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

**Project Overview &
Non-Technical Summary**

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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1 Introduction

This document accompanies the Methods and Data Guidance (Sevenster et al., 2023) and Common Terminology (Cowie et al., 2023) documents to provide a non-technical description of the project that led to the development of those documents, and an executive summary of the key technical decisions in the Methods and Data Guidance document. It is intended for industry decision makers without expert knowledge of greenhouse gas (GHG) accounting, and to be read in conjunction with the two technical documents.

The need for a common approach to GHG accounting across agricultural sectors was identified in a stakeholder workshop in December 2019 with participants representing most Rural Research and Development Corporations (RDCs), the National Farmers Federation and sector-level peak bodies, federal and state government, AFI, Rabobank and expert consultants. As sector-level reporting was starting to become important (e.g. Mayberry et al. 2018), the lack of clear methodological guidance for this type of GHG accounting was clear.

A collaborative project was developed, initially by the Climate Research Strategy for Primary Industries (CRSPI) collaboration and then by Agricultural Innovation Australia (AIA), who commissioned CSIRO and a large team of subcontractors to conduct an interactive, collaborative process to develop such guidance with broad support from both agricultural sectors and technical experts.

The scope of the project was to develop a consistent common framework for agriculture GHG baseline accounting at sector level (i.e. a Common Approach). Implementation of the framework was not part of the project and is up to each sector individually. While many stakeholders contributed to the development of the Common Approach there is no obligation or commitment on any party to implement it. The Common Approach is a state-of-the-art, best practice guidance for sector-level GHG accounting and can be seen as aspirational; guiding improvements in data collection and GHG reporting over time across Australia's agricultural sectors.

2 Purpose of a Common Approach

Prior to the commencement of this project there was no national guidance for sector-level GHG accounting within Australia, and none was identified internationally following an extensive review.

At the start of the process¹, stakeholders articulated the following key benefits of a Common Approach:

- a consistent approach will enhance trust across supply chains and to end users;
- a united front will give Australian agriculture a strong position toward export markets to set a methodology that adequately reflects the reality of Australian farming;
- a solution to support mixed farming by developing agreed approaches applicable to co-products that come under different RDCs;
- facilitate sharing of data across industries and regions, and elimination of double counting;
- a common, standardised terminology across sectors and regions, and in national forums, will enable clarity and transparency in discussions and demonstrate the agricultural sectors' commitment to emissions monitoring;
- increased efficiency by reducing "method confusion", and tell a more accurate, aggregate story around Australia's emissions from the different agricultural sectors.

In other words, a common approach for GHG accounting across agricultural sectors is essential to enhance consistency, transparency and confidence in sector-level GHG reporting.

In the context of all Common Approach documents, agricultural 'sectors' refer to individual commodities (or commodity groups), as distinguished by the system of levies associated with primary production, including forestry and fisheries. Examples of existing sector-level (baseline) accounts are those for red meat (Mayberry et al. 2018) and grains (Sevenster et al. 2022).

Existing national and international standards deal with GHG accounting at the level of products, corporate entities, projects, events and regions, but not for 'sectors'. Agricultural sectors are defined by the products they produce but entail an annually changing cross-section of entities and regions. For example, a particular farm could be part of the grains sector one year, but in the cotton sector the next. For the same reason, the 'region' defined by all cotton production in one year is not the same as the year before. This means some methodology choices need to be tailor-made for sector reporting, and the Common Approach (as detailed in the Methods and Data Guidance document) does exactly that. The Methods and Data Guidance is written as a technical guidance for GHG accounting experts supporting agricultural sectors in their **sector-level** reporting activities. Even when a sector-level account does not fully meet all requirements recommended in the guidance, consistency and transparency will be enhanced by reporting against a common reference and using a common language.

¹ A more detailed description of workshops and outcomes is provided in 3.3

The Common Approach is recommended to be used to develop GHG accounts for Australian agricultural sectors at national and/or regional level, representing the commodity(ies) produced. It can be used for:

- generating a GHG baseline, as a reference against which to track and report sector-wide GHG emission reductions over time;
- generating GHG emissions accounts for sector-level annual reporting;
- informing national and international stakeholders.

Because of the choices made regarding methodology aspects such as activity data, attributional approach, declared unit, allocation and system boundaries, the Common Approach is not suited for:

- generating carbon footprints of products;
- generating farm-level GHG accounts;
- comparing one agricultural sector to another;
- informing the development of new policy or strategy which would require consequential GHG accounting to avoid any indirect or unexpected effects;
- estimating carbon credits.

3 Process followed

3.1 General principles for agriculture

The Common Approach provides a common framework for GHG accounting of Australian agricultural activities at the sector level. It describes how GHG accounting can be undertaken to generate a transparent and trusted inventory of GHG emissions based on:

- a consistent set of principles, that aligns as much as possible with widely accepted, international frameworks and standards;
- a modular approach to account for differences between agricultural sectors;
- a general guidance on data collection and quality;
- consistent terminology and language.

An extensive screening of guidance frameworks relevant for agriculture in general was conducted (see 3.2). The key national and international overarching frameworks that the Common Approach draws on, where possible, are the Australian National Greenhouse Gas Inventory (NGGI) and its approaches, ISO standards, guidance provided by FAO (Livestock Environmental Assessment and Performance Partnership) and the GHG Protocol. This has allowed for the development of general principles that are consistent and equitable, and which align with existing sector-specific guidance or practice on some key aspects such as allocation. The general principles are described in 4.1.

To develop the Common Approach and supporting documents, the science team began by identifying and examining existing guidance, research and GHG accounting tools, and characterising areas of tension. These areas were discussed with representatives from the RDCs and State and Territory governments through an iterative, collaborative process. Following this engagement the science team drafted the Common Approach and Common Terminology documents, and feedback on these was again sought from the participant stakeholders. The screening and stakeholder interaction processes are described briefly below.

3.2 Screening of existing guidance and practice

Existing guidance, studies, and GHG accounting tools were evaluated based on the primary objective of how different agriculture sub-sectors in Australia currently assess GHG emissions from the activities relevant to them.

This work concentrated on guidance, studies, and GHG accounting tools that considered GHG emissions from the agriculture sub-sectors relevant to Australian contexts and/or international contexts. The documents from international contexts were provided by the sub-sectoral stakeholders as key guidance documents they are applying in Australian contexts. For example, the 'Carbon Footprint Standard for the Dairy Sector' by the International Dairy Federation (IDF, 2022) is used by Dairy Australia. This includes guidance, studies, and GHG accounting tools using the process based LCA method.

A literature search (incorporating guidance, studies, and GHG accounting tools) was conducted to determine how different agriculture sub-sectors in Australia currently assess GHG emissions using the project stakeholder network. In the first stage, the science team of this project requested key literature that is currently being used for assessing the GHG emissions of Australian commodities and sectors.

In the second stage, the collected key literature was classified into the following categories:

- National Greenhouse Gas Inventory Report,
- GHG inventory data development studies,
- LCA studies on carbon footprint assessment,
- LCA tools for carbon footprint assessment,
- Sectoral frameworks/guidelines/certification documents for GHG emissions assessment,
- Sector policies/plans/targets for GHG emissions assessment,
- GHG emission measurement and modelling reports/studies,
- Soil carbon measurement/modelling reports/studies,
- Legislation and government directives,
- Emission, carbon trading/offset programs directives.

In the third stage, the key literature collected was reviewed against the following criteria:

- What perspective (attributorial /consequential) and level (organizational/product) have been adopted?
- What is the scope of the emissions (1, 2, and 3) considered within the system boundary?
- What is the product system boundary (cradle to farmgate, factory gate, port/distribution, retail, or consumer plate)?
- What are the functional unit and reference period of the assessment?
- What resources and activities are excluded or included (capital goods, ancillary services, land use change, vegetation, and soil organic carbon change)?
- What allocation approaches (economic, subdivision, mass/energy-based, system separation, biophysical, etc.) are used for allocating the impacts of multiple products/shared processes?
- Which emissions factors are used?
- Which climate change metric is applied?

In the fourth stage, based on the review of the key literature, key tension areas were identified and discussed with stakeholders from the RDCs and State/Territory governments who participated in the project. These Key tension areas were:

- Common or sector-specific system boundaries

- Baseline reference year
- Consistency of inclusion of changes in land use/vegetation carbon stocks/soil carbon stock
- Basis of allocation for multifunctional processes, including transfer of emissions from one sector to another (e.g., dairy bulls to red meat, cotton seed to red meat, molasses to red meat)
- Approach to assigning emissions from shared processes (e.g. rotations)
- Differences in underpinning emission estimation/measurements

The key tension areas were the focus of subsequent expert meetings and are addressed in the Methods and Data Guidance via key decisions (see 4.1).

3.3 Stakeholder interaction

The project was divided into four phases, although those were not strictly separate in time. The starting phase consisted of screening by the project team (see 3.2), development of a draft set of common terminology definitions and three interactive workshops with the participating stakeholders. The workshops focused on establishing a common purpose for collective action (workshop 1), identifying key principles and tension areas for GHG accounting across agricultural sectors (workshop 2) and discussing common definitions for terminology (workshop 3). This research involved working with people and was granted approval to operate by the CSIRO Ethics Committee before the commencement of workshops and stakeholder engagement.

The drafting phase was used by the team to integrate existing guidance, best practice and sector-specific aspects into the draft Methods and Data Guidance document. The draft recommendations addressing the key principles and tension areas identified earlier in the process were highlighted as key decisions (see 4.1) to facilitate the consultation phase.

The consultation phase started with a briefing workshop and a workshop where participating stakeholders had the opportunity to exchange initial reactions. This was followed by a two-month period for providing a formal response, based on conversations within sectors and with other stakeholders.

Formal responses were received from 11 organisations and indicated full support of the majority of the key decisions. Concerns were raised around a number of issues relating to data collection effort (capital goods, services), lack of data (attribution and allocation for Land Use, Land Use Change and Forestry; GHG credit trades) and completeness (significance cut-off).

In the final phase, the draft Methods and Data Guidance document was modified to provide extra clarity and guidance, and shared with the participating stakeholders. A final stakeholder workshop was held to discuss the remaining concerns and following which general consensus around repositioned recommendations was achieved. Key changes at this stage were to focus on cumulative completeness rather than a cut-off threshold for contributions (Section 2.1.5 of the Methods and Data Guidance) and to soften the requirement for reporting on GHG trades as supplementary information (Section 2.2.3 of the Methods and Data Guidance). The latter change was not to suggest that this information is not important but to acknowledge that options for collecting data at the sector level are limited.

In the final workshop, participants were also asked to share how they might use the Common Approach going forward. Responses are summarised in 4.3.

4 Outcomes

4.1 Key Decisions

Several key decisions are highlighted in the Methods and Data Guidance. Together, these key decisions form a consistent methodology to underpin complete, transparent and fair sector-level GHG accounts. The key decisions are listed in Table 1 and the description below gives a high-level summary of the most important aspects.

Attributional accounting is chosen as the overarching approach because this approach essentially attributes all current emissions to current activities. Alternative approaches include “what if” scenarios that are less appropriate for inventory accounting. A data quality framework has been defined to enable transparency in reporting, given that primary data collection is usually not an option for sector-level accounting. Efforts to improve data quality are best focused on the emission sources that contribute most emissions. For emission inventory calculations, the methods and factors of the national GHG inventory and accounts are adopted. Within the attributional approach, further decisions need to be made about how to partition so-called multi-functional systems between sectors. Because sectors as defined by the RDC levy system are not fully aligned with farming systems this poses some specific challenges. The Methods and Data Guidance provides solutions for various situations that integrate recommendations from several key protocols across sectors. Four general situations are distinguished in which there is overlap or interaction between sectors, as outlined in Figure 1.

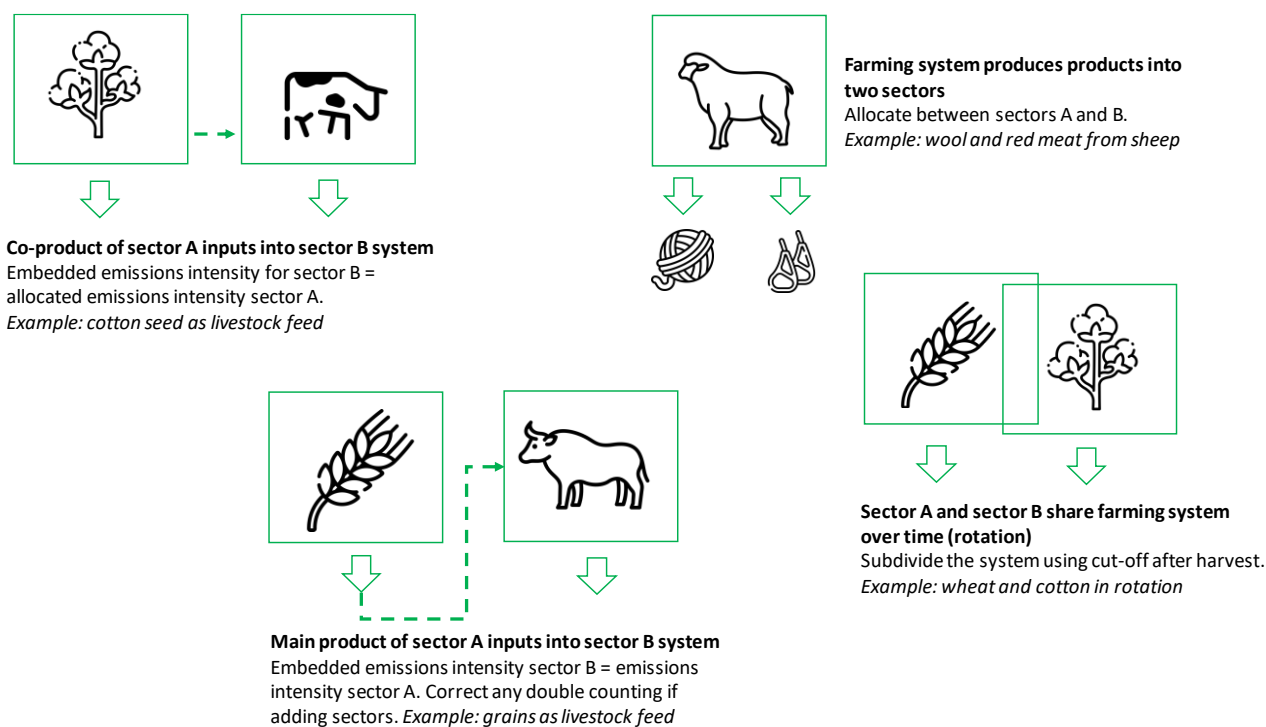


Figure 1 Four general situations in which there are links between sectors (see text for more information)

Where appropriate, the high-level guidance is translated into a specific solution, such as cotton seed as a co-product of the cotton (lint) sector as well as an input to the dairy sector (see Figure 1, upper left). In other cases, the general principles and a decision diagram will allow for resolving allocation issues.

The farming system is the clear anchor point for any agricultural sector and therefore reporting emissions for the system that includes all activities up to the “farm gate” is the minimum requirement. By splitting reporting into Scope 1, 2 and 3 emissions (see Common Terminology) and into emissions and removals, as well as other subcategories, transparency is enhanced.

Finally, to achieve appropriate completeness, all emission sources that contribute more than 1% of total sector emissions need to be included. An exception is made for emissions associated with services such as insurance or consultancy. While an effort should be made to include those, it is acknowledged that this is currently very hard but may become more feasible in future. The GHG “account” emissions include all emissions and removals within the system boundary as well as some attributable removals outside the system boundary such as reforestation on sector-relevant farms. However, supplementary information (estimates) must be provided on any carbon credits that are bought or sold, including for emission reductions, and GHG “target” emissions must be corrected for those.

The Methods and Data Guidance also discusses options for sensitivity assessment. In particular, there may be relatively new practices that are not reflected in generally accepted inventory calculations yet. Demonstrating the potential for emission reduction of those practices via a sensitivity assessment could highlight such gaps and provide the basis for further research that could ultimately lead to updates to national inventory methods.

Table 1: The key decisions regarding principles and tension areas (see 3.3) as highlighted in the Common Approach, with a brief explanation

The Methods and Data Guidance takes precedence in all cases; this table shall not be used as methodological guidance but rather is intended to aid understanding and interpretation of the Methods and Data Guidance

Key methodology issue	Decision adopted in the Methods and Data Guidance	Implications for sector-level emissions accounting
Approach of accounting (decision 2.1.1a)	Attributional LCA approach	In this approach, all emissions for a defined time period are attributed to all activities in that same time period. It is the approach that is most suitable to the goal of sector-level accounting. This choice has implications for inventory calculations and especially allocation choices, which are defined in line with the attributional approach under decisions 2.1.6a and 2.1.6b.
Reporting year and time period 2.1.2a and 2.1.2b)	Baseline reference year shall be one of calendar year (CY) 2005, financial year (FY) 2005, 2006 or the most recent CY/FY that can be assessed following the Method and Data Guidance. A sector-specific accounting time period shall be defined to achieve an appropriate average GHG account representative of the production system in the reporting year.	The year 2005 is used as the reference year for Australia’s contribution under the Paris Agreement, so many sectors aim to align with that. If historical data are limited, a “current” baseline reference is appropriate, with data availability typically lagging behind by a couple of years. It is important that the choice of reference year and accounting time period are appropriate for the sector and clearly documented, but this choice has limited implications for other aspects of the method.
System boundary (decision 2.1.3a and 2.1.3b)	System boundary shall be cradle-to-farm-gate. In addition, processing may be included for sectors where this is recommended and referred to as cradle-to-factory-gate. The farming system is the anchor point for defining Scope 1 emissions, for all sectors, even when post-farm processes are included.	The farming system is central for agricultural sectors. The “farm gate” is the most consistent choice of boundary across sectors and therefore reporting a cradle-to-farm-gate result is essential. It is also consistent and transparent if Scope 1 refers to the on-farm emissions in all reporting. For sectors where further processing is intrinsic and uniform, such as red meat, pork, dairy or wine, additional results for the processed output may be reported as cradle-to-factory-gate.
Inclusion and exclusion of particular emission sources (decision 2.1.3c, 2.1.3d, and 2.1.5a)	Emissions associated with on-farm capital goods shall be included. Emissions associated with the provision of services should be included. All inclusions and exclusions shall be clearly documented, and cumulative completeness of the GHG account shall be estimated and reported, in terms of a percentage of total climate-change impact.	The aim of sector-level accounting is to have as complete an overview of GHG emissions as possible. For some sectors, emissions embedded in on-farm capital goods with relatively short lifetimes can make high contributions to total emissions. The assessment can be based on estimates or secondary data, which means data collection effort does not have to be large. For emissions associated with services such as insurance or consultancy, inclusion is not mandatory (“should” instead of “shall”) but their inclusion or exclusion must be documented in any reporting. The requirement to estimate overall completeness of the GHG account increases transparency about the combined effect of exclusions of (small) emission sources.
Allocation for farming systems shared between sectors (decision 2.1.6a)	Subdivision shall be applied to farming systems shared between sectors due to, e.g., rotations	Subdivision means applying a clean “cut off” between systems, e.g. post-harvest of crop A. Subsequently, all activities and associated emissions are attributed to crop B, etc. This approach is a necessary simplification of highly interactive farming systems. The Methods and Data Guidance discusses this approach in more detail, including limitations which mean it may not be

Key methodology issue	Decision adopted in the Methods and Data Guidance	Implications for sector-level emissions accounting
		appropriate in systems that are less aggregated, such as farm- or commodity level.
Allocation for multifunctional processes (decision 2.1.6b)	For multifunctional processes within the sector system boundary, a distinction between co-products, residual products and waste is made, to allow for consistent treatment of multifunctional processes across different situations in different sectors.	Emissions of waste treatment are attributed to the system producing the waste. Emissions associated with residual products are included in the producing system up to the system boundary (cut off), and any emissions occurring after that boundary are attributed to the receiving system. For co-products with considerable economic value, a share of all emissions of the producing system must be allocated. The Methods and Data Guidance includes a decision tree and guidance on how to implement this.
Consistency of emissions accounting approach (decision 2.2.1a and 2.2.1b)	Inventory calculations shall not be inconsistent with the latest National Greenhouse Gas Inventory (NGGI) report. Alternative emission factors or calculations may be used in sensitivity assessment.	To ensure consistency across different levels of GHG accounting, the NGGI is the primary reference for the calculation of emissions in the GHG account. Methods adopted by the NGGI have passed strict requirements regarding scientific evidence. However, by necessity this means that new evidence may not be adopted very quickly. If certain technologies or new insights are not yet represented in the NGGI inventory methodology, but broadly accepted improved methods or emission factors are available, they may be used if supported by evidence.
Supplementary information (decision 2.2.3a and 2.2.3b)	Carbon credits derived from sector system boundary activities sold to entities outside the sector should be reported as supplementary information. Sectors may also report emissions avoided outside sector system boundary, and carbon sequestration in harvested wood products as supplementary information, following Emissions Reduction Fund (ERF) or NGGI methods.	Reporting trades of carbon credits is best practice to increase transparency around the issue of “double counting”. Emission mitigation achieved within a sector may be sold in the form of credits and claimed outside the sector. Conversely, emission mitigation outside a sector may be triggered by actions within the sector. Both types of effects are reported as “supplementary information” as they are not part of the sector’s physical GHG account.
Emissions from land use, land use change and forestry (decision 2.2.4a, 2.2.4b, and 2.2.4c)	Emissions from direct land use change (dLUC) and land use (LU) shall be included following the NGGI or consistent simulation approach. Carbon sequestration in crop biomass shall only be reported, as supplementary information, for harvested wood products and evaluated using the relevant NGGI method.	Emissions from dLUC and LU shall be included in the baseline, as reduction of those emissions is important. As the emission estimates are likely to have relatively high uncertainty they must be clearly reported as separate emission sources. dLUC in Scope 3 (e.g. animal feed) and Scope 1 (within primary production system) are distinguished in reporting requirements. dLUC includes reforestation as well as deforestation. It also includes increases in carbon stock changes in expanding tree horticulture industries. Carbon stock in crop biomass in stable (non-expanding) systems is not counted as sequestration, but harvested wood products may add to the total carbon pool in the economy and this may be reported as supplementary information.
Climate change metrics (decision 2.3.1a)	The Global Warming Potential value for a 100-year time horizon (GWP100) shall be used in GHG accounts. Alternative metrics may be used in sensitivity assessments.	Climate change metrics like GWP are needed because each greenhouse gas (GHG) (e.g. CO ₂ , N ₂ O or CH ₄) has different impacts, and GHG emissions cannot simply be summed by mass. The suggested GWP100 values have very broad national and international support, and shall be used for the reported GHG account. However, as every metric has limitations in the way it represents actual climate change, a sector may choose to evaluate the overall result using alternative metrics by way of sensitivity assessment.

4.2 Further improvement of consistency and transparency

In the process of drafting the Common Approach the research team identified two challenges the resolution of which is outside the scope of this project as defined in its terms of reference. Consequently the team makes two recommendations: to refine the Common Approach, and to facilitate its adoption and application across agricultural sectors by addressing the lack of easily available disaggregated data for a key emissions category.

The first recommendation is that a list of Scope 3 emission factors for common material and service inputs be developed that can be used by all sectors for increased consistency and transparency. This list could include commonly used inputs from the following groups:

- Fertilisers, such as urea, mono-ammonium phosphate, single super phosphate;
- Soil ameliorants, such as aglime, dolomite, gypsum;
- Crop protection products, including common herbicides, pesticides, fungicides and insecticides;
- Capital goods, such as tractors, irrigation systems, photovoltaic cells, concrete, with guidelines for amortisation;
- Services (if feasible), such as agronomic consultancy, insurance, telecommunications.

The second recommendation is that the lack of easily available disaggregated data for the Land Use, Land Use Change and Forestry category be addressed in collaboration with the Department responsible for the National Inventory. As highlighted by the key decisions described in the Methods and Data Guidance document, the Common Approach requires that land use and land-use change emissions be included in sector GHG inventories, but it is acknowledged that this is currently difficult to implement consistently and transparently, and results are likely to have high uncertainty. An agreed breakdown of the national land use and land use change emissions could be achieved in a separate collaborative project. In addition, attribution and allocation of reforestation (emissions and removals) requires the development of a widely- agreed method; this was beyond the scope of this project as reforestation is largely outside sector boundaries. Part of this might be resolved with involvement of the Department (attribution) but allocation (second situation in Figure 3 in the Methods and data guidance document) is not a National Inventory issue.

4.3 Intended adoption

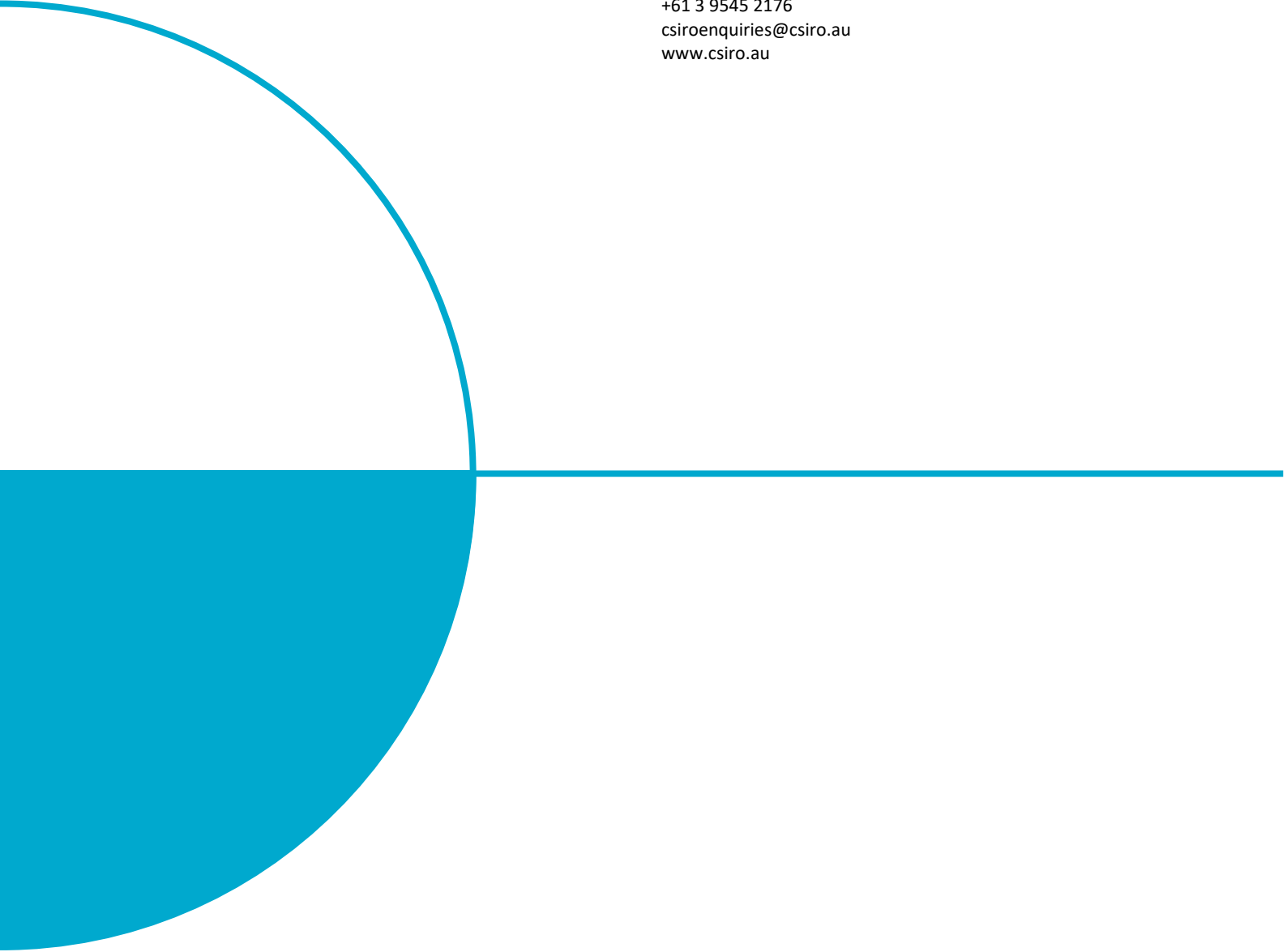
In the final workshop, participants were also asked to share how they might use the Common Approach going forward. Several RDCs are already positioning their GHG accounts to align with the Common Approach or cross-checking the existing methods with the guidance. Some sectors have reasons to deviate from some of the recommendations, while supporting the guidance in its final form. For many sectors the Common Approach may be additionally useful to inform data

collection efforts going forward. The context of sector-level GHG accounting ranges from driving mitigation action within the sector to informing international markets.

Participants foresee that the guidance will also be used for sub-sectors (i.e. commodity subgroups within a levy-defined sector) and for state level emissions accounting and analysis, as coordinated by state departments of primary industries.

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