AGRICULTURAL INNOVATION AUSTRALIA

April 2023

A Common Approach to Sector-Level Greenhouse-Gas Accounting for Australian Agriculture

Common Terminology

Prepared for Agricultural Innovation Australia by:

CSIRO, Queensland University of Technology, NSW Department of Primary Industries, University of Melbourne, Integrity Ag & Environment, Australian Wine Research Institute

Australia's National
Science Agency

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This document is an output the project *A Common Approach to Sector-Level GHG Accounting for Australian Agriculture* which was commissioned by Agricultural Innovation Australia (AIA) and funded through contributions from AIA, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), AgriFutures Australia, Australian Pork Limited, Cotton Research and Development Council (CRDC), Dairy Australia, Grains Research and Development Council (GRDC), Hort Innovation, Meat & Livestock Australia (MLA), Sugar Research Australia (SRA), Wine Australia, and the Western Australian Department of Primary Industries and Rural Development.

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Citation

Cowie, A., Sevenster, M., Eckard, R., Hall, M., Hirlam, K., Islam, N., Laing, A., Longbottom, M., Longworth, E., Renouf, M., and Wiedemann, S., 2023. A Common Approach to Sector-Level GHG Accounting for Australian Agriculture: Common Terminology for GHG Accounting. CSIRO, Australia.

Important disclaimer

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Acknowledgements

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1 Introduction

This document is an extended glossary of terms used in or relevant to the project *A Common Approach to Sector-Level GHG Accounting for Australian Agriculture*, including abbreviations. It accompanies the Methods and Data Guidance (Sevenster et al., 2023a) and Project Overview and Non-Technical Summary (Sevenster et al., 2023b) reports.

Definitions have been sourced from authoritative literature, particularly the Intergovernmental Panel on Climate Change (IPCC) glossary, International Organization for Standardization (ISO) standards, and specific policies and schemes, such as the Emissions Reduction Fund (ERF) and the United Nations Framework Convention on Climate Change (UNFCCC). Abbreviations are included where in common use. Additional relevant information is included in the glossary entries to aid comprehension and to indicate relevance for Australian agricultural systems. Peripheral information such as remarks specific to this project are included in the “Comments” column.

2 Glossary

Italicised words and phrases refer to terms defined in this glossary.

Term	Definition	Source	See also	Comments
Abatement	*GHG removals* by *sinks* and/or reduction in *GHG emissions* by *sources*		Mitigation (synonym)	Some users restrict "abatement" to emission reductions only.
Above-ground biomass	(In *national inventory reporting*, with refence to the carbon *pools* included in the *Land Use Land Use Change and Forestry* sector) all *biomass* of living vegetation, both woody and herbaceous, above the soil surface including stems, stumps, branches, bark, seeds, and foliage. Note: Dead organic matter on the soil surface is classed as litter (straw, leaves) or coarse woody debris (branches, tree stems).	IPCC, 2006	*Below-ground biomass*	
Accounting	(In the *UNFCCC* and associated processes) the rules for comparing *net GHG emissions* with commitments for Annex I Parties under the *Kyoto Protocol*. Recently, the definition has been broadened to mean calculating 'debits' and 'credits' with reference to a specified target, such as the *NDCs* under the *Paris Agreement*. General usage: Outside the UNFCCC, GHG accounting is sometimes applied to estimating and reporting GHG emissions and *GHG removals* without reference to a target. This is called *national inventory reporting* in the UNFCCC context.	UNFCCC, 2003 Cowie et al, 2006	*Reporting*	In the context of this project, accounting refers more broadly to estimating and reporting *emissions* and *removals*, and may include comparison with targets.
ACCU	See *Australian carbon credit unit*			
Activity data	Quantitative measure of the level of a human activity, taking place during a given time period, that results in *GHG emissions* or *GHG removals.* Example: litres of fuel used; tonnes of urea applied; numbers of livestock and their liveweight gain Activity data are multiplied by the relevant *emissions factor* to quantify the GHG emissions or GHG removals generated by a company or country.			

Term	Definition	Source	See also	Comments
Additionality, **Additional**	Additionality (of a *mitigation* activity): the quality of being additional Additional (of mitigation): in excess of mitigation that would occur in the absence of the associated policy intervention, activity or project Additionality is one of several key criteria used to ensure the environmental integrity of *offsets*: an additionality test is applied in *emissions trading* schemes to ensure that credits are not earned for mitigation that would have happened in the absence of the scheme. Under the *Emissions Reduction Fund* additionality is assessed through the "newness requirement".	Adapted from IPCC, 2022a, GHG Protocol	*Offset*	Additionality is relevant to projects that generate carbon credits. It is not applicable to company –level inventory *reporting*, which aims to quantify *GHG emission* and *removals* for which a company has responsibility.
Agriculture, forestry and other land use AFOLU	Sectoral category used in the 2006 *IPCC* Guidelines which includes the *GHG emissions* and *GHG removals* from the Agriculture sector and LULUCF (Land Use, Land Use Change and Forestry) sector, which were treated separately in earlier IPCC Guidelines.			Under SBTi this sector is called FLAG: Forest, land and agriculture
Allocation	In *life cycle assessment*: A procedure used to assign emissions to multiple co-products from a process. Some common bases for allocation include mass, economic value, protein and energy. For example, allocation is relevant to sharing impacts between wool and sheep meat.		*Life cycle assessment*	
Anthropogenic	caused or influenced by people, either directly or indirectly. The *UNFCCC* is focussed on quantifying and managing anthropogenic *GHG emissions* and *GHG removals*.			
Approach	Under the *UNFCCC* and associated policy processes: The conceptual framework for estimating GHG *emissions* and *GHG removals* in inventories. The approach specifies the *system boundary*, defining which emissions and removals are to be reported or accounted by each Party. The approach defines WHAT is being estimated and reported in an inventory and by WHOM (determined by the *system boundary*), while the *method* describes HOW the reported values are derived, that is, the techniques used in estimation.	UNFCCC, 2003; Cowie et al., 2006	*Method*	This project aims to develop a common *approach* to GHG *accounting*, rather than a common *method*.
Australian Carbon Credit Unit **ACCU**	The financial instrument that the Australian Government uses to regulate *emissions trading* in Australia. An ACCU is issued by the *Clean Energy Regulator* by making an entry for the unit in an account in the electronic Australian National Registry of Emissions Units. Each ACCU issued represents one tonne of *carbon dioxide equivalent* (tCO2-e) stored or avoided by a project. An ACCU is issued to a person with a Registry account, and a Registry account can only be opened by a person who the Regulator has determined is a 'fit and proper person'.	Clean Energy Regulator, 2020		

Term	Definition	Source	See also	Comments
Baseline	A reference that provides the basis for comparison. The baseline can be performance in a specified past year or time period, or a projection of future performance under "business as usual". The latter is also referred to as a dynamic or forward baseline, or counterfactual. A baseline can be a benchmark, such as industry average or best practice, such as in a baseline-and-credit *emissions trading* scheme, or the *Safeguard Mechanism*. Australia has used 2005 as the baseline year for its *NDC*. Under the *ERF* some methods, such as *soil carbon* methods, use a historical baseline, determined by the performance prior to project commencement. In contrast, the beef herd management method uses a counterfactual baseline to estimate *GHG emissions* in the absence of the project activities.			This project uses GHG emissions in 2005 as the baseline. MLA and GRDC are using FY2005-06 to align with Australia's NDC.
Below-ground biomass	(In *national inventory reporting*, with refence to the carbon *pools* included in the *Land Use Land Use Change and Forestry* sector): Living vegetation below the soil surface, that is, plant roots In practice, fine roots of <2mm are usually included in the soil organic matter pool, due to difficulties in separating them from soil.		*Above-ground biomass*	
Biochar	stable, carbon-rich material produced by heating *biomass* in an oxygen-limited environment. Biochar is distinguished from charcoal by its application: biochar is used as a soil amendment. Biochar has been shown to improve soil functions and reduce *GHG emissions*. Biochar is recognised as a *carbon dioxide removal* method. Biochar carbon persists for hundreds to thousands of years in soil. Carbon dioxide removal through biochar is less prone to reversal than carbon dioxide removal through afforestation/reforestation and *soil carbon sequestration*.	IPCC, 2022a, IPCC, 2022b		
Biogenic carbon	*Carbon* that is contained in or derived from *biomass*.			
Biogenic carbon emissions	Carbon released as *carbon dioxide* or *methane* from combustion or decomposition of *biomass* or biobased products. Biogenic carbon emitted as CO_2 from non-woody biomass, and removals by non-woody vegetation, are excluded from *national inventory reporting*, and are commonly excluded in company-level inventories, *emissions trading* and *carbon neutrality* schemes. Biogenic carbon emissions from woody biomass are included in national inventory reporting, but are sometimes excluded in LCA, such as when supplied from a sustainably-managed plantation, on the basis that if forest *carbon stock*s are stable there is no net			

Term	Definition	Source	See also	Comments
	emission. Biogenic carbon emissions may be reported separately, and several standards (ISO 14067, *GHG Protocol*) require this for woody biomass. In national inventory reporting, emissions from burning peat are classed as fossil fuel emissions due to the slow formation rate of peat compared with other biomass materials.			
Biogenic methane	Carbon released from *biomass* as methane. This includes methane released by enteric fermentation and from manure, rice production, organic soils, landfills, and combustion of biomass.			Biogenic methane is given a lower GWP100 than fossil methane in some contexts, but a single value for fossil and biogenic methane is used in *national inventory reporting*, and in this project.
Biomass	Organic material excluding material that is fossilised or embedded in geological formations. Biomass includes living and dead organic matter, e.g. trees, crops, grasses, tree litter, algae, animals, manure and waste of biological origin. Carbon comprises about 50% of the dry mass of biomass. In some contexts, including *national inventory reporting*, biomass refers to the mass of organic material in a specific area, expressed as dry weight.	ISO, 2018; IPCC, 2022a		
Carbon	A chemical element with the symbol C. In the context of climate change, carbon often refers to *carbon dioxide*, or to all *greenhouse gases*.			The inconsistent and ambiguous use of carbon to sometimes refer to C, or CO_2 or all GHGs can cause confusion. In this project we use carbon when referring to the element, CO_2 when referring to carbon dioxide, and GHG, or CO_2e when referring to all *greenhouse gas*es.
Carbon border adjustment mechanism CBAM	A levy on imports to Europe announced by the European Commission in 2021, as part of the "Fit for 55" package. It will apply to specific products exported by producers that are not subject to *carbon* pricing. Initially it will apply to electricity, cement, aluminium, fertilizer, iron and steel. The levy will be paid by importers, through purchase of carbon certificates corresponding to the carbon price that would have been paid had the goods	Austrade		It is unclear whether the CBAM will include agricultural products in the future. It could be applied to paper products, which are included in

Term	Definition	Source	See also	Comments
	been produced under the EU's carbon pricing rules. The purpose of the CBAM is to reduce the risk of international leakage and create a level playing field for EU-based producers. The CBAM will commence in 2023, with a 3-year transition period. Importers will pay financial adjustments from 2026. The CBAM will not apply to agriculture products. In 2026, the Commission will evaluate whether to extend the scope to include other products. Other countries (US, Canada, Japan) are considering similar measures.			the current EU emission trading scheme, while agricultural products are not.
Carbon credit	Tradeable certificate representing one tonne of *carbon dioxide equivalents (CO_2e)* in *GHG emission* reductions or *GHG removals* Carbon credits are generated by *abatement* projects, and quantified relative to a *baseline*. In Australia, *ERF* projects generate carbon credits, called *ACCUs*. Carbon credit schemes commonly apply integrity criteria to ensure that the abatement is genuine, for example, ensuring *additionality* and *permanence*, avoiding double-counting and *leakage*. Carbon credits are commonly purchased to *offset* GHG emission of the purchasing entity.	ISO, 2022	*Offset*	
Carbon dioxide (CO_2)	A naturally occurring greenhouse gas, that is also a by-product of burning fossil fuels (such as oil, gas and coal), of burning *biomass*, of land use changes and of industrial processes (e.g., cement production). It is the principal *anthropogenic greenhouse gas* that affects the Earth's radiative balance. It is the reference gas against which other GHGs are measured and therefore has a *Global Warming Potential* (GWP) of 1.	IPCC, 2022a		
Carbon dioxide equivalent (CO_2e)	unit for comparing the radiative forcing of a *GHG* to that of *carbon dioxide* The carbon dioxide equivalent is calculated as the mass of a given *GHG* multiplied by its *global warming potential*	ISO, 2022		
Carbon dioxide removal	*Anthropogenic* activities that remove *carbon dioxide* from the atmosphere and durably store it in geological, terrestrial or ocean *reservoirs*, or in products. CDR methods include afforestation, reforestation, *biochar*, bioenergy with carbon dioxide capture and storage (BECCS), *soil carbon sequestration*, enhanced weathering, direct air carbon capture and storage (DACCS), ocean alkalinisation and ocean fertilisation. A carbon dioxide removal activity initiates a *sink* process that leads to *GHG removals*.	IPCC, 2022a	*Carbon sequestration*	Synonym: Negative emissions technology. Many CDR methods offer opportunities for the land sector.
Carbon Farming Initiative	a voluntary scheme that operated between 2011 and 2014, to encourage adoption of measures to reduce *GHG emissions* and sequester *carbon* in the land sector, through which projects undertaken using approved methodologies could be awarded *ACCUs*,	Modified from GrainGrowers, 2021		

Term	Definition	Source	See also	Comments
CFI	that could be purchased via a reverse auction by the Commonwealth Government or sold on the voluntary *offsets* market. Superseded by the *Emissions Reduction Fund* (ERF). The CFI Act and associated legislative instruments continue to govern the ERF.			
Carbon footprint	Sum of *GHG emissions* minus *GHG removals* of the subject expressed as *carbon dioxide equivalents (CO_2e)*. The subject could be a product or an organisation. Where the subject is an organisation, such as a company, the *carbon* footprint often includes *indirect emissions* also known as *scope 2* and *scope 3* emissions. Where the subject is a product, the carbon footprint includes the emissions and removals across the product life cycle.	Modified from ISO, 2022		Sometimes applied to *carbon dioxide* only, rather than all *greenhouse gases*.
Carbon negative, carbon positive	Condition in which net CO_2 emissions are negative or positive, respectively. These terms are sometimes used to suggest that an activity, organisation or product has a positive or negative impact on the climate, respectively. These terms are ambiguous and used inconsistently. For example, sometimes carbon positive is used to refer to the desirable situation in which net emissions are negative. Sometimes these terms refer to all GHGs rather than just to CO_2.			These terms are not used in this project, due to their ambiguity.
Carbon neutrality **Carbon neutral**	IPCC definition: Condition in which *anthropogenic carbon dioxide* (CO_2) *emissions* associated with a subject are balanced by anthropogenic CO_2 *removals*. Common usage e.g. *Climate Active*, ISO Carbon neutrality standard: Condition in which *anthropogenic GHG emissions* associated with a subject are balanced by anthropogenic *GHG removals.* Achieving carbon neutrality commonly involves *offset*ting residual emissions through the purchase of carbon credits to counterbalance residual emissions. The subject can be an entity such as a country, an organisation, a district or a commodity, or an activity such as a service or an event. For a company: Carbon neutrality assessment includes the *emissions* and *removals*, over a specified period, for which the company has direct control, and may also include "*scope 3*" *emissions* and other *indirect emissions*, as specified by the relevant scheme. For a product: Carbon neutrality is assessed over the life cycle of the product, although the use phase and disposal are sometimes excluded. For a country, state or local government: Carbon neutrality is assessed on a territorial basis, including direct emissions and removals occurring within the territory, over a specified period. The term net zero (CO_2 or GHG) is more commonly applied to the territorial perspective.	IPCC, 2022a	Figure 2; *net zero CO_2 emissions;* *GHG neutrality*	Note that "carbon neutrality" is often used as a synonym for *GHG neutrality* but the definitions put forward by *IPCC* make the distinction clear. Carbon neutral certification under the Climate Active program includes all *greenhouse gas*es. The term 'carbon neutral' typically refers to the footprint perspective, which includes both emissions and removals outside the direct sphere of influence of the reporting entity, and neutrality is achieved through the purchase of *carbon credits*, to counterbalance *residual (net) emissions*. In contrast, the term "*net zero CO_2 emissions*" is commonly used in the territorial perspective, to indicate that the CO_2 emissions and removals for which the reporting entity has

Term	Definition	Source	See also	Comments
	Rules specified by carbon neutrality certification schemes for quantification of CO_2 /GHG *emissions* and *removals* have a significant influence on the achievement of *carbon neutrality*.			direct control balance each other out. Note, however, that these terms are not used consistently in practice. Note also that, at a global scale, *carbon/GHG neutrality* and *net zero CO_2/GHG emissions* are equivalent.
Carbon sequestration	The process of removing *carbon* from the atmosphere and transferring it to a carbon *pool* such as vegetation, soil, ocean or geological formation. Carbon can be sequestered through natural and *anthropogenic* processes. In *national inventory reporting* and many other contexts the carbon uptake by annual plants and herbaceous perennial plants , such as grasses, is excluded because it is usually returned to atmosphere within a short period (<10 years, often <1 year).	IPCC, 2022a	*Carbon dioxide removal*; *Sink;* *Soil carbon sequestration*	
Carbon stock	The mass of *carbon* in a carbon *pool*. Carbon stock in vegetation and or soil is often expressed as mass per unit area. For *soil carbon* stock, it is also necessary to specify the depth; commonly soil carbon stock is expressed to 30cm, the default depth in the IPCC guidelines for *national inventory reporting*. Sometimes soil carbon stock is expressed per mass of soil, to take into account differences in soil bulk density that can confuse assessment of change in soil carbon stock. The change in carbon stock over a period indicates the CO_2 *emissions* or *removals* from the pool. A decline in carbon stock indicates an emission; an increase in carbon stock indicates a removal.			
Carbon trading	See *emissions trading*			
Clean energy regulator	The Commonwealth Government body that administers the *ERF*.			
Climate Active	A program operated by the Commonwealth Government that awards *carbon neutral* certification to organisations, products, buildings, precincts and events. Note that the definition of *carbon neutrality* used in this scheme includes all GHGs, not just CO_2.			
Climate neutrality	The condition in which an activity, organisation or product has no net effect on the climate. This situation has been deemed difficult to assess, as climate change effects		*Carbon negative,*	Climate neutrality is not used in the project as it is considered

Term	Definition	Source	See also	Comments
Climate negative **Climate positive**	encompass a very broad range of aspects, that are influenced by a broad range of drivers. Related terms "climate negative" and "climate positive" are sometimes used to suggest that an activity, organisation or product has a negative or positive impact on the climate. These are also difficult to assess.		*carbon positive*	ambiguous and difficult to quantify. The Red Meat Industry uses the term climate neutrality and has defined climate neutral as follows: "Climate neutral means not causing additional global temperature rise. The measurement unit is tonne of carbon dioxide warming equivalent (tCO_2we) emissions." According to this definition a climate neutral position can be characterised by achieving and maintaining 0 tCO_2we and indicates there is no contribution to global temperature rise.
Climate solutions fund	Funding of AU $2b to extend the *Emissions Reduction Fund*, announced by the Commonwealth Government in 2019 as part of the Climate Solutions Package, intended to support Australia to meet its 2030 Paris Agreement *abatement* target.			
CO_2 equivalent	See *carbon dioxide equivalent*			
Crediting period	In the *ERF*: the period of time a project is able to apply to claim *ACCU*s.			
Decarbonisation	Actions to reduce GHG emissions from human activities. Commonly applied at sectoral level, especially the energy sector, or to the whole economy of a country, or globally.			
Direct emissions	*GHG emissions* from sources owned or controlled by the reporting entity. Agricultural examples include GHG emissions from burning diesel in farm machinery, the release of N2O from bacteria breaking down crop residues or N fertilisers. Also called Scope 1 emissions.	ISO, 2022; GrainGrowers, 2021	Scope 1 (synonym) Contrast: *Indirect emissions*	Synonym: Scope 1 emissions Note that in *national inventory reporting* (e.g. *NGGI*) the terms direct and indirect are used differently. For example, in the

Term	Definition	Source	See also	Comments
				context of agricultural *nitrous oxide* (N_2O) emissions, direct emissions of N_2O refer to N_2O emitted from the site of N application, and indirect N_2O results from N volatilised as ammonia or translocated by leaching and runoff, that is converted to N_2O elsewhere.
Embedded emissions	Life cycle GHG *emissions* associated with the production of a product. Usually considers all life cycle stages prior to use by the consumer, that is, emissions from raw material acquisition, processing and transport, minus *carbon* sequestered.			Synonym: Embodied emissions
Emissions factor	A [representative value] [coefficient] that quantifies the GHG *emissions* or *removals* per unit of an activity. Example: number of kg CO_2e emitted per l of diesel combusted in a heavy vehicle conforming to Euro 5 design standards	IPCC, 2022		
Emissions intensity	The quantity of *emissions* per unit of production. Example: number of kg CO_2e emitted per tonne of grain at farm gate. Emissions intensity can be expressed per unit of total mass, mass of protein or energy, or dollar value of production.			
Emissions reduction fund **ERF**	A voluntary scheme that aims to provide incentives for organisations and individuals to adopt new practices and technologies to reduce their *GHG emissions* or *sequester carbon*. Superseded the *Carbon Farming Initiative*. Under the ERF, *ACCUs* are issued for projects that meet rules for eligible activities set out in "methodology determinations", legislative instruments commonly known as "methods".		*Carbon farming initiative*	
Emissions trading	Buying and selling *carbon credits* generated by activities that reduce *GHG emissions* or achieve *GHG removals*. Emissions trading in Australia occurs through the sale of *ACCUs*, via the *ERF* or on the voluntary *offsets* market.			Also referred to as carbon trading
Functional unit	In life cycle assessment: unit of production used as a reference that reflects the function of a product or service Example: paint to cover 1m^2 of plasterboard (rather than 1 litre of paint, reflecting the function of paint); 1 km driven by a standard passenger vehicle (reflecting the transport			

Term	Definition	Source	See also	Comments
	service for which the fuel is acquired; when comparing E10 and petrol, this reference takes into consideration the lower energy content of ethanol)			
Global warming potential **GWP**	An index measuring the radiative forcing following an emission of a unit mass of a GHG, accumulated over a chosen time horizon, relative to that of the reference substance, *carbon dioxide* (CO_2). The GWP represents the combined effect of the differing times that GHGs remain in the atmosphere and their different effectiveness in causing radiative forcing, that is, in heating the Earth's atmosphere. GWP is measured in units of carbon dioxide equivalents (CO_2e). The most common time horizon is 100 years (GWP100). Parties to the UNFCCC have agreed to use GWP100 values from the IPCC's Fifth Assessment Report (AR5) or GWP100 values from a subsequent IPCC Assessment Report to report aggregate emissions and removals of GHGs under the Paris Agreement. In addition, parties may use other metrics to report supplemental information on aggregate emissions and removals of GHGs.	IPCC, 2022a	*Greenhouse gas emission metric*	
Greenhouse gas **GHG**	Gaseous constituent of the atmosphere, either natural or *anthropogenic*, that absorbs and emits radiation at specific wavelengths within the spectrum of radiation emitted by the Earth's surface, by the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapour (H_2O), *carbon dioxide (CO_2)*, *nitrous oxide (N_2O)*, *methane (CH_4)* and ozone (O_3) are the primary GHGs in the Earth's atmosphere. Human-made GHGs include sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs), chlorofluorocarbons (CFCs) and perfluorocarbons (PFCs). Emissions of CO_2, methane, nitrous oxide, HFCs, nitrogen trifluoride, PFCs and sulphur hexafluoride are reported under the UNFCCC and aggregated into carbon dioxide equivalents (CO_2e) using *global warming potentials* (GWPs). Water vapour and ozone, which are *anthropogenic* as well as natural *greenhouse gas*es, are not included in reporting under the UNFCCC. GHGs differ in their radiative efficiency (potency as a GHG) and their atmospheric lifetime.			
Greenhouse gas account **GHG account**	Chart of accounts that reports the inventory of *GHG emissions*, detailing the *emissions* and *removals* of each *GHG*, from each *source* and *sink* process, over a specified period. *GHG accounts* usually report *emissions* and *removals* over a period of one year. For agricultural systems, that are often subject to wide annual variation, the data are often derived by averaging over a period of five or ten years.			

Term	Definition	Source	See also	Comments
Greenhouse gas emission **GHG emission**	release of a *GHG* into the atmosphere. GHG emissions result from a GHG *source*.	ISO, 2022	*source*	
Greenhouse gas management hierarchy	Priority order of actions to achieve *carbon neutrality*: 1. Reduce *GHG emissions* 2. Remove CO_2 by implementing *carbon dioxide removal* methods 3. *Offset residual emissions* through purchase *of carbon credits*		Figure 3, Figure 4	
Greenhouse gas emission metric	A simplified relationship used to quantify the effect of emitting a unit mass of a given *GHG* on a specified measure of climate change. A relative GHG emission metric expresses the effect from one gas relative to the effect of emitting a unit mass of a reference GHG on the same measure of climate change. There are multiple emission metrics, and the most appropriate metric depends on the application. GHG emission metrics differ with respect to (i) the key measure of climate change they consider, (ii) whether they consider climate outcomes for a specified point in time or integrated over a specified time horizon, (iii) the time horizon over which the metric is applied, (iv) whether they apply to a single emission pulse, emissions sustained over a period of time, or a combination of both, and (v) whether they consider the climate effect from an emission compared to the absence of that emission or compared to a reference emissions level or climate state. Most relative GHG emission metrics (such as the *global warming potential* (GWP), global temperature change potential (GTP), global damage potential, and GWP*), use *carbon dioxide* (CO_2) as the reference gas. Emissions of non-CO_2 gases, when expressed using such metrics, are expressed in *carbon dioxide equivalents* (CO_2e). A metric that establishes equivalence regarding one key measure of the climate system response to emissions does not imply equivalence regarding other key measures. The most common GHG emission metric used is the GWP100, that is, the global warming potential assessed over a 100-year time horizon. This is the metric used for *national inventory reporting*. Under the Paris Rulebook *UNFCCC* parties have agreed to use GWP100 values from the IPCC fifth assessment report (AR5) or GWP100 values from a subsequent IPCC Assessment Report as the *GHG emissions metric* used to report aggregate emissions and removals of GHGs. In addition, parties may use other metrics to report supplemental information on aggregate emissions and removals of GHGs.	IPCC, 2022a	*Global warming potential*	

Term	Definition	Source	See also	Comments
Greenhouse gas footprint **GHG footprint**	See *carbon footprint*			
Greenhouse gas neutrality **GHG neutrality**	Condition in which *anthropogenic GHG emissions* associated with a subject are balanced by anthropogenic *GHG removals*. The subject can be an entity such as a country, an organisation, a district or a commodity, or an activity such as a service or an event. Achieving greenhouse gas neutrality often relies on the supplementary use of *offsetting* to balance *residual emissions*. For a company: GHG neutrality assessment includes the GHG *emissions* and *removals*, over a specified period, for which the company has direct control, and may also include *indirect emissions* ("*scope 3*" *emissions)*, as specified by the relevant scheme. For a product: GHG neutrality is assessed over the life cycle of the product. For a country, state or local government: GHG neutrality is assessed on a territorial basis, including direct GHG emissions and removals occurring within the territory, over a specified period. The term *net zero GHG* is more commonly applied to the territorial perspective. The quantification of GHG emissions and removals depends on the GHG emission metric chosen to compare emissions and removals of different gases, as well as the time horizon chosen for that metric. *Greenhouse gas neutrality* and *net zero greenhouse gas emissions* are overlapping concepts. At a global scale, greenhouse gas neutrality and net zero greenhouse gas emissions are equivalent. At sub-global scales, net zero GHG emissions is generally applied to emissions and removals under direct control or territorial responsibility of the reporting entity, while GHG neutrality generally includes emissions and removals within and beyond the direct control or territorial responsibility of the reporting entity. Rules specified by GHG neutrality certification schemes for quantification of GHG emissions and removals have a significant influence on the achievement of GHG neutrality.	Adapted from IPCC, 2022a	Figure 2, *Carbon neutrality*, *Greenhouse gas emission metric*, *Net zero GHG emissions*	This IPCC definition, which explicitly refers to all GHGs, is applied to the term "carbon neutrality" in some initiatives, such *as Climate Active* and the ISO standard on carbon neutrality.
Greenhouse gas Protocol **GHG Protocol**	An initiative of the World Resources Institute and the World Business Council on Sustainable Development that provides standards, guidance and tools for quantifying organisation-level GHG inventories			
Greenhouse gas removal **GHG removal**	Withdrawal of a *GHG* from the atmosphere by a *sink*	ISO, 2022		

Term	Definition	Source	See also	Comments
Indirect emissions	*GHG emissions* that are a consequence of the organisation's activities, but that arise from GHG *sources* that are not owned or controlled by the organisation. Indirect emissions occur upstream and/or downstream of the farm, across the value chain, and include emissions from manufacture of inputs such as fertiliser, and from processing of products, such as abattoir operations or milling. Indirect emissions also include emissions outside the value chain that are induced by change in demand for (or supply of) products produced or sourced by the organisation.	ISO, 2022 GrainGrowers, 2021	Scope 3 *leakage*	Scope 3 emissions are indirect emissions that occur within the value chain. Scope 3 excludes indirect emissions resulting from market-mediated effects.
Insetting	Emissions reduction or *carbon sequestration* through management of GHG *sources* and GHG *sinks* within the value chain the reporting entity. Insetting occurs when a company *offsets* its emissions using *abatement* occurring within its own value chain. The definition of insetting varies between schemes. Under *Climate Active*, insetting refers to management of GHG *sources* and GHG *sinks* within the emission boundary, that reduce the net *GHG emissions* of that enterprise.		*Offset*	
Inventory boundary	(for *reporting* or *accounting*): Boundary specifying which *GHG emission*s and *GHG removal*s are accounted and reported by the organisation. GHG accounting and reporting boundaries can have several dimensions, i.e. organizational, operational, geographic, business unit, and target boundaries.	Adapted from GHG Protocol		
Inter-governmental Panel on Climate Change **IPCC**	An intergovernmental body of the United Nations established in 1988 to provide scientific information on *anthropogenic* climate change, including the impacts and risks, and possible response options. The IPCC does not conduct original research but rather undertakes periodic, systematic reviews of published literature. IPCC reports are prepared by thousands of scientists and other experts who volunteer to assess the science related to climate change. The IPCC is governed by its member states through an elected bureau of scientists, who select the authors for each report from nominations received from governments and observer organisations. The IPCC periodically produces assessment reports and also produces Special Reports within each assessment cycle. The IPCC also produces Guidelines for preparation of national *greenhouse gas* inventories.			
Kyoto Protocol	A legally-binding instrument made under the UNFCCC, adopted at the third meeting of the convention (COP 3) in 1997. The Kyoto Protocol obliged developed countries (known as 'Annex I Parties') to meet *GHG emission* targets. It entered into force in 2005. The first Kyoto Protocol commitment period ran from 2008 to 2012, and the second from 2013-2020. Australia signed the Kyoto Protocol in 1998 but did not ratify until 2007. While most other Annex I parties agreed to reduce their emissions compared with the 1990		*UNFCCC, Paris Agreement*	

Term	Definition	Source	See also	Comments
	baseline, Australia's target was to limit increase in *GHG emission*s to 108 per cent of the 1990 emissions. Australia also negotiated for Article 3.7 in the Kyoto Protocol, which became known as the Australia Clause. This Article allowed nations for which the *land use, land use change and forestry (LULUCF)* sector was a net source of emissions in 1990 to add these emissions to their base-year calculations. Australia was one of the few nations that were in this position in 1990 and Australia benefitted the most from this clause. Australia committed to reducing GHG emissions to 99.5 per cent of 1990 levels during the second commitment period (2013–20), thereby committing to reducing emissions by 5 per cent below 2000 levels by 2020.			
Land use, land use change and forestry **LULUCF**	Inventory sector in which *GHG emissions* and *GHG removals* due to land clearing, afforestation and reforestation, forest management, establishing plantations or tree crops, controlled burning and wildfire, and CO_2 emissions and removals due to changes in *soil carbon* stocks in forest and agricultural land are reported.			
Land use change	Change in land use category, such as conversion from forest to cropland or grassland. Land use change can cause *GHG emissions*, such as through land clearing, or *removals*, such as though reforestation. Direct land use change is land use change that occurs on land owned or controlled by the organisation, due to the activities of the organisation. Indirect land use change is land use change that occurs outside the value chain, that is induced by change in demand for (or supply of) products produced or sourced by the organisation.			Land use change that occurs on land outside the ownership or control of the organisation, but within the value chain is classed as direct land use change in some schemes (e.g. draft GHG Protocol land sector and removals guidance), and indirect in others.
Leakage	An increase in emissions that results indirectly from mitigation actions. Leakage can include increased *GHG emissions* upstream or downstream in the value chain (such as increased emissions from fertiliser production if a landholder applies more fertiliser to lift pasture growth to sequester more *soil carbon*), or through market-mediated effects (such as land clearing triggered by converting land use from food production to biofuel production or adoption of lower-intensity production practices to boost soil carbon, known as indirect land use change)			
Life cycle assessment **LCA**	Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle. Life cycle refers to "cradle-to-grave": the consecutive and interlinked stages, from raw material acquisition or generation from natural resources to final disposal or recycling.	ISO 14044		

Term	Definition	Source	See also	Comments
	In LCA of farm products, partial LCA is common, often covering cradle to farm gate.			
Methane **(CH_4)**	A potent *greenhouse gas* with short atmospheric lifetime. Methane is the major constituent of natural gas. Livestock production and paddy rice are significant methane sources. Methane is produced naturally when organic matter decays under anaerobic conditions, such as in wetlands. Under future global warming, there is potential for increased methane emissions from thawing permafrost, wetlands and sub-sea gas hydrates. Methane is classed as a *short-lived climate pollutant*.	Adapted from IPCC, 2022a		
Method	In the *UNFCCC*: refers to the procedures for measurement and estimation of *GHG emissions* and *removals*. In contrast, the *approach* defines WHAT is being estimated and reported in an inventory and by WHOM (determined by the *system boundary*), while the method describes HOW the reported values are derived, that is, the techniques used in estimation. In the *ERF*: "methods" are the documents prescribing the rules for eligible activities and quantification of *abatement*, for each project type. Methods are set out in legislative instruments formally called "methodology determinations".	UNFCCC, 2003; Cowie et al, 2006	*Approach*	
Metric	See *greenhouse gas emission metric*			
Mitigation	*GHG removals* by *sinks* and/or reduction in *GHG emissions* by *sources*		Synonym: *Abatement*	Some users restrict mitigation to emissions reduction only
Monitoring, Reporting and Verification **Measurement, reporting and verification** **MRV**	Procedures for quantification, documentation and independent evaluation of GHG inventories, in the context of *national inventory reporting*, *emissions trading* and *carbon/GHG neutrality* claims.			
National Greenhouse and Energy Reporting **NGER**	A national scheme for reporting and disseminating company information about *greenhouse gas emission*s, energy production and energy consumption. Facilities with annual emissions over 25 kt CO_2e, or corporate groups with emissions over 50 kt CO_2e, are required to undertake NGER reporting.			

Term	Definition	Source	See also	Comments
National greenhouse gas inventory	The inventory prepared annually according to *IPCC* Guidelines that quantifies annual *GHG emissions* and *GHG removal*s on a territorial basis, for Australia. Inventories are also prepared for each state and territory. The inventory data are available from the Australian Greenhouse Emissions Information System (AGEIS).			In the Methods and Data Guidance (Sevenster et al. 2023), the abbreviation NGGI is used.
National inventory report	The report prepared and submitted annually to the UNFCCC that presents the *national greenhouse gas inventory*. The national inventory report includes supplementary information to demonstrate Australia's progress towards its emissions reduction target (Kyoto Protocol and Paris Agreement). That is, it includes data for both *reporting* and *accounting* to the UNFCCC. The report presents *GHG emissions* and *removals* for each of the sectors specified in the *IPCC* Guidelines for national inventory reporting. GHG emissions and removals associated with agriculture are reported in three sectors: • Agriculture, which includes *methane* emissions from livestock, manure management and rice production; *nitrous oxide* emissions from soil; CO_2 emissions from lime and urea application; and emissions from savanna burning and residue burning. • Land use , land use change and forestry (LULUCF), which reports emissions and removals due to land clearing, afforestation and reforestation, forest management, tree crops, controlled burning and wildfire, and *soil carbon sequestration.* • Energy, which reports fuel combustion and electricity use.			
National inventory reporting	Preparing and submitting a *national inventory report*			
Nationally determined contribution NDC	(Under the *UNFCCC*) National plans that specify a party's self-determined target for GHG emissions reduction under the Paris Agreement, and describe how it intends to meet the target, and to assess progress. Australia has committed to reduce emissions by 43% below 2005 levels by 2030, and to reach *net zero GHG emissions* by 2050.			
Negative emissions technology	See *Carbon dioxide removal*			

Term	Definition	Source	See also	Comments
Net GHG emissions	*GHG emissions* minus *GHG removals*		Figure 1	
Net zero CO_2 emissions	Condition in which *anthropogenic carbon dioxide (CO_2)* emissions are balanced by anthropogenic CO_2 removals over a specified period. *Carbon neutrality* and net zero CO_2 emissions are overlapping concepts. See *carbon neutrality* for explanation of the differences.	IPCC, 2022a	Figure 2, *Carbon neutrality,* *Net zero GHG*	
Net zero GHG emissions	Condition in which *GHG emissions* are balanced by *GHG removals* over a specified period. For a company: Net zero GHG assessment includes the GHG *emissions* and *removals*, over a specified period, for which the company has direct control, and may also include *indirect emissions* ("*scope 3*" *emissions)*, as determined by the relevant scheme. The term GHG neutrality is also applied to the company perspective, with the same meaning. For a country, state or local government: Net zero GHG is assessed on a territorial basis, including GHG emissions and removals occurring within the territory, over a specified period. The quantification of net zero GHG emissions depends on the GHG emission metric chosen to compare emissions and removals of different gases, as well as the time horizon chosen for that metric. *GHG neutrality* and net zero GHG emissions are overlapping concepts. See *GHG neutrality* for explanation of the differences.	IPCC, 2022a	Figure 2	
Nitrous oxide (N_2O)	A long-lived, potent *greenhouse gas*. Agriculture is the major *anthropogenic* source, particularly from use of organic and chemical nitrogen fertilisers, decomposition of biomass residues, livestock urine and manure management. Nitrous oxide is also produced naturally, especially from microbial activity in soils in warm wet environments, as a component of the nitrogen cycle.			
Offset	(noun) A reduction, avoidance or *removal* of a unit of *greenhouse gas* (GHG) emissions by one entity, used by another entity to counterbalance a unit of GHG emissions by that other entity. Offsets are usually represented by a *carbon credit* that has been retired or cancelled in a register by or on behalf of the entity to counterbalance its *residual GHG emissions*	IPCC, 2022a; ISO, 2022	Figure 4 *ACCU* *Carbon credit*	

Term	Definition	Source	See also	Comments
	Generation of carbon credits and use of offsets are commonly subject to rules and environmental integrity criteria intended to ensure that offsets achieve their stated mitigation outcome. Relevant criteria include *additionality*, the avoidance of double counting, double-claiming and *leakage*, use of appropriate *baselines*, and *permanence* or measures to address impermanence. *ACCUs* are purchased as offsets on the voluntary *emissions trading* market.			
Offsetting	counterbalancing *residual emissions* by retiring or cancelling a *carbon credit*(s) in a public registry			
Paris Agreement	Legally binding international treaty on climate change made under the *UNFCCC*. It was adopted by 196 Parties at UNFCCC COP 21 in Paris, in 2015 and entered into force in 2016. Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. Under the Paris Agreement (2021-2030), Australia has pledged to cut emissions by 43 per cent compared with 2005 emissions. Based on a 43% reduction by 2030, Australia's emissions budget for this period is 4,381 Mt CO_2-e.		*UNFCCC, Kyoto Protocol*	
Payments for ecosystem services (PES)	Arrangements through which the beneficiaries of environmental services such as catchment protection, habitat conservation and *carbon sequestration*, reward those whose lands provide these services with subsidies or market payments.			
Permanence	In *carbon credit* schemes: refers to measures applied to manage the risk of reversal of *carbon dioxide removals*, such as requirements to maintain sequestered carbon in vegetation or soil pools for 100 years. Under the *ERF*, a 25-year permanence period is permitted, however, if this option is chosen rather than the 100-year option, the number of *ACCUs* issued is reduced by 20%. All *carbon sequestration* projects in the ERF are also subject to the "risk of reversal buffer" which reduces the number of credits issued by 5%, so if a 25-year permanence period is selected the number of credits issued is 25% lower than the quantified *abatement*.		*Carbon credit* *Offset*	
Pool	see *Reservoir*			Synonym: reservoir
Removal	See *Greenhouse gas removal*			

Term	Definition	Source	See also	Comments
Reporting	Under the *UNFCCC* and associated processes: The action of providing the results of the estimation of *emissions* and *removals* to the UNFCCC in a standardized manner. This refers to the *national inventory report*, submitted by parties to the UNFCCC. *IPCC* Guidelines specify *methods* and *approaches* for reporting and *accounting*.	UNFCCC, 2003	*Accounting*	
Reservoir	A component of the climate system that contains *carbon* or a *greenhouse gas (GHG)*. A reservoir has the capacity to hold, accumulate or release a GHG. Soils, oceans, forests and wood products are examples of reservoirs of carbon. Usually excludes the atmosphere. *Carbon dioxide removal* involves a *sink* process, that transfers CO_2 from the atmosphere to a reservoir.	UNFCCC, 1992 Cowie et al. 2006		Synonym: pool
Residual emissions	*GHG emissions* that remain after *mitigation* actions by the organisation are taken into account.			
Residue	An output of a production system that has a use but not an economic value. An example of a residue is manure which has no economic value at the farm gate without further processing but has subsequent use as a fertiliser. In *life cycle assessment*, a residue is not a waste; waste is defined as an output that has neither an economic value nor any other type of use. In legislation, such as environmental protection, residues are sometimes defined and treated as wastes.	ISO, 2006; FAO, 2016		
Safeguard Mechanism	An element of Australia's climate change policy, the Safeguard Mechanism requires Australia's largest *greenhouse gas* emitters to keep their net *GHG emissions* below an emissions limit (a *baseline*). The safeguard mechanism applies to facilities with *scope 1* emissions of more than 100,000 tonnes of *carbon dioxide equivalent* (CO_2e) per year.			
Science-based targets initiative **SBTi**	Initiative that aims to support companies to set *GHG emission* reduction and *net zero* targets in line with climate science and *Paris Agreement* goals. The SBTi is a partnership between CDP, the United Nations Global Compact, World Resources Institute (WRI) and the World Wide Fund for Nature (WWF).			
Scope 1,2,3 emissions	Terminology developed by the Greenhouse Gas Protocol and now adopted broadly, including in *National Greenhouse and Energy Reporting (NGER)* documentation.			

Term	Definition	Source	See also	Comments
	Scope 1 emissions: *direct emissions* arising from sources within the control of the reporting organisation. Scope 2 emissions: *indirect emissions* from the generation of purchased or acquired electricity, steam, heating or cooling consumed by the reporting organisation. For farms, this is predominantly electricity use. Scope 3 emissions: indirect emissions other than scope 2 emissions that occur within the value chain as a consequence of the organisation's activities. For farms, scope 3 emissions are the pre-farm and post-farm emissions, such as from manufacture of urea and herbicides, processing in abattoirs, and refrigerated transport of produce. Scope 3 emissions are not reported under the NGER scheme. Scope 3 emissions that occur outside Australia are not reported in Australia's *national inventory report*. Scope 3 emissions are included in consumption-based *accounting*, that seeks to capture the climate impacts of the manufacture of imported goods.			
Sequester, sequestration	See *carbon sequestration*			
Sink	A process, activity or mechanism that removes a *GHG*, an aerosol or a precursor to a GHG from the atmosphere. A *pool* (*reservoir*) is a sink for atmospheric carbon if, during a given period, more *carbon* is moving into it than is flowing out. Forests and agricultural lands are reservoirs: they can be either a *source* or a sink. A forest is a sink if there is net flow of *greenhouse gas*es into the aggregated forest pools (sum of living *biomass*, litter and soil pools), and it is a source if there is a net flow of GHG to the atmosphere from the aggregated pools.	UNFCCC, 1992 IPCC, 2022a	*Source*	
Short Lived Climate Pollutant	*Greenhouse gas*es and other chemically reactive compounds with short (relative to *carbon dioxide*) atmospheric lifetimes (from hours to about two decades) that directly or indirectly affect radiative forcing. Direct SLCPs include *methane* (CH_4), ozone (O_3), and black carbon (soot).	Adapted from IPCC, 2022		Short lived climate forcer, although this is a broader term that also includes compounds that cause cooling
Soil carbon **Soil organic carbon**	*Carbon* present in the soil carbon pool. Soil carbon usually refers to soil organic carbon. Soil organic carbon is derived from *biomass*, such as leaf litter, dead roots and manure. Carbon constitutes about 50% of the dry mass of soil organic matter. In alkaline soils, carbon can also be present as soil inorganic carbon, e.g., as carbonate.			Soil organic carbon is often abbreviated as SOC. Soil carbon projects under the *ERF* aim to increase the soil organic *carbon stock*.
Soil carbon sequestration	Land management changes undertaken to increase the *soil organic carbon* content, resulting in a net removal of *carbon dioxide* from the atmosphere. Practices include zero	IPCC, 2022a		Also known as soil carbon management

Term	Definition	Source	See also	Comments
	tillage combined with stubble retention; modified grazing/pasture management; ponding to increase moisture retention. Soil carbon sequestration is recognised as a *carbon dioxide removal* (CDR) method.			
Soil organic carbon	See *soil carbon*			
Source	A process, activity or mechanism that releases a *GHG*, an aerosol or a precursor to a GHG into the atmosphere. Forests and agricultural lands are *reservoirs*: they can be either a source or a *sink*. A forest is a sink if there is net flow of *greenhouse gas*es into the aggregated forest pools (sum of living *biomass*, litter and soil pools), and it is a source if there is a net flow of GHG to the atmosphere from the aggregated pools	UNFCCC, 1992 Cowie et al, 2006	*Sink*	
Sustainability framework: principles criteria and indicators	A scheme designed to support sustainable management, comprising a hierarchy of principles, criteria and indicators, focussing on outcomes rather than prescriptive guidance on practices to be applied. 'Principles' are fundamental statements about a desired outcome, that are universally applicable. 'Criteria' are the conditions that need to be met in order to comply with a principle. 'Indicators' are the measurable states which allow the assessment of whether a particular criterion has been met. Suitable indicators are likely to vary depending on context, so should be chosen to suit the specific context.			
System boundary	In *life cycle assessment*: Boundary that specifies which activities are included in the system under study. The system could refer to a product or an organisation, and the boundary could be defined on the basis of area (territorial boundary, as applied in *national inventory reporting*), financial or management control (for organisations) or influence (such as a product life cycle, which includes effects upstream and downstream of production, on cradle-to-grave, or cradle-to-farm gate basis). The system boundary defines which *GHG emissions* and *removals* associated with an organisation or product are included in the assessment.	Adapted from ISO, 2020	*Inventory boundary*	
System expansion	In *life cycle assessment*: An approach that can be used to separately quantify the environmental impacts of one co-product amongst multiple co-products from a production process, as an alternative to *allocation*. All emissions are assigned to the		*Allocation*	

Term	Definition	Source	See also	Comments
	determining product, but a credit is also applied for avoided emissions from the beneficial use of co-products.			
United Nations Framework Convention on Climate Change UNFCCC	International treaty that aims to achieve the stabilization of *greenhouse gas* concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system. One of the three "Rio Conventions" (the others being the Convention on Biological Diversity (CBD) and the United Nations Convention to Combat Desertification, the latter addressing land degradation in the drylands)			

3 Figures

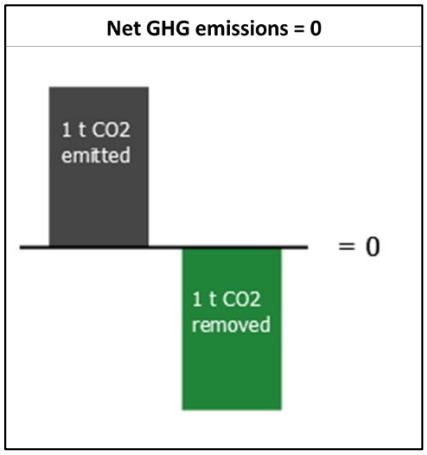

Figure 1: Net GHG emissions. Figure source: NSW DPI

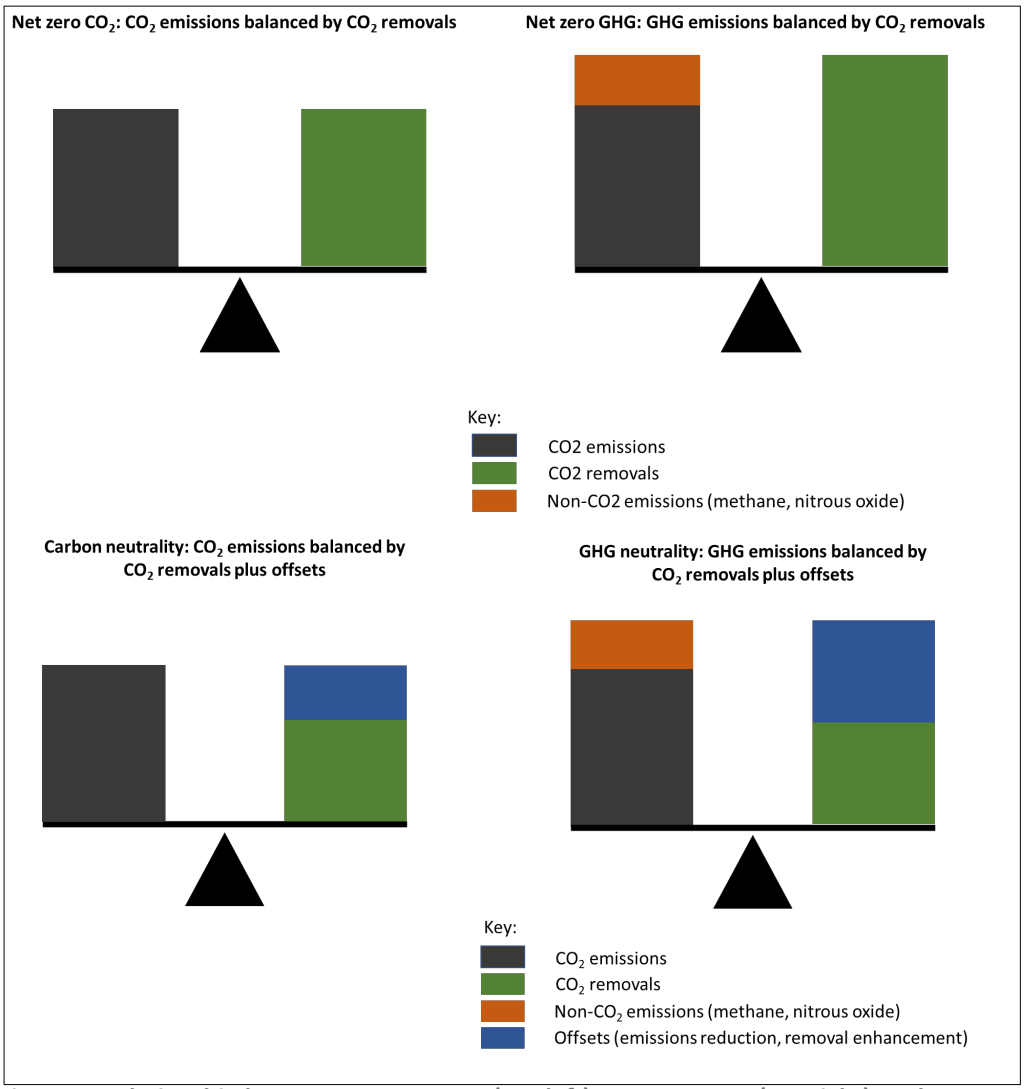

Figure 2: Relationship between net zero CO_2 (top left), net zero GHG (top right), carbon neutrality (lower left) and GHG neutrality (lower right). Figure source: NSW DPI

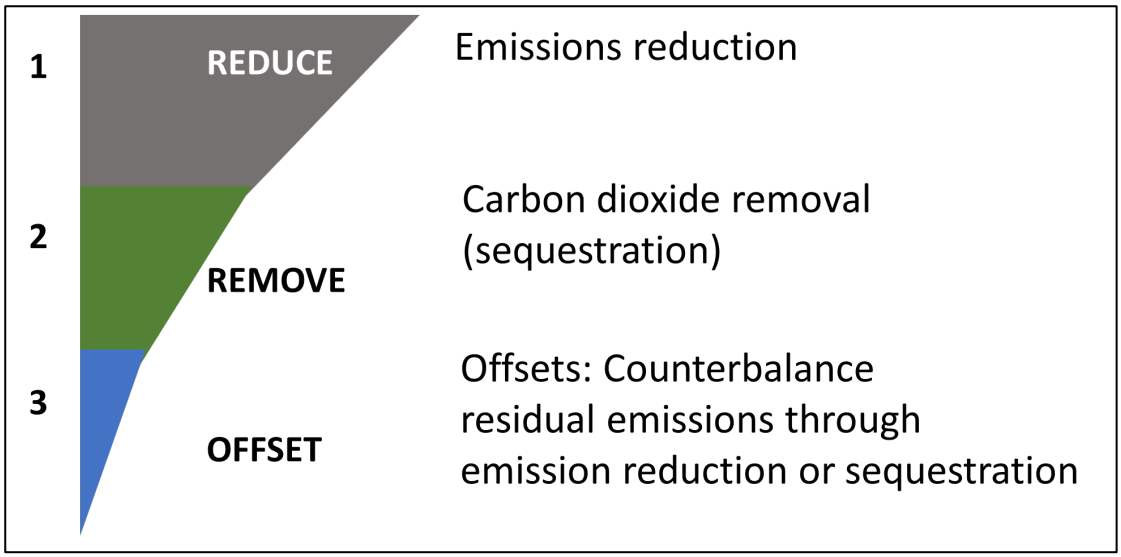

Figure 3: GHG management hierarchy. Figure source: NSW DPI

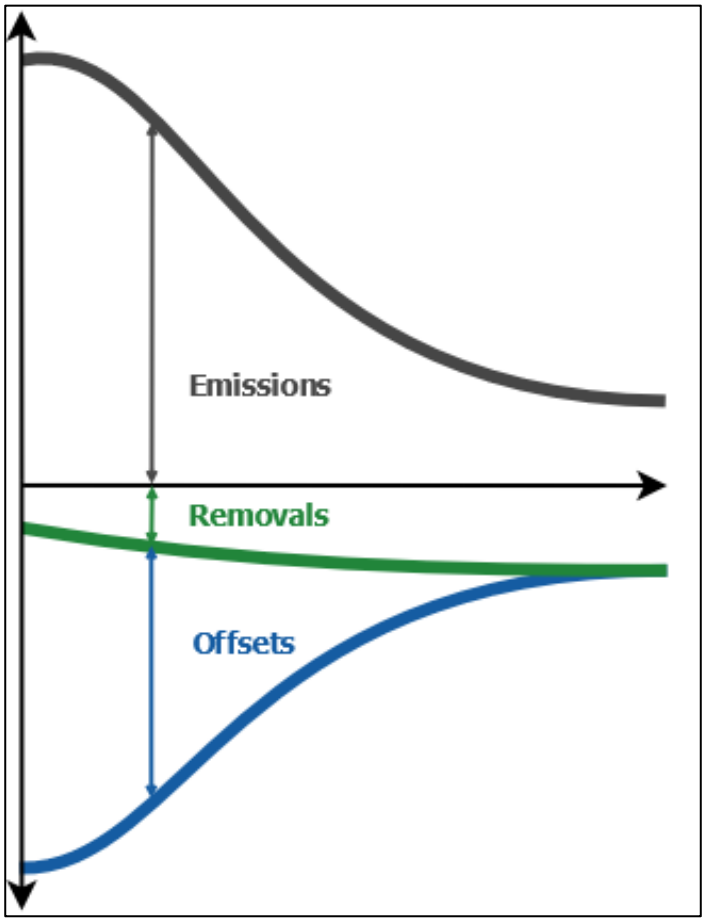

Figure 4: Trajectory showing implementation of GHG management hierarchy: initially offsets are used to balance emissions. Over time emissions are reduced, reducing the need for offsets, and removals are increased to a point where removals balance residual emissions. Figure source: NSW DPI

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