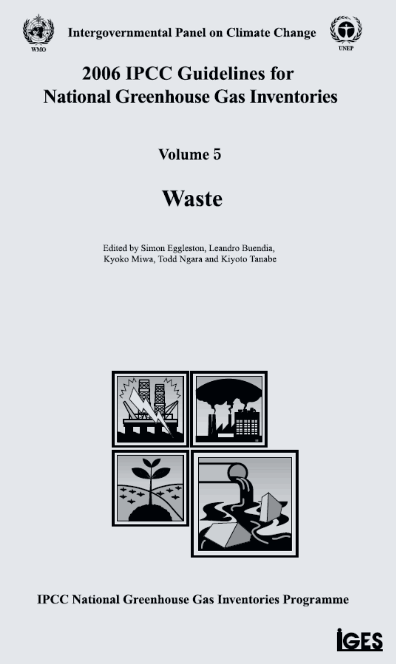
The TFI is responsible for the **internationally-agreed methodologies** used **for the calculation of national anthropogenic GHG emissions and removals by signatories to the UNFCCC and its Paris Agreement**











GHG emissions

IPCC Methodologies

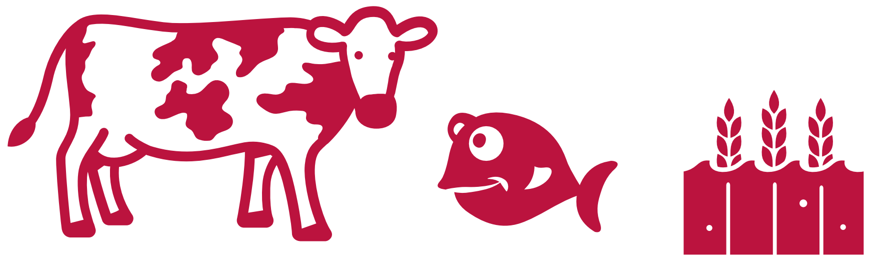
CH_4 N_2O CO_2

GHG emissions

Agriculture: Emissions of CH_4 and N_2O (and sometimes CO_2) come from many sources, including soils, livestock and manure, biomass burning, dead wood and litter. Estimating them normally involves estimating the rate of emissions from a source directly to the atmosphere*.

Emission = A x EF

Where
Emission = Emissions, tonnes of gas
A = Data on activities related to the source of emissions (e.g. surface area, number of animals or units of mass, depending on the type of source)
EF = Emissions factor for a specific gas and source category, tonnes per unit of A



<u>The emission factor is a standardized value that convert known activity data into an estimate of emissions</u>

Source:
Lignes directrices du GIEC 2006

Carbon stock changes

IPCC methodologies

Stock Difference Method

Changes in carbon stocks in a particular pool as the annual average difference between estimates made at two different time points:

$$\Delta C = \frac{(C_{t2} - C_{t1})}{(t_2 - t_1)}$$

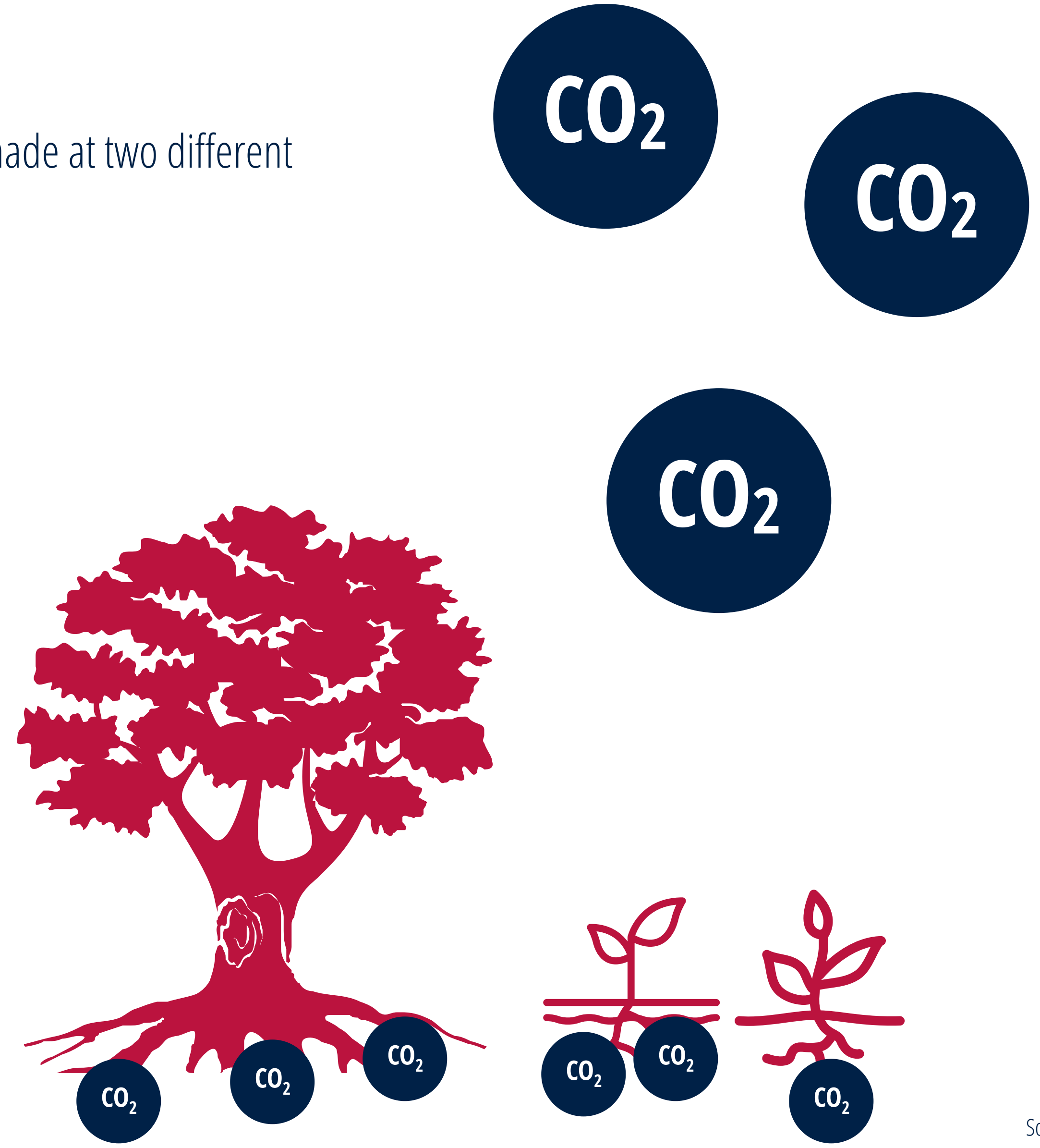
With:

ΔC = Annual changes in carbon stocks in the pool, in tonne C per year,

C1 = Carbon stock in the pool at time point t1, in tonne C, and

C2 = Carbon stock in the pool at time point t2, in tonne C

Pools included: aboveground biomass, belowground biomass, litter, dead wood and soil



Source:
IPCC 2006

Soil organic carbon (SOC)

$$SOC = SOC_{ref} \times F_{land\ use} \times F_{management} \times F_{inputs}$$

With:

SOC = Final organic carbon stock in the soil, in tC/ha,

SOCref = Reference carbon stock, in tC/ha,

Fland use = Stock variation factor for land use systems, dimensionless,

Fmanagement = Stock variation factor for management regimes, dimensionless, and

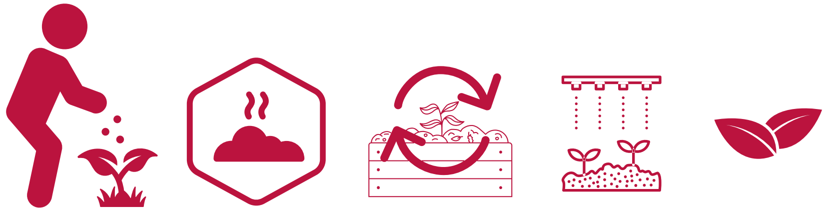
Finputs = Stock variation factor for organic matter input, dimensionless.

If $\Delta Csoil < 0$, then there are also N_2O emissions from the soil (remineralisation of organic matter)

F land use

Fmanagement

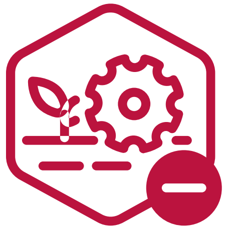
Finputs



$F_{management}$ - Soil tillage

full tillage: Substantial soil disturbance with complete inversion and/or frequent tillage operations (during the year). At the time of planting, little (less than 30%) of the surface is covered by residues

reduced tillage: Primary and/or secondary soil disturbance but reduced (usually shallow and without complete soil inversion). Normally leaves the surface with more than 30% residue cover at planting



no-till: No-till with only minimal soil disturbance in the planting area. Herbicides are generally used to control weeds

For cropland:

Annual cropland & agroforestry

F_{inputs} - Soil inputs

For cropland:

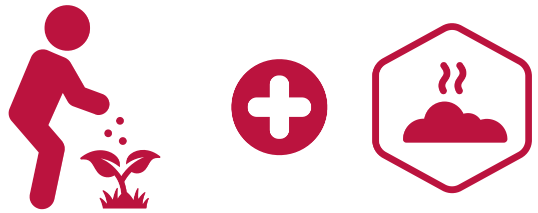
Annual cropland **only**

Low inputs: low return of crop residues which are collected or burnt, frequent fallowing, crops produce few residues (e.g. vegetables, tobacco, cotton), no mineral fertilisation or nitrogen fixing crops

Medium inputs: Representative of annual crops with cereals where all crop residues are returned to the field. If residues are removed, organic matter is added. Also requires mineral fertilisation or a nitrogen-fixing crop in rotations

High inputs without manure: Crop residue inputs are significantly higher than previous cropping systems (moderate inputs) due to additional practices, such as high residue crop production, use of green manures, cover crops, improved fallows, irrigation, frequent use of perennial grasses in annual crop rotations, but without applied manure (see below)

High inputs with manure: Represents a significantly higher carbon input compared to medium carbon crop systems (moderate inputs) due to regular addition of animal manure



Tier

It's a degree of methodological complexity

Tier 1 is the default method/emission factors (data with low spatial and temporal resolution, e.g. emission factor for enteric fermentation by animal category, i.e. no distinction between male and female, for example).)

Tier 2 is an intermediate level (more precise approach using data from the country or region, e.g. animal weight, animal sex, forest carbon stock, etc.).

Tier 3 is the most demanding in terms of information and complexity of methodology (more detailed approach that uses data at a higher/fine spatial and temporal resolution, can take into account seasons, geography, soil type and management among others).

Tier 1 | IPCC 2006

TABLE 2.3
DEFAULT REFERENCE (UNDER NATIVE VEGETATION) SOIL ORGANIC C STOCKS (SOC_{REF}) FOR MINERAL SOILS
(TONNES C HA^{-1} IN 0-30 CM DEPTH)

Climate region	HAC soils[1]	LAC soils[2]	Sandy soils[3]	Spodic soils[4]	Volcanic soils[5]	Wetland soils[6]
Boreal	68	NA	10#	117	20#	146
Cold temperate, dry	50	33	34	NA	20#	87
Cold temperate, moist	95	85	71	115	130	
Warm temperate, dry	38	24	19	NA	70#	88
Warm temperate, moist	88	63	34	NA	80	
Tropical, dry	38	35	31	NA	50#	86
Tropical, moist	65	47	39	NA	70#	
Tropical, wet	44	60	66	NA	130#	
Tropical montane	88*	63*	34*	NA	80*	

TABLE 5.5
RELATIVE STOCK CHANGE FACTORS (F_{LU}, F_{MG}, AND F_I) (OVER 20 YEARS) FOR DIFFERENT MANAGEMENT ACTIVITIES ON CROPLAND

Factor value type	Level	Temper-ature regime	Moist-ure regime[1]	IPCC defaults	Error[2,3]	Description
Land use (F_{LU})	Long-term culti-vated	Tem-perate/ Boreal	Dry	0.80	± 9%	Represents area that has been continuously managed for >20 yrs, to predominantly annual crops. Input and tillage factors are also applied to estimate carbon stock changes. Land-use factor was estimated relative to use of full tillage and nominal ('medium") carbon input levels.
			Moist	0.69	± 12%	
		Tropical	Dry	0.58	± 61%	
			Moist/ Wet	0.48	± 46%	
		Tropical montane[4]	n/a	0.64	± 50%	
Land use (F_{LU})	Paddy rice	All	Dry and Moist/ Wet	1.10	± 50%	Long-term (> 20 year) annual cropping of wetlands (paddy rice). Can include double-cropping with non-flooded crops. For paddy rice, tillage and input factors are not used.
Land use (F_{LU})	Peren-nial/ Tree Crop	All	Dry and Moist/ Wet	1.00	± 50%	Long-term perennial tree crops such as fruit and nut trees, coffee and cacao.
Land use (F_{LU})	Set aside (< 20 yrs)	Tempe-rate/ Boreal and Tropical	Dry	0.93	± 11%	Represents temporary set aside of annually cropland (e.g., conservation reserves) or other idle cropland that has been revegetated with perennial grasses.
			Moist/ Wet	0.82	± 17%	
		Tropical montane[4]	n/a	0.88	± 50%	

Soil carbon stock, SOC ref, is defined by a type (6) and an associated climate

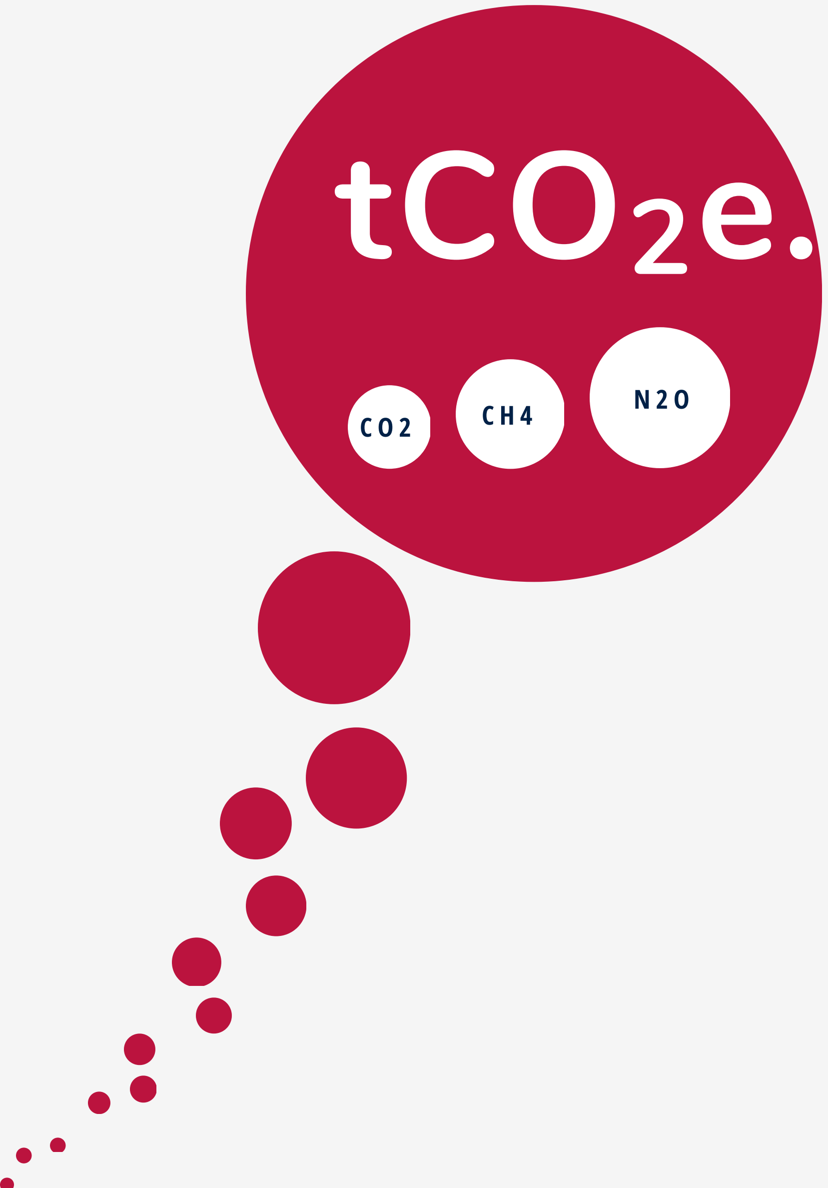
The forest is defined by an ecological zone dependent of a climate

in those examples there are no geographical distribution… this is not always the case

TABLE 4.1
CLIMATE DOMAINS (FAO, 2001), CLIMATE REGIONS (CHAPTER 3), AND ECOLOGICAL ZONES (FAO, 2001)

Climate domain		Climate region	Ecological zone		
Domain	Domain criteria		Zone	Code	Zone criteria
Tropical	all months without frost; in marine areas, temperature >18°C	Tropical wet	Tropical rain forest	TAr	wet: ≤ 3 months dry, during winter
		Tropical moist	Tropical moist deciduous forest	TAwa	mainly wet: 3-5 months dry, during winter
		Tropical dry	Tropical dry forest	TAWb	mainly dry: 5-8 months dry, during winter
			Tropical shrubland	TBSh	semi-arid: evaporation > precipitation
			Tropical desert	TBWh	arid: all months dry
		Tropical montane	Tropical mountain systems	TM	altitudes approximately >1000 m, with local variations

A single metric



ADVANCE VERSION (corrected on 14 May)

United Nations

FCCC/PA/CMA/2018/3/Add.2

Framework Convention on Climate Change

Distr.: General
19 March 2019

Original: English

Conference of the Parties serving as the meeting of the Parties to the Paris Agreement

Report of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement on the third part of its first session, held in Katowice from 2 to 15 December 2018

Annex

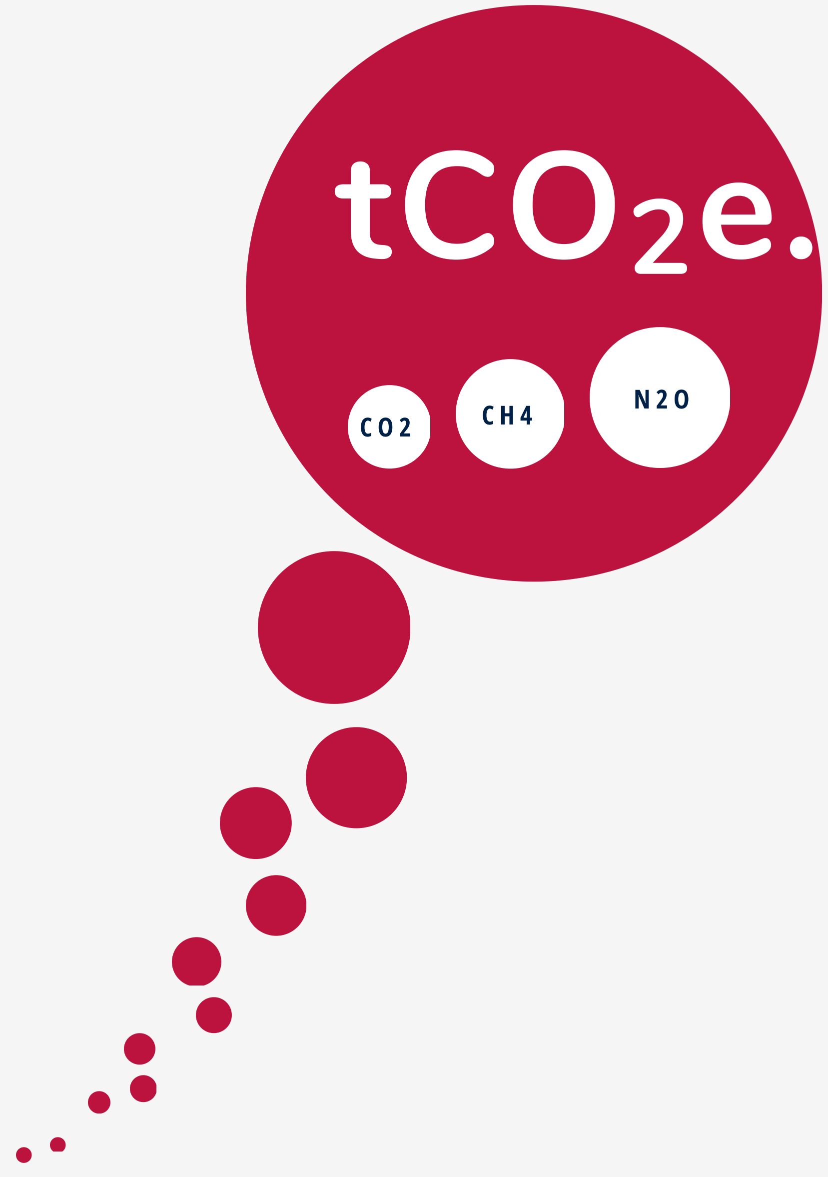
Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement

D. Metrics

37. Each Party shall use the 100-year time-horizon global warming potential (GWP) values from the IPCC Fifth Assessment Report, or 100-year time-horizon GWP values from a subsequent IPCC assessment report as agreed upon by the CMA, to report aggregate emissions and removals of GHGs, expressed in CO_2 eq. Each Party may in addition also use other metrics (e.g. global temperature potential) to report supplemental information on aggregate emissions and removals of GHGs, expressed in CO_2 eq. In such cases, the Party shall provide in the national inventory document information on the values of the metrics used and the IPCC assessment report they were sourced from.

Slide credit: Philip Audebert

A single metric



8 Anthropogenic and Natural Radiative Forcing

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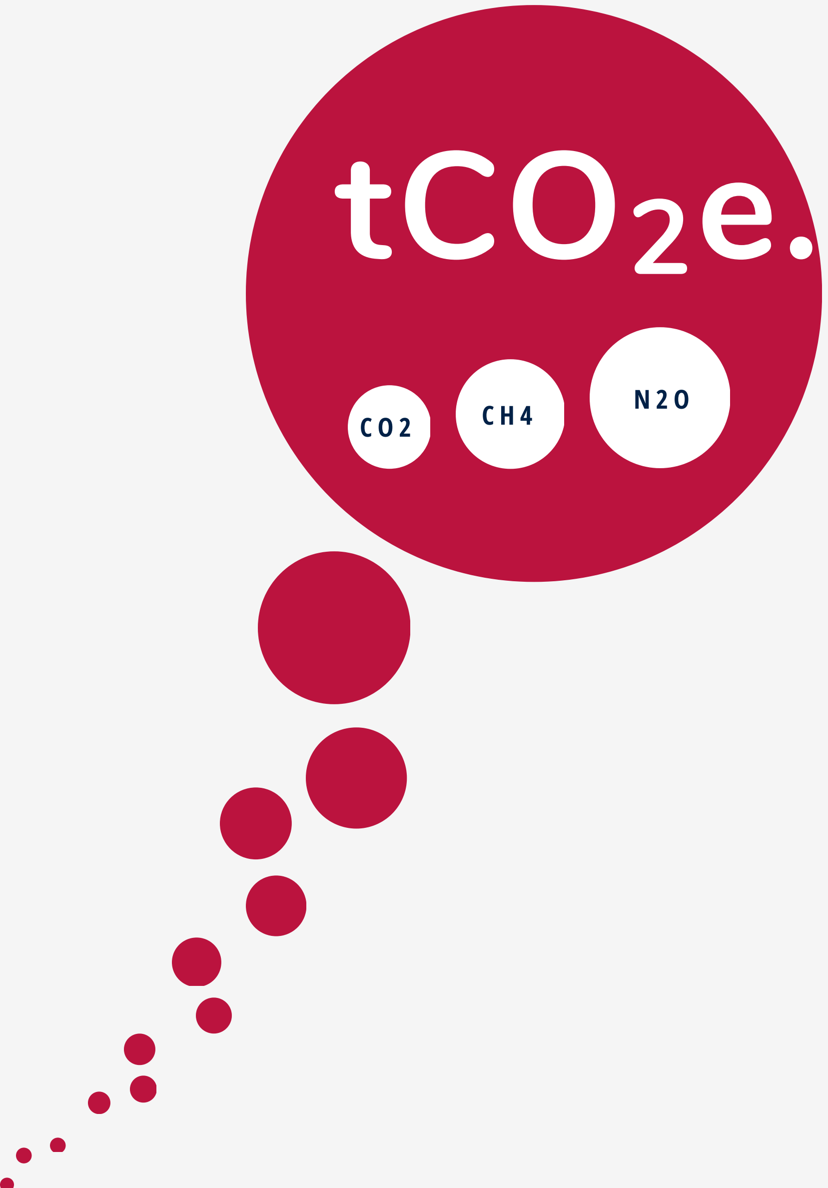
Appendix 8.A: Lifetimes, Radiative Efficiencies and Metric Values

Table 8.A.1 | Radiative efficiencies (REs), lifetimes/adjustment times, AGWP and GWP values for 20 and 100 years, and AGTP and GTP values for 20, 50 and 100 years. Climate–carbon feedbacks are included for CO_2 while no climate feedbacks are included for the other components (see discussion in Sections 8.7.1.4 and 8.7.2.1, Supplementary Material and notes below the table; Supplementary Material Table 8.SM.16 gives analogous values including climate–carbon feedbacks for non-CO_2 emissions). For a complete list of chemical names and CAS numbers, and for accurate replications of metric values, see Supplementary Material Section 8.SM.13 and references therein.

Acronym, Common Name or Chemical Name	Chemical Formula	Lifetime (Years)	Radiative Efficiency ($W\ m^{-2}\ ppb^{-1}$)	AGWP 20-year ($W\ m^{-2}\ yr\ kg^{-1}$)	**GWP 20-year**	AGWP 100-year ($W\ m^{-2}\ yr\ kg^{-1}$)	**GWP 100-year**	AGTP 20-year ($K\ kg^{-1}$)	**GTP 20-year**	AGTP 50-year ($K\ kg^{-1}$)	**GTP 50-year**	AGTP 100-year ($K\ kg^{-1}$)	**GTP 100-year**
Carbon dioxide	CO_2	see*	1.37e-5	2.49e-14	**1**	9.17e-14	**1**	6.84e-16	**1**	6.17e-16	**1**	5.47e-16	**1**
Methane	CH_4	12.4†	3.63e-4	2.09e-12	**84**	2.61e-12	**28**	4.62e-14	**67**	8.69e-15	**14**	2.34e-15	**4**
Fossil methane‡	CH_4	12.4†	3.63e-4	2.11e-12	**85**	2.73e-12	**30**	4.68e-14	**68**	9.55e-15	**15**	3.11e-15	**6**
Nitrous Oxide	N_2O	121†	3.00e-3	6.58e-12	**264**	2.43e-11	**265**	1.89e-13	**277**	1.74e-13	**282**	1.28e-13	**234**

Slide credit: Philip Audebert

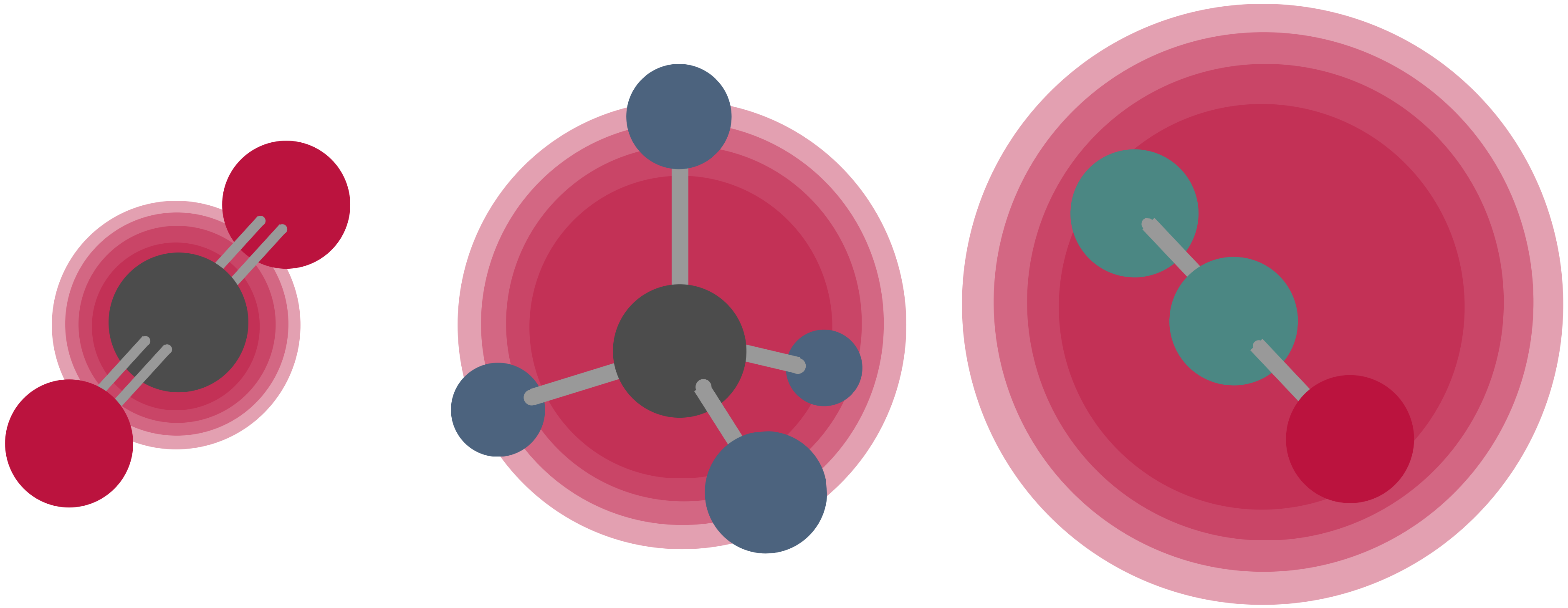
A single metric



1
Global warming potential (100y)

28
Global warming potential (100y)

265
Global Warming Potential (100y)



CO_2
Carbon dioxide

CH_4
Methane

N_2O
Nitous oxide

Slide credit: Philip Audebert

GHG emissions Estimation for non state actors

UN initiative for non state actors: High Level group of Experts

To ensure that net zero emissions commitments and implementation are aligned with the goal of keeping global temperature rise to 1.5°C goal and credibly contribute their fair share to urgently **cutting emissions in this decade to achieve a decline of 45% from 2010 levels by 2030**, the UN Secretary-General is proposing to convene a High-Level Expert Group on the Net-Zero Emissions Commitments of NonState Entities (HLEG) to help ensure credibility and accountability of net-zero pledges.

COP 27

The HLEG was officially **launched on March 31, 2022**, by UN Secretary-General António Guterres. The group is chaired by chaired by Catherine McKenna, former Canadian Minister of Environment and Climate Change, and comprised a diverse group of independent experts with expertise across government, business, the global financial system, civil society, and academia

Assessing GHG emissions & reduction through mitigation actions

Who?	Sustainability teams, procurement teams, supply chain managers, and executives responsible for climate risk management. Collaboration with suppliers, farmers, and local stakeholders is also essential.	
Steps?	1. Mapping all supply chain activities, assess GHG emissions and identify hotspots	GHG protocol, SBTi & FLAG...
	2. Set mitigation targets by developing science-based targets, ensure alignment with sourcing country NDC & engage with suppliers	Supplier leadership on climate transition collaborative
	3. Implement the mitigation actions by deploying climate practices	
	4. Track and report	TCDF reports, CDP supply chain, world benchmarking, press releases...
Outputs?	A structured sectoral mitigation strategy with measurable targets for Scope 1, 2, and 3 emissions, in line with the supply chains actors and country climate priorities.	

Source:
Pathways to climate climate-resilient net net-zero supply chains
A guide for global agrifood businesses
FAO&UNDP, forthcoming

Step 1. Mapping the value chain & assessing GHG emissions

Define organizational boundaries & Inventory

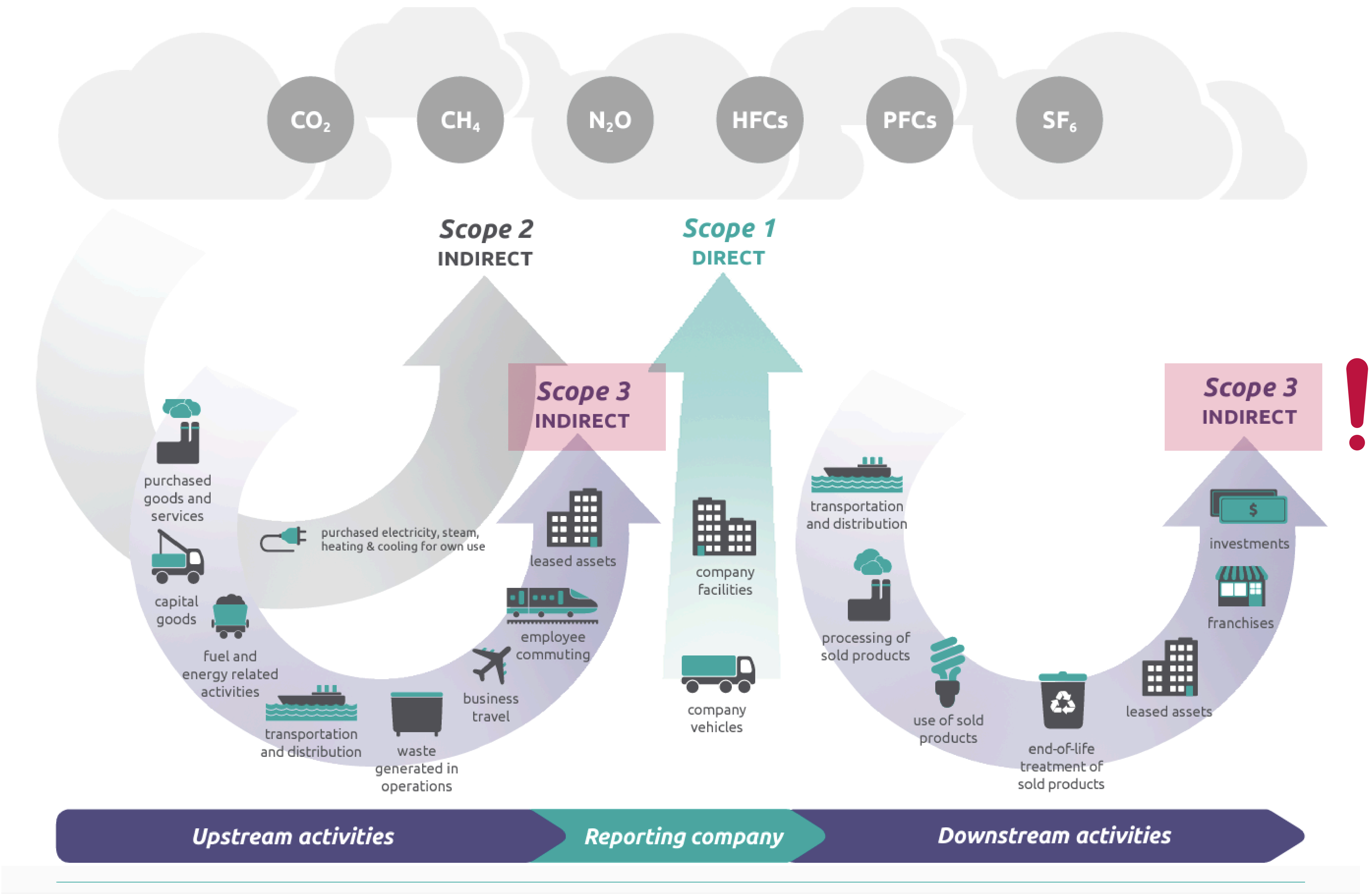
Scope 1: are direct emissions from sources that are owned or controlled by the reporting company. This would include emissions from a company car or natural gas that is used to heat an office.

Scope 2: are emissions others create to generate the energy a company purchases – so typically Scope 2 emissions come from electricity use

Scope 3: are emissions that occur both upstream and downstream in its value chain that are generated as a result of the company's activities

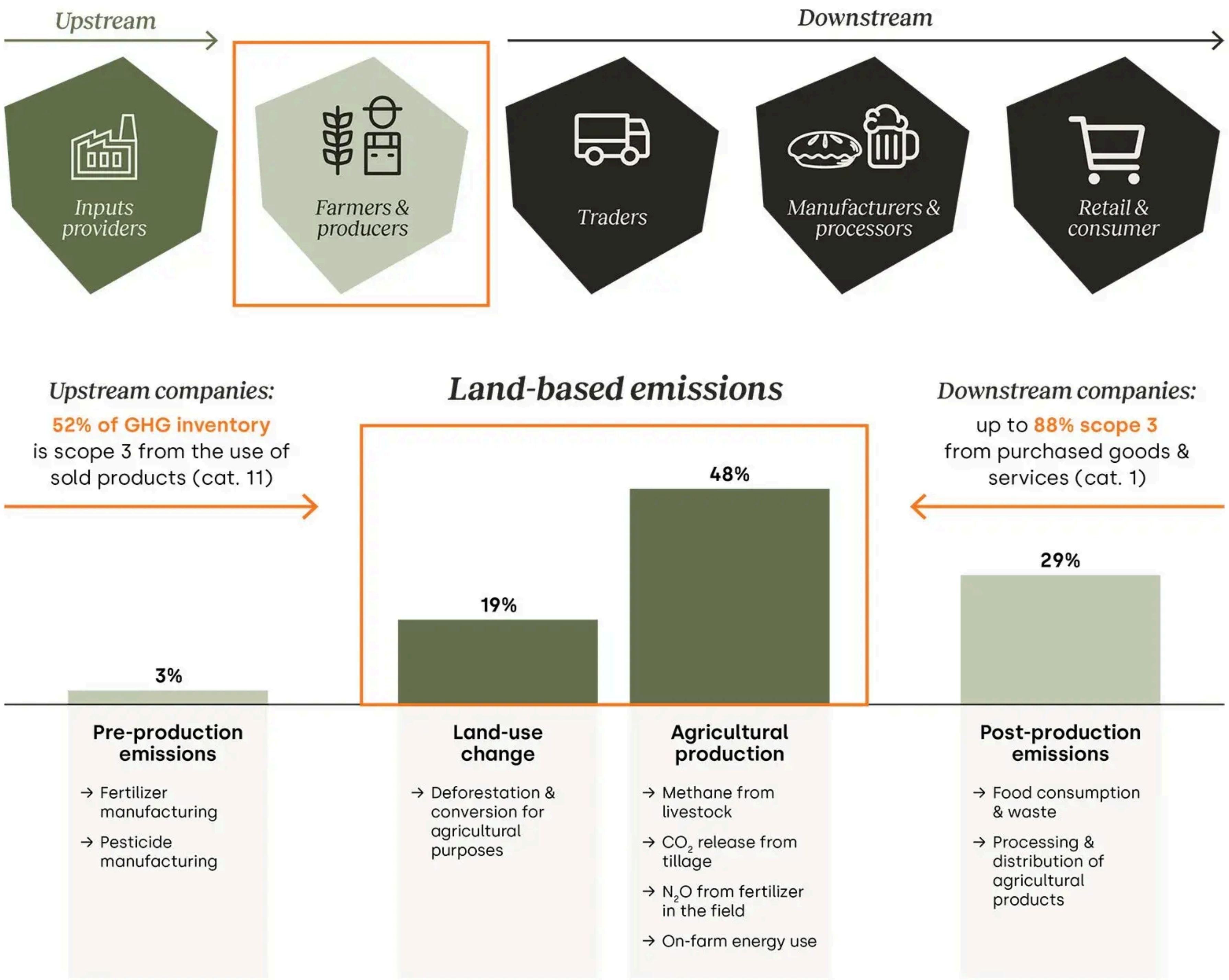
→ Direct versus indirect emissions?

Source: GHG protocol



Majority of the GHG emissions

Source: GHG protocol



Source: https://improvin.com/

Step 1. Mapping the value chain & assessing GHG emissions

Standards

GHG protocol establishes comprehensive global standardized frameworks to measure and manage GHG emissions from private and public sector operations, value chains and mitigation actions.

ISO 14064 such as the ISO 14064-1:2018 specifies principles and requirements at the organization level for the quantification and reporting of GHG emissions and removals. It includes requirements for the design, development, management, reporting and verification of an organization's GHG inventory

Science-based targets initiative develops standards, tools and guidance which allow companies to set GHG emissions reductions targets in line with what is needed to keep global heating below catastrophic levels and reach net-zero by 2050 at latest.

The Exponential Roadmap Initiative is a collaborative climate initiative uniting companies that are innovators, disruptors and transformers to drive exponential action to halve emissions by 2030.

Why do we use standardized methods?

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

Source: GHG protocol

Step 2. Set a target & develop climate change mitigation actions

Pathway to decarbonization

To set science-based targets, companies must first **define a base year** – a past calendar or financial year from which progress will be tracked. This should be **no earlier than 2015** to ensure data reflects recent trends.

Next, set a target year, which should be a minimum of five and maximum of ten years from the date of submission to SBTi for validation.

Target must align with 1.5°C above pre-industrial levels using either absolute reduction targets or intensity based targets

For Scope 2 emissions (electricity use), companies must procure at least 80 percent renewable electricity by 2025 and 100 percent by 2030 to be aligned with best practice

A dairy company has taken a structured approach to supply chain decarbonization, -> **63 percent reduction target for its Scope 1 and 2 emissions by 2030, compared to a 2015 baseline**. Recognizing that the majority of its emissions come from farming and feed production, it **also set a Scope 3 target to cut emissions per tonne of standardized raw milk and whey by 30 percent by 2030**. This is significant because livestock production is a major source of methane emissions, and shifting to more sustainable feed and manure management practices can help reduce its carbon footprint.

Source:
Pathways to climate climate-resilient net
net-zero supply chains
A guide for global agrifood businesses
FAO&UNDP, forthcoming

Step 3. Tracking & disclosing

Tracking and disclosure must be clear, credible, and aligned with international reporting frameworks

Corporate actions support governments in tracking progress toward national climate targets under the Paris Agreement

Integrate climate risks into corporate reporting

- Report GHG emissions from the different activities and the different sector
- Challenge: engaging supplier participation in emissions tracking

  To address this, some companies are starting to incentivize suppliers to disclose and reduce emissions by embedding climate criteria into procurement policies and offering financial benefits for transparency and action

  One multinational retailer has partnered with a financial institution to launch a preferential programme for suppliers to disclose their GHG emissions and commit to reductions. Suppliers with gold -tier status have access to lower financing costs and preferential green loans, creating direct financial incentives for transparency and reduction efforts

Comprehensive disclosure & 1.5°C alignment

Partial disclosure and demonstrated commitments to reduce emissions

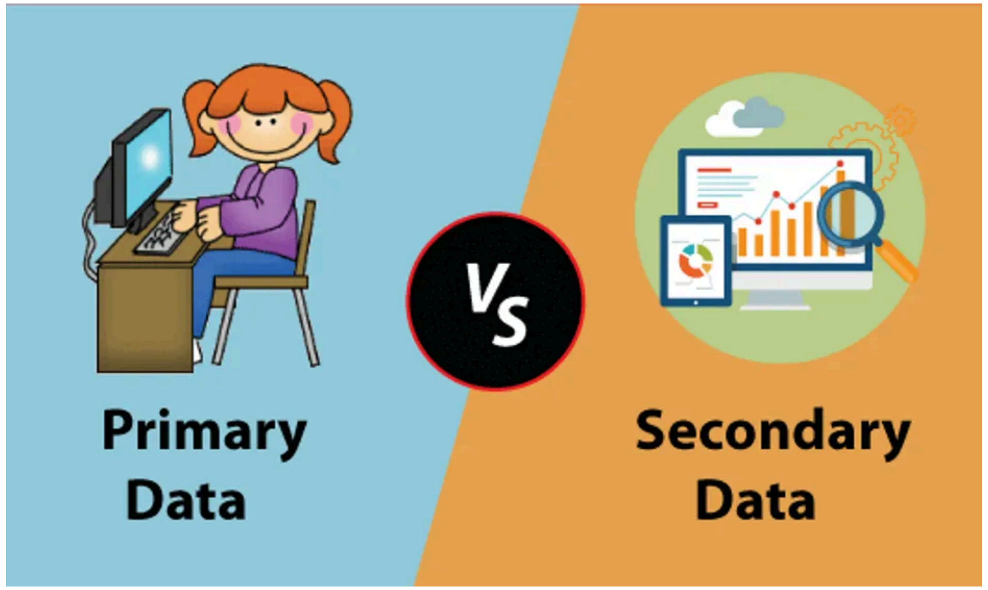
Entry level - basic carbon footprint

Source:
Pathways to climate climate-resilient net net-zero supply chains
A guide for global agrifood businesses
FAO&UNDP, forthcoming

Recap emissions calculation methods

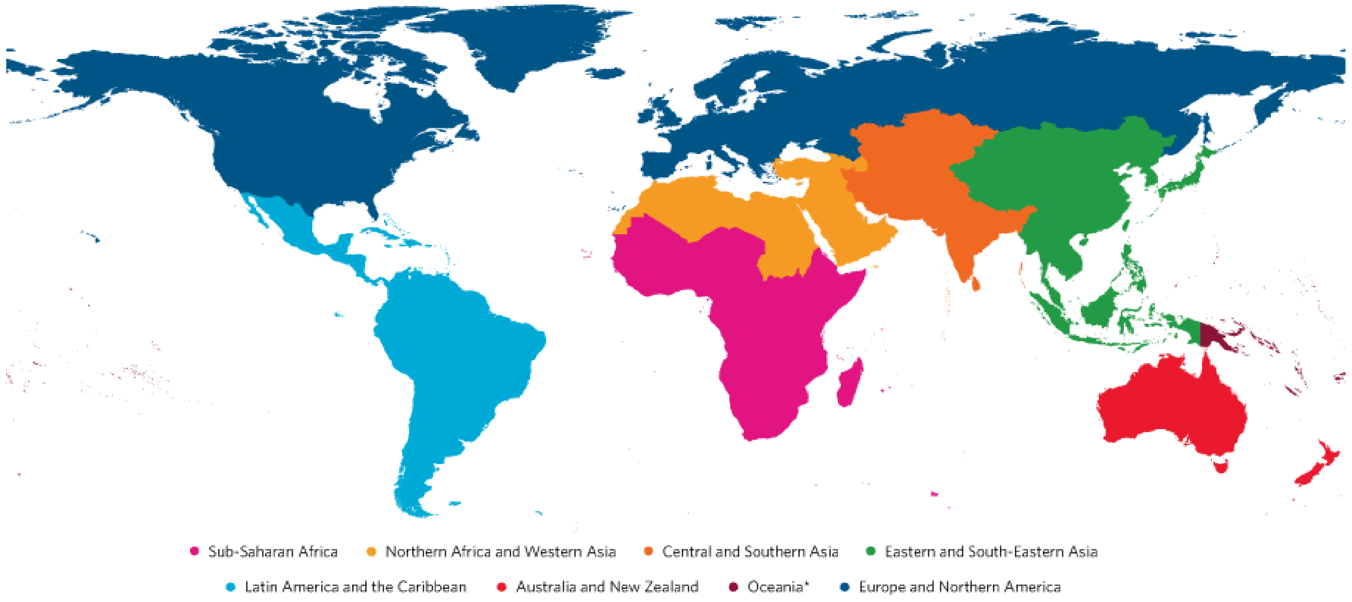
Activity data, e.g., fuel used, hectares, number of animals, electricity consumed, km traveled)

Emission factors, e.g., kg CO_2 per liter of diesel, kgCH_4 per head of dairy cow, biomass growth rate, kgN_2O per kg fertilizer, kgCO_2-e/km traveled



Primary data collected from operations, surveys…

Secondary data from research, database such as FAOSTAT, office of national statistics…



Notes: • Oceania* refers to Oceania excluding Australia and New Zealand throughout the publication.
• The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Mitigation measures in the AFOLU sector

On the supply side

On the demand side

?

The deployment of these options varies from country to country

Source:
Figure SPM. 7, AR6, WG III

Mitigation measures in the AFOLU sector

On the supply side

Two types of measures: GHG emission reduction and carbon sequestration

[R] Reduction of conversion of forests and other ecosystems

[C] Carbon sequestration in agriculture (soils)

[C] Ecosystem restoration, afforestation, reforestation

[R]&[C] Improving sustainable forest management

[R] Reduction of CH_4 and N_2O emissions from the agricultural sector (livestock, rice, fertilizers, biomass burning)

7.3 $GtCO_2$-e per year for forests and other land uses

4.1 $GtCO_2$-e per year for agriculture

The deployment of these options varies from country to country

On the demand side

- Switch to balanced and sustainable diets
- Reducing food loss and waste


ARTICLES

https://doi.org/10.1038/s43016-021-00358-x

nature food

Check for updates

Global greenhouse gas emissions from animal-based foods are twice those of plant-based foods

Xiaoming Xu[1], Prateek Sharma[1], Shijie Shu[1], Tzu-Shun Lin[1], Philippe Ciais[2], Francesco N. Tubiello[3], Pete Smith[4], Nelson Campbell[5] and Atul K. Jain[1]

2.2 $GtCO_2$-e per year for demand-side mitigation options

Source:
Figure SPM. 7, AR6, WG III

GHG allocation challenge

GHG allocation challenge - Scenario 1

AgriFarm is a family-grown agribusiness that's become a regional producers of organic sunflower oil, wheat flour, and dairy products. It combines traditional Serbian agricultural knowledge with modern technology, operating across farming, food processing, packaging, and distribution.

Allocate its business activities into scope 1, 2 and 3:

1. **Crop Farming Division**
   - Owns 6,000 hectares to grow sunflowers, wheat, and corn
   - Uses diesel-powered tractors and harvesters
   - Applies nitrogen-based fertilizers produced by a supplier in North Macedonia
2. **Livestock Division**
   - Operates a medium-sized organic dairy farm with 400 cows
   - Manure used as fertilizer for crops
   - Cattle feed is a mix of company-grown and purchased grains
3. **Processing & Packaging**
   - Has a sunflower oil plant in Kragujevac
   - Flour mill and dairy processing facility near Nis
   - Runs 24/7 using electricity from the Serbian national grid and backup diesel generators
   - Packaging includes recyclable plastic bottles and paper sacks from a supplier in Slovenia
4. **Distribution**
   - Uses third-party logistics companies for transport to Belgrade, Novi Sad, and export partners in Croatia and Bulgaria
   - Refrigerated trucks used for dairy products
   - Grain products shipped via train and truck
5. **Corporate Operations**
   - 100 employees in admin, sustainability, marketing, and sales
   - Remote work allowed 2 days a week, but many commute by car
   - Business travel includes site visits and export meetings across the Balkans

GHG allocation challenge - Scenario 2

Bela is a second-generation family-owned farm that has grown from a small grain producer into a diversified operation focused on crop production, free-range poultry, and direct-to-market sales. The farm prides itself on using eco-conscious methods, combining tradition with innovation to reach markets in Serbia and Hungary.

Allocate its business activities into scope 1, 2 and 3:

1. **Crops**
   - 600 hectares of land for growing corn, barley, and sunflower
   - Diesel-powered machinery: tractors, planters, sprayers
   - Uses synthetic fertilizer and some compost from farm waste
   - Drones used for crop monitoring
2. **Livestock (Poultry)**
   - 2,000 free-range chickens raised for meat and eggs
   - Fed with grains grown on the farm
   - Chicken manure composted and used in fields
3. **On-site Food Processing**
   - Small facility for sunflower oil pressing and egg packaging
   - Powered by purchased electricity (mostly from coal-fired grid)
   - Uses natural gas for heating in the winter
   - Recyclable packaging sourced from a Serbian supplier
4. **Sales & Distribution**
   - Products sold at local markets in Novi Sad and Subotica
   - Delivers weekly to Belgrade via a rented van from a local courier
   - Occasionally exports small batches of sunflower oil to Hungary via a third-party transport firm
5. **Household & Admin**
   - The family lives on-site
   - Solar panels installed on the farmhouse roof, partially powering the egg-packing station
   - Occasional travel to agri-fairs or supplier visits

GHG allocation challenge - Scenario 3

Gouda is a cozy, independent cheese shop in the heart of Belgrade that specializes in handmade Serbian cheeses. The shop focuses on local sourcing, eco-friendly packaging, and slow food values.

Allocate its business activities into scope 1, 2 and 3:

1. **Sourcing & Supply Chain**
   - Buys cheese and occasionally milk (from dairy cows and goats) from 7 small-scale dairies across Serbia
   - Dairies deliver products weekly in refrigerated vans (not owned by Gouda)
   - Occasionally imports specialty rennet and salt from Croatia and Italy
2. **Retail Store**
   - Operates a small walk-in store along the right bank of the Danube
   - Refrigerated display cases and cold storage room powered by Belgrade's electricity grid
   - Uses biodegradable packaging: paper wraps, compostable containers
   - Lights and cooling run year-round; heating in winter via electric heaters
3. **Logistics & Delivery**
   - Offers local delivery via a bike courier in central Belgrade
   - Uses third-party courier for orders to Novi Sad and Niš
   - No owned vehicles
4. **Office/Admin**
   - Three employees handle inventory, sales, and social media marketing
   - Work from laptops, phones, and a small back office
   - Travel occasionally to visit producers or attend food fairs

GHG allocation challenge - What can we retain?

and How we could intituively proceed...

1. Inventory phase: Identification of Actors /emission sources and classification per scope
2. Collect AD
3. Determinate EF using IPCC, GHG protocol...
4. Estimate (AD*EF) and convert to tCO_2-e (GWP 100 AR5 without CC feedback)
5. Report data (sometime 3rd parties verify transparency, accuracy, consistencies and completeness)
6. Track data & report
7. Set a GHG emissions reduction target and identifying where it is easy to reduce and if feasible
8. Identify missing areas and gaps, and where to shift from tier 1 to tier 2
9. Address residual emissions (carbon offset?) & Plan

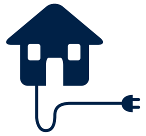
[Transversal] What are the national commitments, e.g. NDC & LT-LEDS

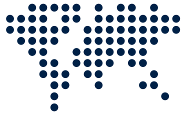
Module 3 | Key takeaway notes

Carbon Accounting: Involves measuring GHG emissions using the formula (except for carbon stocks and stocks changes) Emissions = Activity Data × Emission Factor to assess environmental impact and support climate action.

The **emission factor** is a standardized values that convert known activity data into an estimate of emissions

Scope 1: Direct emissions, e.g., fuel use 

Scope 2: Indirect emissions from energy, e.g. electricity 

Scope 3: All other indirect emissions, e.g., supply chain 

Standards: GHG Protocol, ISO 14064, SBTi, and CDP

Pathway to decarbonization summarized in 3 steps

GHG inventory

GHG emission reduction

"Carbon" neutrality

GHG accounting terminologies

Direct emissions

[GHG protocol] Emissions own or control by the company
[IPCC] In national GHG inventories, direct emissions are those taking place directly from a source as consequence of an activity resulting in the emissions

Indirect emissions

[GHG protocol] Emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another entity.
[IPCC] In national GHG inventories, indirect emissions are those occurring through indirect pathways

Scope 3 are indirect emissions are the most challenging to identify. They are the ones cause on your behalf but not cause by you directly

GHG accounting and reporting

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

Source: GHG protocol

GHG accounting terminologies

Carbon footprint	Measure of the exclusive total amount of emissions of carbon dioxide (CO2) that is directly and indirectly caused by an activity or accumulated over the life stages of a product (Wiedmann and Minx, 2008).
Carbon intensity	The amount of emissions of CO_2 released per unit of another variable such as gross domestic product, output energy use or transport, (1.5C report)
Carbon offset	A reduction in emissions of carbon dioxide or other greenhouse gases made in order to compensate for ("offset") an emission made elsewhere (https://www.ipcc.ch/2018/06/15/ipcc-meetings-go-carbon-neutral/)
Net zero emissions **Carbon neutrality**	When anthropogenic CO_2 emissions are balanced by anthropogenic CO_2 removals over a specified period. At a global scale, the terms 'carbon neutrality' and net zero CO_2 emissions are equivalent. At sub-global scales, net zero CO_2 emissions is generally applied to emissions and removals under direct control or territorial responsibility of the reporting entity, while carbon neutrality generally includes emissions and removals within and beyond the direct control or territorial responsibility of the reporting entity, (AR6).

Basic of Business GHG accounting & NDC alignment

National mitigation strategies are anchored in the **NDCs** and the **LTS**

Businesses should align with those national goals to enhance impact and build more resilient, sustainable supply chains.

Mapping national climate policies would help companies understanding regional priorities in GHG emissions reductions.

Key focus areas in agrifood business include reducing livestock methane, using renewable energy, land restoration, and sustainable farming.

Companies can tailor their strategies to support and scale these high-impact national interventions.