Final Report

AMPC
AUSTRALIAN MEAT PROCESSOR CORPORATION

Emissions and Climate Gap Analysis

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1.0 Contents

2.0 Executive summary

The Australian Meat Processor Corporation (AMPC) engaged GHD to undertake a targeted gap analysis of climate information available to red meat processors. This research was funded under the Agricultural and Land Sectors Low Emissions Future program, through the Cabon Farming Outreach Program (CFOP) grant opportunity "Integrated Approaches to Building On-farm Emissions Knowledge: Gap Analysis".

A key driver for this work is the introduction of the Australian Sustainability Reporting Standards (ASRS), which mandate formal climate-related financial disclosures for certain entities under the Corporations Act 2001. Two critical components of ASRS, including climate **scenario analysis** and **scope 3 emissions reporting**, have been selected as the focus of this gap analysis given their heavy reliance on external, publicly available data. This report evaluates the availability, quality, and relevance of that data and identifies priority actions to strengthen sector readiness.

For scenario analysis, the findings show that while physical climate data is generally robust and Australia-specific, there are notable gaps in the availability of industry-wide qualitative narratives and in scenario coverage for socioeconomic and industry characteristics. Some parameters, such as disease and pest distribution or feed resources, lack detailed, scenario-aligned data, and these gaps reduce the sector's ability to conduct consistent and meaningful scenario stress testing. Overall, there is a need for a more consistent approach to developing and sharing scenario narratives across the sector.

For scope 3 emissions, processors are generally able to report on the most material sources – particularly purchased livestock – using available average activity-based emission factors and supplier-specific calculators. However, these factors are often outdated or inflexible, and supplier-specific tools, while robust, face challenges in adoption and input complexity. Minor to moderate gaps exist for less material sources such as refrigerant, goat, and processing machinery, and for transport emissions where more granular data would improve reporting. In some categories, allocation methods are required in the absence of activity-based emission factors. While current data allows ASRS compliance, improvements are needed to increase accuracy, credibility, and futureproofing.

To address the most important gaps identified in scenario analysis and scope 3 emissions reporting for the red meat processing sector, four priority actions are proposed:

1. **Centralised ASRS knowledge platform:** Develop a single source of truth for emission factors, scenario tools, default inputs, methodologies, and reporting templates.
2. **Targeted training & support:** Deliver interactive workshops, webinars, scenario analysis training and step-by-step guidance on using the knowledge bank and reporting tools to build processor capability.
3. **Continuous data & methodology improvement:** Regular updates to emission factors, enhanced methane methodologies for livestock emissions, improved transport data, and piloting of emerging interventions.
4. **Cross--industry collaboration and standardisation:** Establish a coordinated working group to harmonise scenario narratives, allocation methodologies, and emissions frameworks across the value chain.

Addressing these gaps is likely to support more robust compliance, enhance the accuracy and comparability of reporting, and enable more effective risk assessment and emissions reduction across the value chain. Continued collaboration, targeted training, and ongoing data and methodology improvement will help ensure the sector remains well-positioned to meet evolving regulatory and stakeholder expectations.

3.0 Introduction

The Carbon Farming Outreach Program (CFOP) supports Australian farmers and land managers to make informed decisions about managing emissions and participating in carbon farming. This research is funded under the Agricultural and Land Sectors Low Emissions Future program, through the CFOP grant opportunity “Integrated Approaches to Building On-farm Emissions Knowledge: Gap Analysis”. The grant has been awarded to the Australian Meat Processor Corporation Ltd (AMPC) to undertake a targeted gap analysis of climate information available to red meat processors.

The purpose of this research is to identify gaps in publicly available and accessible knowledge that enable processors to understand and assess climate financial risk and emissions abatement. This focus reflects the evolving regulatory and market landscape, where red meat processors are increasingly required to demonstrate robust climate risk management and emissions reduction strategies.

A key driver for this work is the introduction of the Australian Sustainability Reporting Standards (ASRS), which mandate formal climate-related financial disclosures for certain entities under the Corporations Act 2001. ASRS requires companies to report on climate financial risks and emissions abatement activities in a manner that is useful to investors, lenders, and other stakeholders. For red meat processors, this means that access to reliable, commodity-specific information is essential for compliance and for identifying effective pathways to reduce emissions and build resilience.

Through this grant, AMPC, in partnership with GHD, has:

- Analysed current gaps in climate information relevant to processor needs, particularly for compliance with ASRS and for assessing climate financial risk and emissions abatement;
- Recommended appropriate formats and delivery channels for this information, ensuring it is accessible and actionable for industry stakeholders;
- Identified opportunities for collaboration across the supply chain and with other research and development corporations to maximise the impact of existing CFOP training and resources

The findings of this research will support the red meat processing sector in meeting emerging reporting requirements and in advancing Australia’s broader climate change commitments.

3.1 Project Objective

The objective of this project is to:

- Analyse current gaps in climate information relevant to processor needs, particularly for compliance with ASRS and for assessing climate financial risk and emissions abatement;
- Recommended appropriate formats and delivery channels for this information, ensuring it is accessible and actionable for industry stakeholders;
- Identify opportunities for collaboration across the supply chain and with other research and development corporations to maximise the impact of existing CFOP training and resources.

While compliance with the Australian Sustainability Reporting Standards (ASRS) primarily requires entities to report on climate-related financial risks and emissions abatement in the context of their current business strategy and operations, two critical components – **scenario analysis** and **scope 3 emissions reporting** – rely heavily on external, publicly available data. Scenario analysis requires processors to assess both physical and transition risks under multiple plausible climate futures, while scope 3 emissions reporting demands comprehensive information on indirect emissions across the entire value chain.

Given these requirements, and the DAFF grant requirement to undertake a gap analysis specifically, this report focuses on identifying gaps in publicly available and accessible information that are essential for robust scenario analysis and accurate scope 3 emissions reporting. The rationale for this focus is that, while internal data and strategy are central to ASRS compliance, the ability to assess future risks and value chain emissions depends on the availability, quality, and relevance of external data sources.

To achieve this, the project undertook:

- **Comprehensive literature review:** A systematic review of publicly available data sources relevant to both scenario analysis and scope 3 emissions for the red meat processing sector. This included identifying existing datasets, emission factors, scenario narratives, and guidance materials.
- **Critical gap analysis:** Building on the literature review, a detailed gap analysis was conducted to identify where information is missing, insufficient, or not fit-for-purpose for scenario analysis and scope 3 emissions reporting in line with ASRS requirements.
- **Stakeholder engagement:** Consultation with industry stakeholders was undertaken to validate the findings of the literature review and gap analysis, and to ensure a comprehensive understanding of current information gaps and sector needs.
- **Development of recommendations:** Providing practical, actionable recommendations to address identified gaps, strengthen emissions reporting, and support climate risk management and ASRS compliance across the sector.

A summary of the method is provided in Figure 1.

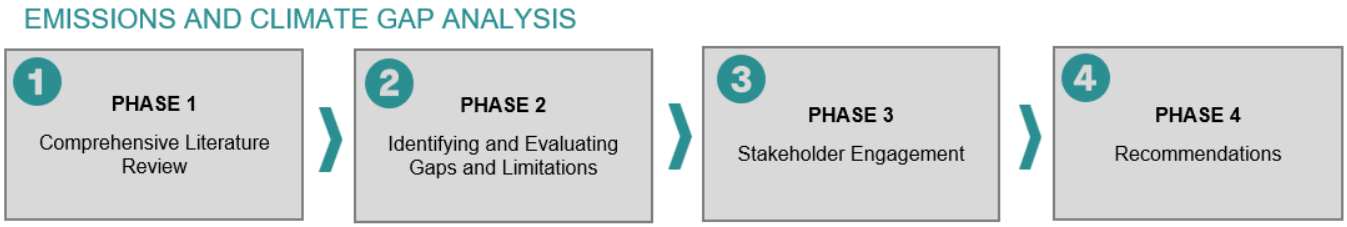

Figure 1 Methodological framework used in this report

3.2 Scope and Limitations

This report: has been prepared by GHD for AMPC and may only be used and relied on by AMPC for the purpose agreed between GHD and AMPC as set out in section 1 of this report.

GHD otherwise disclaims responsibility to any person other than AMPC arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

3.3 Assumptions

This report is a high-level gap analysis prepared by GHD, based on a range of assumptions detailed below and throughout the document:

- The gap analysis was undertaken on publicly available and accessible information only as of the report date and does not consider information that may be accessible via non-public databases, or after the date of this report. This approach aligns with the grant requirements, and promotes transparency, reproducibility, and consistency.
- This gap analysis assumes that input from third parties – including literature reviewed, AMPC inputs, and other consultancies engaged – is accurate, however this has not been independently verified.
- The gap analysis focuses on the Australian context and may not fully reflect regional differences in climate scenario planning and scope 3 emissions reporting gaps and limitations.
- This report has been developed based on current interpretations of reporting requirements and regulatory conditions, which are subject to change. Therefore, gaps and recommendations reflect the time of assessment and may not reflect future changes.
- The parameters considered in the scenario analysis gap assessment are not exhaustive but are rather designed to capture general, cross-cutting factors that are most likely to be relevant for scenario analysis in the red meat processing industry.

3 Consultation & Collaboration

Consultation with industry stakeholders, including a number of Research and Development Corporations (RDCs) was undertaken to:

a) Collaborate with industry on the Carbon Farming Gap Analysis Grants from DAFF;
b) Validate the findings of the literature review; and
c) Ensure the selected parameters and identified gaps reflected sector needs.

GHD engaged with the RDCs including Meat & Livestock Australia (MLA), Australian Pork Limited (APL), and LiveCorp. The key insight from these meetings has been that there is a diversity of approaches with respect to the Gap Analysis Grant with AMPC's approach unique to the others in its focus on ASRS compliance. The RDCs agreed that this was a valuable area of research and requested the findings of this research be shared with industry if possible.

With respect to industry carbon calculators, the below insights were garnered:

- APL noted its members are planning to adopt Agricultural Innovation Australia's (AIA) Carbon Calculator.
- MLA noted they do not compile or track the inputs or outputs of the MLA Carbon Calculator (when used by its producers). While this information could be used to publish anonymised generic results including benchmarks, they acknowledged the limitations of the calculator, in particular that it is self-assessed with no verification of the inputs.

In addition to individual meetings with other livestock RDCs (MLA, LiveCorp and Australian Pork), AMPC also participated in series of cross-RDC meetings aimed at identifying opportunities for horizontal collaboration to address information gaps to ensure consistency across commodities and avoid duplication. An initial meeting held on 7 October 2025 identified broad areas for future cross-sector collaboration with additional detail agreed at a subsequent meeting on 13 November 2025.

This process identified the following themes for cross-RDC collaboration to be consider going forward:

- **Measurement**: Need for a single emissions footprint calculator that is fit for purpose for farmers and the value chain.
- **Knowledge**: Reframe existing CFOP training package to be much clearer and prioritise basic knowledge gaps identified in Gap Analysis.
- **Delivery**: Scale up place-based or regional in-person delivery so farmers can co-learn with peers, from trusted advisers.

4.0 Scenario analysis gap assessment

4.1 Context

Scenario analysis is a structured approach used to test how different plausible climate futures may affect an organisation's risks, opportunities, and resilience. Rather than predicting the future, scenario analysis explores a range of potential pathways to inform robust decision-making under uncertainty. Within the Australian Sustainability Reporting Standards (ASRS), scenario analysis is a core requirement for climate-related disclosures. Entities are expected to assess both physical and transition risks under at least two climate scenarios aligned with IPCC pathways, typically including:

- A low-emissions scenario (e.g. 1.5°C or well below 2°C), reflecting strong global action to reduce greenhouse gas emissions.
- A high-emissions scenario (e.g. 3–4°C or more), representing limited or delayed mitigation and higher physical climate impacts.

A robust scenario analysis considers risks and opportunities over short, medium, and long-term horizons. ASRS does not prescribe specific dates for these horizons; instead, it requires companies to define what is appropriate for their business context and to organise their analysis accordingly. This flexibility allows companies to tailor scenario analysis to their strategic planning cycles and risk profiles.

Another key consideration is the type of information used in scenario analysis. Both quantitative (e.g. modelled projections, numerical data) and qualitative (e.g. expert judgement, narrative scenarios) approaches are valid, and the choice between them depends on the availability of data, the nature of the risk, and the decision-making context. There is no single 'right' answer – often, a combination of quantitative and qualitative insights provides the most robust foundation for scenario analysis, capturing both measurable trends and sector-specific uncertainties.

4.2 Literature review and data sources

A comprehensive literature review was undertaken to identify and evaluate publicly available data sources relevant to scenario analysis for the red meat processing sector. The review included:

- **Climate and environmental datasets:** e.g. CSIRO, IPCC, Bureau of Meteorology (BOM), Australian Energy Market Operator (AEMO).
- **Socioeconomic and market data:** e.g. ABARES, Australian Bureau of Statistics (ABS), MLA, government and industry reports.
- **Sector-specific scenario modelling:** e.g. national and international scenario studies, industry climate risk assessments, and relevant academic literature.

Sources were selected based on their relevance, credibility, and alignment with the types of scenarios and risks required under ASRS. Priority was given to data that is Australian-specific, sector-relevant, and available at the regional or local scale.

4.3 Methodology

A structured framework, comprising three categories of parameters was developed to assess the availability and relevance of publicly available data related to climate scenario analysis for the red meat processing industry. The

approach focused on identifying where data is missing or insufficient to inform scenario development for both physical and transition climate risks and opportunity assessments.

2.3.1 Parameter categorisation

The parameters considered in the scenario analysis gap assessment were grouped into three key areas including:

Physical characteristics: Environmental and climatic variables likely to impact processor operations directly (e.g. drought, water availability, extreme weather events).

Socioeconomic characteristics: Market and financial variables influencing exposure and adaptive capacity (e.g. energy costs, carbon pricing, insurance access).

Industry characteristics: Sector-specific factors affecting operational resilience and future viability (e.g. livestock supply, regional energy reliability, consumption trends).

A longlist of parameters was developed under each category based on relevance to the red meat industry (see Appendix A). This set of parameters is not intended to be exhaustive. Rather, it is designed to capture general, cross-cutting factors that are most likely to be relevant for scenario analysis in the red meat processing industry. The focus is on those parameters that have broad applicability and are expected to influence risk and opportunity assessments across a range of plausible climate futures.

2.3.2 Evaluation criteria

Each parameter was assessed using a consistent set of criteria to help evaluate the quality, completeness, and applicability of publicly available data, described in *Table 1* below.

Table 1 Scenario analysis evaluation criteria

Criteria	Details
Geographic Scale	Evaluates the spatial resolution (national, state, regional, or local) of data. Priority was given to data available at local or regional scales.
Scenario Coverage	Assesses whether the data covers a range of climate scenarios aligned with IPCC pathways, including 1.5°C, <2°C, 2–3°C, and >4°C warming scenarios. Parameters that only included historical data or single-scenario projections were identified as having limited scenario coverage.
Timeframe	Considers whether the data includes relevant projection horizons: short-term (to 2030), medium-term (to 2050), and long-term (to 2100). Where projections were missing or skewed heavily toward only near-term or long-term outlooks, gaps were noted.
Data Type	Classifies whether the data is quantitative or qualitative. Quantitative, model-based data was prioritised. Qualitative or expert-opinion-based data was included when quantitative alternatives were unavailable but noted as lower certainty.

2.3.3 Assessing gap criticality

The evaluation criteria were applied not only to identify gaps, but also to assess their criticality for scenario analysis and ASRS compliance. The following principles guided this assessment:

- **Qualitative information** is considered the minimum requirement for each parameter. If only qualitative data (such as expert judgement or narrative scenarios) is available, this is sufficient for basic compliance, but the

absence of any information is a critical gap. Where quantitative data is available, it provides a stronger basis for analysis and decision-making, but its absence is not necessarily a compliance failure if qualitative information is present.

- **Scenario coverage** is assessed against ASRS expectations: at a minimum, information should be available for a 1.5°C scenario and at least one higher warming scenario (either 2–3°C, representing a business-as-usual pathway, or >4°C, representing a worst-case scenario). If information is missing for these key scenarios, this is considered a significant gap for compliance and risk assessment.
- **Timeframe** is evaluated by the presence of information across short, medium, and long-term horizons. ASRS does not prescribe specific dates for these horizons, allowing companies to define what is appropriate for their context. However, the absence of information for any of these horizons – especially for transition risks (which may play out over longer periods) or physical risks (which may be acute or chronic) – is considered a gap.
- **Geographic specificity** is particularly important for physical characteristics, as physical climate risks are highly location dependent. For these parameters, Australia-specific information is required for robust risk assessment. The absence of Australia-specific data is considered a critical gap for physical characteristics.
- **For socioeconomic and industry characteristics**, Australia-specific data is preferred for relevance and accuracy. However, where only international or generic data is available, these sources can still be used to infer general trends and inform risk assessments. The absence of quantitative data is less critical if qualitative information is available but still represents an area for improvement.

The evaluation criteria were used to determine not just the presence or absence of information, but whether the available data is sufficient for compliance and robust scenario analysis. Gaps are prioritised for action based on their potential impact on compliance, risk management, and decision-making for the red meat processing sector.

4.4 Gap assessment results

The gap analysis reveals a clear disjointedness in the availability and quality of publicly accessible information for red meat processors undertaking scenario analysis. While information for some parameters – particularly physical characteristics – is robust, Australia-specific, and quantitative, there are notable inconsistencies and gaps across other areas, especially for socioeconomic and industry characteristics. This fragmented landscape means that processors face different challenges depending on the type of risk or scenario being assessed.

The below section provides a summary of the key gap analysis findings, while Appendix A provides a detailed breakdown of these gaps for each parameter, supporting a clear understanding of the most critical information needs for robust scenario analysis and ASRS compliance in the red meat processing sector.

4.4.1 Lack of qualitative scenario narratives

A recurring and critical gap is the absence of qualitative scenario narratives, which are essential for interpreting how different climate futures may impact the sector. For example, there is no qualitative information at all for disease and pest distribution, severely limiting the industry's ability to assess animal health risks under different climate pathways. Similarly, for processor regional network outages and livestock supply restrictions, only limited qualitative evidence exists, with no scenario-based projections to support robust operational resilience planning.

4.4.2 Gaps in scenario coverage

Scenario coverage is a key requirement for compliance. The absence of information for the 2–3°C scenario (representing a business-as-usual pathway) and the >4°C scenario (worst-case) is particularly significant for several parameters. For instance, feed resources lack scenario-based or detailed projections for Australia, constraining long-term stress testing and financial planning. For trade/market conditions (CBAM), there is no scenario-based data on the impacts for red meat exports, which is a significant gap for understanding future market risks.

4.4.3 Gaps in timeframe coverage

Robust scenario analysis requires information across short, medium, and long-term horizons. For several parameters, there are notable gaps in medium- and long-term projections. For example, electricity price projections are mainly available for the near term, with medium- and long-term data scarce, limiting the ability to forecast operational costs. Similarly, carbon price/costs of carbon regulation projections lack detail beyond 2030, which is a moderate gap for long-term regulatory planning.

4.4.4 Geographic and data-type gaps

For physical characteristics, Australia-specific data is essential due to the location-specific nature of climate risk. While parameters like historical climate trends and climate projection data are well-supported, others such as disease and pest distribution and feed resources lack Australia-specific, scenario-aligned quantitative data. Where only global or qualitative information is available, this is noted as a gap to be improved, though it is less critical than a complete absence of data.

4.4.5 Orderly vs disorderly transition pathways

Understanding whether scenarios assume an orderly or disorderly transition is important for assessing transition risks. For technology adoption, while Australia-specific quantitative estimates exist for methane abatement and energy efficiency, the assumptions on transition pathways are not explicitly defined. This limits the ability to analyse scenario uncertainty and the potential impacts of abrupt versus gradual policy and market changes.

3. Scope 3 gap assessment

3.1 Context

Scope 3 emissions are the indirect greenhouse gas (GHG) emissions that occur throughout a company's value chain, both upstream and downstream of its direct operations. These emissions often represent the majority of a company's total footprint and are increasingly scrutinised by regulators, investors, and other stakeholders.

Under the GHG Protocol, scope 3 emissions are divided into 15 distinct categories, covering a wide range of upstream and downstream activities. These include purchased goods and services, capital goods, transportation, waste, business travel, and the use and end-of-life treatment of sold products. As shown in Figure 2, these categories span the full value chain and are intended to provide a comprehensive framework for emissions accounting.

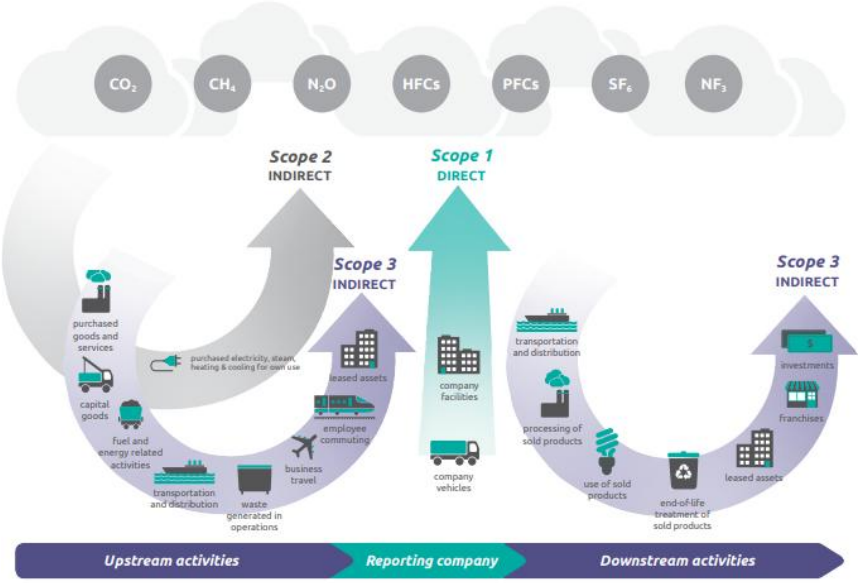

Figure 2 Overview of GHG Protocol scope 1, 2 and 3 and emissions across the value chain[1] (World Resources Institute & World Business Council for Sustainable Development, 2013, p. 6).

The Australian Sustainability Reporting Standards (ASRS) require entities to disclose scope 3 emissions in alignment with these 15 categories. ASRS also provides its own measurement guidance, which prioritises:

- Direct measurement where feasible;
- Activity-based emission factors, which may be either supplier-specific or industry-average;
- Spend-based emission factors are not explicitly mentioned in ASRS guidance. While this does not mean they are entirely excluded, it suggests they may not be considered eligible or preferred for compliance purposes.

For red meat processors, scope 3 emissions are particularly material due to the emissions intensity of upstream agricultural inputs and the complexity of downstream logistics and product use. Accurate and transparent reporting across all relevant categories is essential not only for ASRS compliance but also for identifying emissions reduction opportunities and managing climate-related financial risks.

[1] World Resources Institute & World Business Council for Sustainable Development 2013, *Technical Guidance for Calculating Scope 3 Emissions (version 1.0), Greenhouse Gas Protocol (GHG Protocol).* https://ghgprotocol.org/sites/default/files/standards/Scope3_Calculation_Guidance_0.pdf

3.2 Literature review and data sources

A targeted literature review was conducted to identify available emission factors and data sources relevant to each scope 3 category and the specific activities most likely to apply to red meat processors. This review focused on:

- **Industry and supply chain datasets** e.g. Australian Life Cycle Inventory Database (AusLCI), Meat & Livestock Australia (MLA) calculators (SB-GAF, G-GAF, F-GAF), Agricultural Innovation Australia (AIA) Environmental Accounting Platform
- **Government and regulatory inventories** e.g. Australian Government National Greenhouse Accounts, Clean Energy Regulator datasets, and other government-published emission factor resources.
- **Sector-specific research and publications** e.g. MLA Greenhouse Gas Footprint study and Agriculture Victoria Greenhouse Gas Farm Monitor.

The literature review prioritised emission factors that are supplier-specific or activity-based, as these provide greater accuracy and relevance for the Australian context. Spend-based emission factors were excluded due to their limited availability and lower relevance for the meat processing sector, and because ASRS does not prioritise their use.

3.3 Methodology

To undertake the scope 3 gap analysis, the most likely distinct activities of a red meat processor within each scope 3 category were identified. For example, within the purchased goods and services category, activities included the purchase of cattle, sheep, goat, packaging, and refrigerant replacement. These activities were considered separately, as each may require a different emission calculation method to ensure accuracy in reporting. The activities listed under each category, in Appendix B, are intended as examples and may not include all possibilities; they are based on factors most likely to be material and relevant for processors.

For each identified activity, available emission factors were sourced and assessed. Where multiple emission factors existed for a single activity, these were evaluated individually for their suitability and relevance. The relationship between scope 3 category, activity, and emission factor was mapped to ensure comprehensive coverage and to highlight where gaps in data or methodology exist.

3.3.1 Evaluation criteria

Each emission factor source was assessed using a consistent set of criteria to help evaluate its quality, suitability, and limitations, as described in Table 2 below.

Table 2 Scope 3 evaluation criteria

Criteria	Details	Explanation
Emission factor type	Activity-based, supplier-specific	Activity-based emission factors use data specific to an activity (e.g. km travelled, kg produced). Supplier-specific emission factors are tailored to a specific supplier's products or services and are generally more accurate.
Year	Date of publication and date of inputs	Emission factors should be current and based on recent data. The date of publication and any key input dates were recorded to assess currency and relevance.

Boundary	Cradle-to-gate, gate-to-gate, gate-to-grave	Boundaries refer to different stages in a product's life cycle and define the emissions included in an emission factor. Clear boundaries ensure completeness and avoid under- or over-estimation.
Location	National, state, regional, or local	The spatial resolution of the data was determined. Spatial specificity improves accuracy by accounting for regional differences.
Granularity	Per animal, per location, per kg, per volume, per km, per tonne, etc.	Granularity refers to the level of detail. High granularity allows for more tailored and accurate emissions estimates, supports benchmarking, and enables processors to identify specific emissions drivers.
Updated regularly	Annually, irregularly, unclear	This reflects how frequently the emission factor source is updated or revalidated. Regular updates ensure emissions estimates remain relevant and credible.

3.3.2 Assessing gap criticality

The evaluation criteria above were applied not only to identify gaps, but also to assess their criticality for ASRS compliance and robust scope 3 emissions reporting. The following principles guided this assessment:

- If a supplier-specific emission factor is not available but an industry-average activity-based factor is, this is not considered a critical gap, as reporting can still proceed with reasonable accuracy.
- A critical gap is identified where no emission factor is available at all for a relevant activity or category, as this prevents processors from reporting or estimating emissions for that source.
- Outdated, generic, or low-granularity emission factors are noted as gaps, but their criticality depends on the materiality of the category and the potential impact on overall reporting accuracy.
- Unclear or inappropriate boundaries, or the absence of Australia-specific data for activities with significant geographic variation, are considered more significant gaps, especially for categories expected to be material.

To further understand the criticality of each gap, scope 3 categories and activities were assessed for their relevance to processor business goals, sphere of influence, risk exposure (e.g. reputational or supply chain risk), and stakeholder expectations. Materiality was determined based on the expected contribution of each category to total anticipated scope 3 emissions and the potential for GHG reduction. Gaps in highly relevant or material categories were prioritised for action, as they are most likely to impact the accuracy, completeness, and credibility of scope 3 emissions reporting for red meat processors.

3.4 Gap assessment results

The Scope 3 gap analysis highlights several key themes in data availability, accuracy, and reporting challenges for red meat processors. These themes reflect both the current state of emission factor availability and the practical realities of reporting under ASRS.

The below section provides a summary of the key gap analysis findings, while Appendix B provides a detailed breakdown of these gaps for each evaluation criteria, supporting a clear understanding of the most critical information needs for robust scope 3 reporting and ASRS compliance in the red meat processing sector.

4.4.6 Reporting for purchased livestock is possible, but accuracy and futureproofing are limited

Purchased livestock (beef, sheep) is widely recognised as the dominant source of scope 3 emissions for red meat processors, with industry sources (e.g. MLA, National Greenhouse Gas Inventory) indicating that livestock production can account for a substantial majority – often cited as more than 90% – of total value chain emissions for the broader red meat industry.[2] However, the exact proportion attributable to processors' scope 3 emissions may vary depending on operational boundaries and supply chain structure.

Average activity-based emission factors are available and sufficient for reporting, but are often outdated and inflexible, lacking the ability to reflect changes in farm practices, feed, or region. Supplier-specific calculators (e.g. MLA SB-GAF, G-GAF, F-GAF, AIA platform) are available and based on robust methodologies, but adoption is uneven and they require detailed, producer-specific inputs. The fixed nature of enteric methane calculations for pasture beef is a future concern, as it may not capture the impact of methane-reducing interventions as these are developed and deployed. This is a moderate gap – reporting is possible and compliant, but accuracy and comparability are limited, and future improvements are needed to reflect mitigation interventions and improve engagement with producers.

4.4.7 Methodological and data quality limitations in transport emission factors

For upstream and downstream transportation, the available emission factors are generally outdated, generic, and lack transparency in methodology and update frequency. While processors can estimate transport emissions using average distances, fuel consumption, and emission factors from the National Greenhouse Accounts, this approach requires more engagement with the supply chain to obtain accurate activity data.

A key gap is the absence of average emission factors specifically for refrigerated transport, which is relevant given that most outbound trucks from processors are refrigerated. Estimating these emissions would require direct engagement with logistics providers or supply chain partners to obtain more granular data. The severity of this gap is minor to moderate, depending on the materiality of transport emissions for individual processors. For most, transport emissions are likely to be less material than livestock emissions but improving the quality and specificity of emission factors would enhance reporting accuracy and comparability.

4.4.8 Absence of emission factors for some sources

For some categories, such as goat (purchased goods and services), refrigerant production, capital goods (processing machinery), upstream leased assets, and use of sold product, emission factors are missing or only available as proxies. These sources are generally low materiality for most processors (e.g. refrigerant emissions are likely less than 5% of total scope 3 emissions), so their absence is a minor gap. Addressing these would improve completeness but has limited impact on overall reported emissions.

4.4.9 Allocation methods required for processing sold products

For processing sold product, the absence of activity-based emission factors means processors must rely on allocation methods (e.g. by engaging with downstream partners to avoid over-reporting). This is a minor to moderate

[2] Ridoutt, B. (2022). *Final report Greenhouse Gas Footprint of the Australian Red Meat Production and Processing Sectors 2020*. [online] Available at: https://www.mla.com.au/contentassets/8033491508fe4028b1ac11c5a727a4e7/b.cch.2301-greenhouse-gas-footprint-of-the-australian-red-meat-production-and-processing-sectors-2020_.pdf.

gap for a category with medium relevance and low-medium materiality. While not a major compliance risk, it does complicate reporting and may affect comparability across the sector.

4 Conclusions

This report has undertaken a comprehensive gap analysis of scenario analysis and scope 3 emissions reporting for the Australian red meat processing sector, in line with ASRS requirements and industry best practice. Through a systematic review of publicly available data sources, stakeholder engagement, and critical assessment of emission factors and scenario information, the analysis has identified both strengths and limitations in the current landscape.

For scenario analysis, the findings show that while physical climate data is generally robust and Australia-specific, there are notable gaps in the availability of industry-wide qualitative narratives and in scenario coverage for socioeconomic and industry characteristics. Some parameters, such as disease and pest distribution or feed resources, lack detailed, scenario-aligned data, and there is a need for a more consistent approach to developing and sharing scenario narratives across the sector.

For scope 3 emissions, processors are generally able to report on the most material sources – particularly purchased livestock – using available average activity-based emission factors and supplier-specific calculators. However, these factors are often outdated or inflexible, and supplier-specific tools, while robust, face challenges in adoption and input complexity. Minor to moderate gaps exist for less material sources such as refrigerant, goat, and processing machinery, and for transport emissions where more granular data would improve reporting. In some categories, allocation methods are required in the absence of activity-based emission factors.

Addressing these gaps is likely to support more robust compliance, enhance the accuracy and comparability of reporting, and enable more effective risk assessment and emissions reduction across the value chain. Continued collaboration, targeted training, and ongoing data and methodology improvement will help ensure the sector remains well-positioned to meet evolving regulatory and stakeholder expectations.

5 Recommendations

The recommendations in *Table 2* are designed to address the most important gaps identified in scenario analysis and scope 3 emissions reporting for the red meat processing sector. These recommendations target both moderate and minor gaps, recognising that incremental improvements across the sector will support robust ASRS compliance, more accurate risk assessment, and practical emissions reduction.

Delivery channels refer to the mechanisms through which these recommendations could be implemented – such as online platforms, training modules, or industry hotlines – to maximise accessibility and engagement for processors. Collaboration identifies the key organisations and stakeholders who could or should be involved in developing, delivering, or maintaining these solutions, ensuring sector-wide consistency, practicality, and the avoidance of duplication.

These are initial recommendations and delivery channels; further refinement and prioritisation may be required as sector needs evolve. For minor to moderate gaps, it is recommended that their materiality be assessed through direct engagement with processors, ensuring that resources are focused on the most impactful improvements.

Table 2 Key Recommendations

#	Recommendation	Format	Potential delivery Channel	Collaboration
1	**Centralised ASRS knowledge platform** Develop a centralised, online knowledge bank for processors integrating up-to-date emission factors, scenario analysis tools (including sector-specific socioeconomic narratives), default inputs, allocation methodologies, and reporting templates.	Online database, interactive tools, downloadable templates, guidance notes	CFOP knowledge bank, AMPC website, integrated into CFOP training modules	AMPC, MLA, AIA, APL, AusLCI, logistics providers, research institutes, government
2	**Targeted training and capacity building** Deliver interactive workshops, webinars, scenario analysis training (including socioeconomic scenario interpretation), and step-by-step guidance on using the knowledge bank and reporting tools, with regular updates and Q&A sessions.	Webinars, workshops, online modules, guidance documents, AMPC hotline (potential)	CFOP training calendar, AMPC outreach, knowledge bank, AMPC hotline	RDCs, research institutes, industry partners
3	**Continuous data and methodology improvement** Prioritise updating the methane methodology for livestock emissions, regularly update emission factors and input datasets, pilot new interventions (e.g. methane reduction), and improve data granularity for transport and processing emissions. For other minor to moderate gaps, assess materiality through engagement with processors before prioritising action.	Data update packs, technical guidance, case studies	CFOP portal, AMPC technical bulletins, knowledge bank	Industry, logistics providers, downstream processors, research institutes
4	**Sector-wide collaboration and standardisation** Establish a cross-industry working group to oversee resource development, scenario modelling (including development of industry-wide socioeconomic narratives), and allocation methodologies; co-develop sector-wide frameworks for emissions allocation and reporting.	Working group, framework documents, collaborative workshops	CFOP portal, AMPC and partner platforms	RDCs, industry, government, supply chain partners

5.0 Bibliography

World Resources Institute & World Business Council for Sustainable Development 2013, *Technical Guidance for Calculating Scope 3 Emissions (version 1.0), Greenhouse Gas Protocol (GHG Protocol)*. *https://ghgprotocol.org/sites/default/files/standards/Scope3_Calculation_Guidance_0.pdf*

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6.0 Appendices

6.1 Appendix 1 - Detailed climate scenario gap analysis findings

This Appendix provides a detailed breakdown of the gaps identified for each parameter considered in the climate scenario gap analysis. Table 3, Table 4 and Table 5 provide a breakdown for the gaps identified for physical, socioeconomic and industry characteristics, respectively.

Physical characteristics

Table 3 Climate scenario gap analysis findings – Physical parameters

Parameter	Detailed findings	Summary
Historical climate trends	Extensive, well-established datasets exist nationally and regionally for observed temperature, rainfall, extreme events, and other baseline climate variability (sources include BOM Climate Data Online, CSIRO State of the Climate). Data is quantitative, multi-scale (local to national), and spans long timeframes.	No major gaps in data availability for this parameter.
Climate projection data	Quantitative climate projections across 1.5°C, 2-3°C, <2°C, and >4°C scenarios are available from Australian-specific sources. These cover temperature, rainfall, extreme weather, and are accessible across local to national scales with short-, medium-, and long-term horizons.	No major gaps in data availability for this parameter.
Water availability/drought	Regional-level quantitative data exists on seasonal and annual rainfall trends, drought frequency, and intensity, supported by the Australia Water Outlook.	Significant gap in data specific to processor water supply restrictions, limiting industry-specific drought risk assessment.
Floods	Quantitative projections on flood hazard consider updated Australian Rainfall and Runoff (ARR) climate factors with climate change adjustments. Data is available at local scales, across scenarios and timeframes, supporting risk modelling for operational planning.	No major gaps identified for this parameter, though integration with sector-specific exposure data could improve risk assessments.
Wildfire	Multi-scale, multi-scenario quantitative datasets exist for bushfire risk, including Forest Fire Danger Index (FFDI) and compound fire weather indicators. Available nationally and regionally, these data allow risk mapping under varied climate futures.	No major gaps in data availability for this parameter.

Parameter	Detailed findings	Summary
Disease and pest distribution	Data is largely qualitative and global in scope, with limited Australia-specific or scenario-aligned quantitative datasets. Ecological studies indicate increasing pest and disease risk with warming, but quantitative projections or spatial risk maps at the industry or regional scale are not currently available. This gap limits understanding of animal health risks under different climate pathways.	Significant gaps identified in limited Australia-specific quantitative data.
Feed resources	Some quantitative national-level projections exist, but detailed temporal breakdowns are scarce. Global qualitative evidence suggests increased climate variability will negatively affect feed reliability, yet no scenario-based quantitative data for Australia is available. This limits capacity for long-term stress testing and financial planning.	Significant gaps for scenario-based or detailed projections.

Socioeconomic characteristics

Table 4 Climate scenario gap analysis findings – Socioeconomic parameters

Parameter	Findings	Summary
Population Change	Population projections exist at regional and national scales (ABS, NSW Department of Planning). However, linkages to climate pathways remain limited.	Moderate gap in climate-linked population projections.
Diesel price	Quantitative forecasts for diesel prices exist under multiple scenarios (Step Change <2°C, Progressive Change, Green Energy 1.5°C), available at state and national levels. Price projections cover 2030, 2040, and 2050. These data represent generator-level diesel but serve as proxies for industry retail prices, supporting operational cost scenario modelling.	No major gaps in data availability for this parameter.
Electricity price	Scenario-based electricity price projections are available mainly for the near-term scenarios (AEMC). Medium- and long-term publicly available projections are scarce, limiting operational cost forecasting.	There is a significant gap, as medium- and long-term projections are limited
Renewable energy costs	Quantitative cost projections for renewable technologies are available nationally through 2050. These data inform feasibility and adoption rates for decarbonisation investments but require integration with operational cost models.	There are no major gaps in data availability for this parameter.

Parameter	Findings	Summary
Carbon price/costs of carbon regulation	Australian carbon pricing forecasts exist under central policy, low price, and high price scenarios to 2030 (MLA carbon price report). These projections affect operational expenses and incentivise emissions reductions but lack scenario detail for post-2030 periods.	There is a moderate gap, as projections lack detail beyond 2030.
Access to green finance	Evidence shows that green finance availability has grown over the past decade, driven by policy and investor demand. However, no direct metrics map access to green finance specifically under different climate scenarios for the red meat industry. Qualitative data suggest orderly transition scenarios increase green finance access, but quantitative scenario-based financial modeling remains absent.	There is a significant gap, as no quantitative scenario-based metrics exist for industry access.
Insurance premiums/access	Currently unquantified; consequences under different climate scenarios remain to be assessed. Lack of data presents a significant gap for understanding financial resilience related to physical and transition climate risks in the industry.	There is a significant gap, as no quantified scenario-based data are available.
Trade/market conditions – CBAM	Strong climate action scenarios (1.5°C) may see wider adoption of Carbon Border Adjustment Mechanisms, potentially raising compliance costs for high-emission exporters. No publicly available scenario-based data exist on CBAM impacts for agricultural goods like red meat or on policy adoption by other countries.	There is a significant gap, as no scenario-based data exist for red meat trade impacts.

Industry characteristics

Table 5 Climate scenario gap analysis findings – Industry parameters

Parameter	Findings	Summary
Processor regional network outages	Qualitative data on network outages exist, but no scenario-based quantitative projections link climate-driven temperature extremes to outage frequency, duration, or severity. This represents a critical gap, as outages impact processing continuity and resilience but are not yet modelled in climate risk frameworks.	There is a significant gap, as no quantitative scenario-based projections exist for outages.
Livestock supply restrictions	No quantitative projections exist on how climate change-induced extreme weather and heat will restrict livestock transport. Qualitative evidence indicates increased restrictions under extreme conditions, potentially disrupting supply chains and operations, but scenario-aligned, detailed data is missing.	There is a significant gap, as scenario-aligned data on livestock transport restrictions are not available.
Red meat consumption trends	Global quantitative data project consumption trends under business-as-usual and transition scenarios to 2050, but Australian-specific data are limited. This limits the ability to plan for domestic market shifts influenced by climate or dietary changes.	There is a moderate gap, as projections exist globally but are limited for Australia.
Electricity decarbonisation	NGFS and AEMO ISP provide global and national scenario-based data on electricity generation mix shifts and decarbonisation through 2050. This supports operational emissions reduction planning and renewable energy sourcing in the processing sector.	There are no major gaps in data availability for this parameter.
Technology adoption	CSIRO provides Australia-specific quantitative estimates for methane abatement (around 30% reduction by 2050 under 1.5°C and 2°C scenarios) and energy efficiency technology adoption. However, assumptions on transition pathways (orderly vs disorderly) are not explicitly defined, which limits scenario uncertainty analysis in technology uptake impacts.	There is a moderate gap, as scenario pathway assumptions are not fully defined.

6.2 Appendix 2 – Detailed scope 3 gap analysis findings

This Appendix provides a detailed breakdown of the gaps identified for each category considered in the scope 3 gap analysis.

Table 6 Detailed scope 3 gap analysis findings

Criteria (Scope 3 Category/Activity)	Findings	Summary (Gap Severity, Relevance & Materiality)
Purchased goods and services – beef, sheep	Average activity-based emission factors are available and sufficient for reporting, but are outdated and inflexible, lacking the ability to reflect changes in farm practices, feed, or region. Supplier-specific calculators are available and based on robust methodologies, but adoption is uneven and inputs are complex. Enteric methane calculations are fixed and may not reflect future mitigation interventions.	Moderate gap (High relevance, Very high materiality): Purchased livestock is widely recognised as the dominant source of scope 3 emissions for red meat processors (often estimated at >90% of total value chain emissions, though this may vary by operation).[3] Reporting is possible and compliant, but accuracy and comparability are limited. Future improvements are needed to reflect mitigation interventions and improve engagement with producers.
Purchased goods and services – goat	No average activity-based emission factors available for goat.	Minor gap (High relevance, Low materiality): Reporting is not possible for goat, but this is a minor source for most processors. Addressing this would improve completeness but has limited impact on total emissions.
Purchased goods and services – refrigerant	No publicly available emission factors for refrigerant production. Potential sources may exist on paid platforms but may not be compatible with assurance requirements.	Minor gap (Medium relevance, Low materiality): Refrigerant emissions are likely a small proportion of total scope 3 emissions for most processors. Absence of factors is a completeness issue, but not a major compliance risk.
Upstream transportation and distribution	Available emission factors are outdated, generic, and lack transparency in methodology and update frequency.	Minor to moderate gap (High relevance, Medium materiality): Reporting is possible using average distances, fuel consumption, and National Greenhouse Accounts factors, but accuracy is limited. Improving data quality would enhance reporting, but current gaps are not a major barrier.
Downstream transportation and distribution –	No average emission factor exists for refrigerated transport. Existing transport factors are outdated and generic.	Minor to moderate gap (High relevance, Materiality varies): The absence of a specific factor for refrigerated transport requires processors to engage with the supply chain to

[3] Ridoutt, B. (2022). *Final report Greenhouse Gas Footprint of the Australian Red Meat Production and Processing Sectors 2020*. [online] Available at: https://www.mla.com.au/contentassets/8033491508fe4028b1ac11c5a727a4e7/b.cch.2301-greenhouse-gas-footprint-of-the-australian-red-meat-production-and-processing-sectors-2020_.pdf.

Criteria (Scope 3 Category/Activity)	Findings	Summary (Gap Severity, Relevance & Materiality)
refrigerated transport		estimate emissions. The severity depends on the materiality of refrigerated transport for individual processors, but for most, this is not expected to be a major source compared to livestock emissions.
Capital goods – processing machinery	No proxy emission factor for the purchase of processing machinery. Sufficient factors exist for new facilities or refurbishments.	Minor gap (Medium relevance, Low materiality): Not sector-specific; limited influence for processors. Not a priority for immediate action.
Upstream leased asset	Proxy energy intensity factors are available for offices and warehouses (no cold storage), but not for other assets.	Minor gap (Low–Medium relevance, Low materiality): Not a specific gap for processors; only relevant if other leased assets are material.
Processing sold product	No activity-based emission factors available. Processors must engage with downstream facilities/suppliers and apply allocation methods to avoid over-reporting.	Minor to moderate gap (Medium relevance, Low–Medium materiality): Allocation methods are required in the absence of factors. This complicates reporting but does not prevent compliance.
Use of sold product	No proxy emission factor for consumption of meat products, but this is unlikely to be material.	Minor gap (Low relevance, Low materiality): Not material for most processors; not a priority for immediate action.

8.2 Appendix C – Complete gap analysis findings

See excel file attached.