

EGG INDUSTRY EMISSIONS CALCULATOR



Handbook for Carbon Footprint Determination
and GHG Calculations on Australian Egg Farms



About Australian Eggs

Australian Eggs is a member owned not-for-profit company providing marketing and research & development (R&D) services for the benefit of Australian egg farmers.

Working together with the egg industry and the Australian Government, Australian Eggs strives to deliver value to industry and the public by investing in programs that increase consumption and ensure industry sustainability.



The purpose of this document

Climate action is a global priority for governments, business and industries. In 2021, the Australian Government delivered a Long-Term Emissions Reduction Plan for net-zero economy-wide GHG emissions by 2050. This technology-driven approach aims to facilitate emission reduction by lowering the cost of existing and emerging technologies and accelerating their adoption. The development and cost reduction of alternatives to fossil energy, such as ultra low-cost solar, energy storage and low-emission fuels (Liquefied natural gas, uranium), are positioned as significant steps in Australia's pathway to net zero. Understanding the contribution of fossil energy to the emission profile of Australian egg production was the first step in assessing how decarbonisation of energy supply would benefit the Australian industry.

Further emissions, and in some cases sequestration, arise from land use and direct land-use change, which are also closely related to agriculture. Agricultural industries face the challenge of increasing production to meet consumer demand, while concurrently reducing impacts.

As the Australian egg industry continues to grow, further growth will require a substantial reduction in the emission intensity of eggs just to maintain total emissions. With multiple industries and the Australian Government already having set emissions reduction, net zero or carbon neutral targets, and devised roadmaps to that end, the Australian egg industry recognises the need to examine emission reduction options for the industry.

The egg industry produces highly efficient, high-quality food products with a relatively low environmental footprint but along with every sector, there is an imperative to reduce impacts over time.

This document reports on findings from a baseline carbon footprint study for the industry and an investigation of emission mitigation options, with a view to support egg farmers to understand their on-farm emissions and carbon footprint, then identify the technically and economically viable pathways to emission reduction.

Contents

Greenhouse emissions	4
Measuring egg industry emissions	5
Supply chain assessment of the Australian egg industry	7
Emission benchmarks	10
Emission mitigation strategies	11
Comparison with other animal proteins	12
How can egg farms calculate GHG emission & carbon footprint?	13
How to use the emissions calculator	14





Greenhouse emissions

Greenhouse gases (GHGs) in the atmosphere increase the retention of the Earth's outgoing energy, holding heat in the atmosphere and causing changes in the radiative balance between energy received from the sun and energy emitted from Earth. This can cause significant alterations in climate and weather patterns.

GHGs are reported in the Australian Government's National Inventory Report (NIR), also known as the National GHG Inventory (NGGI) and include:

- ◆ Carbon dioxide (CO₂)
- ◆ Methane (CH₄)
- ◆ Nitrous oxide (N₂O)
- ◆ Sulphur hexafluoride (SF₆)
- ◆ Other hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).

Methane and nitrous oxide have much higher warming potentials than carbon dioxide.

GHGs are standardised using the Global Warming Potential (GWP) system, which allows for comparison between the quantity and potency of each gas.

Although there are other metrics for determining the relative impacts of different GHGs, GWP100 values are the most commonly used system in global GHG accounting. Each GWP is reported based on its carbon dioxide equivalent (CO₂-e). The GWP100 value for methane, for example, is 28, meaning that methane has 28 times the global warming potential of CO₂. The GWP100 value for nitrous oxide is 265.



Measuring egg industry emissions

- ◆ Agri-food supply chains differentiate emissions based on the contribution from land use (LU) and direct land-use change (dLUC).
- ◆ Emissions associated with LU relate to soil carbon losses from cultivation for crop production which, under some conditions, can lead to CO₂ emissions from soil.
- ◆ Emissions from dLUC refer to emissions that arise when land is converted from one use (e.g. forest or pasture) to another (such as cropland). This generally results in carbon losses from vegetation and soil.
- ◆ LU and dLUC impacts are reported separately as part of a carbon footprint as there is an acknowledged higher level of uncertainty in determining these emission sources.

- ◆ LU and dLUC impacts for poultry production in Australia tend to be dominated by impacts from imported soy meal in feed. In some instances, these impacts can exceed the carbon footprint of all other aspects of egg production.

Both the intensity and total emissions associated with a particular product and business are important measures of their environmental performance.

Determining and reporting carbon footprints is important for communicating with the supply chain (customers and consumers) and for benchmarking performance.

Determining and reporting total scope 1 and 2 emissions is important for setting emission reduction targets for a business and for communicating with investors.

Understanding the different emission 'scopes' is useful for understanding a carbon account, and being able to switch between different targets and objectives.

Measuring egg industry emissions *cont.*

Carbon footprint

Carbon footprinting is an analysis system defined in ISO standards (14067). The system is based on life cycle analysis and is effectively a 'single issue' LCA study. A carbon footprint is typically focused on a product (e.g. eggs) rather than a business or organisation, though it can be applied in that setting also. By definition, a carbon footprint includes scope 1, 2 and 3 emissions sources. This method is distinct from business carbon accounting which may be limited to only scope 1 and 2 sources.

A product carbon footprint reports impacts per kilogram of product (e.g. kilograms of CO₂-e kg⁻¹ of eggs), which is commonly referred to as an emission intensity. Often used for benchmarking and comparisons, a carbon footprint is important when comparing products or marketing the low carbon credentials of a particular product.

Business accounting – scope 1 and 2 emissions

Scope 1 and 2 emissions are the most relevant emission sources for businesses,

as they represent the emissions within direct operational control.

Because these terms are relative to the operational boundary, they are typically not comparable between businesses.

Some emissions that are 'scope 3' for one business may be 'scope 1' for another. Care must therefore be taken in comparing results and typically an emission intensity number is only reported for scope 1, 2 and 3 to ensure comparability.

Net zero scope 1 and 2 emissions

Business targets typically focus on emissions within operational control (i.e. scope 1 and 2 emissions), though assessment of scope 3 emissions and target setting are considered best practice if these exceed 40% of total emissions.

Business targets are usually set for the total emissions from the business rather than on the emission intensity of the products sold.

Scope 3 emissions

1. Scope 3 emissions “are a consequence of the activities of the company but occur

from sources not owned or controlled by the company. Some examples of Scope 3 activities are those arising from the extraction and production of purchased materials; the transportation of purchased fuels; and those from the use of sold products and services.” These can be further broken down into two sources for a farm:

- ◆ Upstream Scope 3 emissions from pre-farm sources, such as the production of purchased feed commodities, and breeding and hatchery operations.
- ◆ Downstream Scope 3 emissions from post-farm sources, such as retail and distribution.

2. Emissions can also be described with the terms direct and indirect emissions:

- ◆ Direct emissions “are emissions from sources that are owned or controlled by the company.”
- ◆ Indirect emissions “are a consequence of the activities of the company but occur at sources owned or controlled by another company (Ranganathan et al., 2004).”

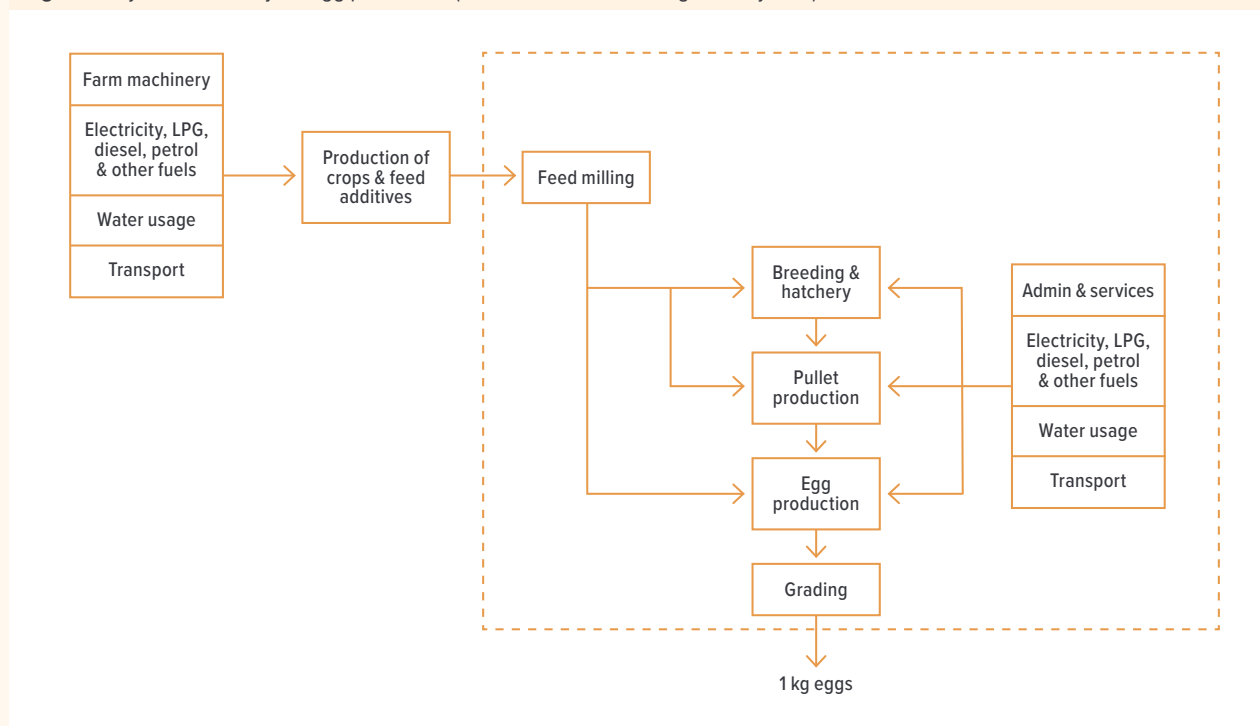
Supply chain assessment of the Australian egg industry

An assessment of the emissions and climate impact of the Australian egg industry for all production systems across the supply chain has been conducted to establish industry benchmarks and identify opportunities for reduction.

The supply chain assessment found:

- ◆ 1.2, 1.4 and 1.5 kg CO₂-e kg⁻¹ eggs for cage, cage-free and free range production, respectively.
- ◆ The carbon footprints (greenhouse gas emissions, incl. LU and dLUC) for cage, cage-free and free range eggs were 2.0, 2.1 and 2.3 CO₂-e kg⁻¹ eggs.
- ◆ The weighted average emission intensity of Australian eggs was 1.4 kg CO₂-e kg⁻¹, with LU and dLUC emissions of 0.8kg CO₂-e kg⁻¹, yielding a total emission intensity, incl. LU and dLUC, of 2.2kg CO₂-e.
- ◆ Feed production was the greatest contributor to emissions (71-74%, incl. LU and dLUC).

Figure 1. System boundary for egg production (dotted line denotes foreground system).



- ◆ Layer farm operations accounted for 14-16% of impacts, the upper bound being for free range production, which had the highest emissions from manure. Pullet production, including feed production, accounted for 7-9% of emissions. Grading (4-5%) and breeding (1%) were less significant sources of emissions.

Supply chain assessment of the Australian egg industry *cont.*

Figure 2: Emission intensity of cage, cage-free and free range eggs.

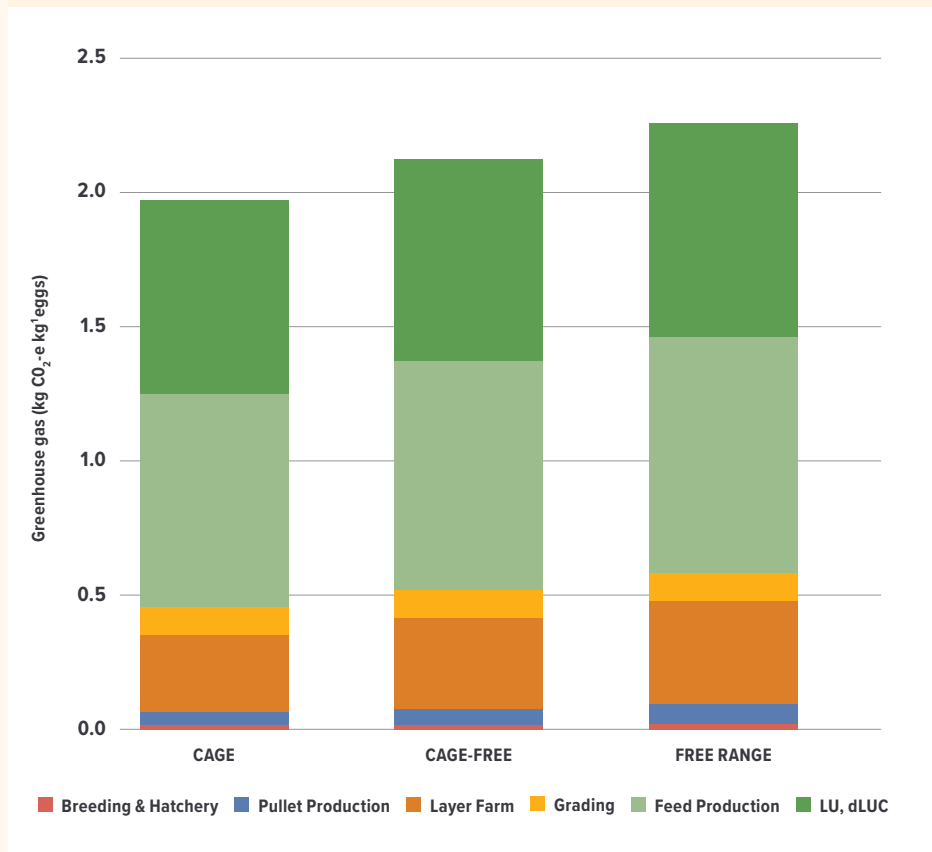


Figure 2 shows Greenhouse gas emissions (excl. LU and dLUC)

Figure 3: Emissions for the Australian egg industry, reported as scope 1, 2 and 3 (incl. LU and dLUC) emissions.

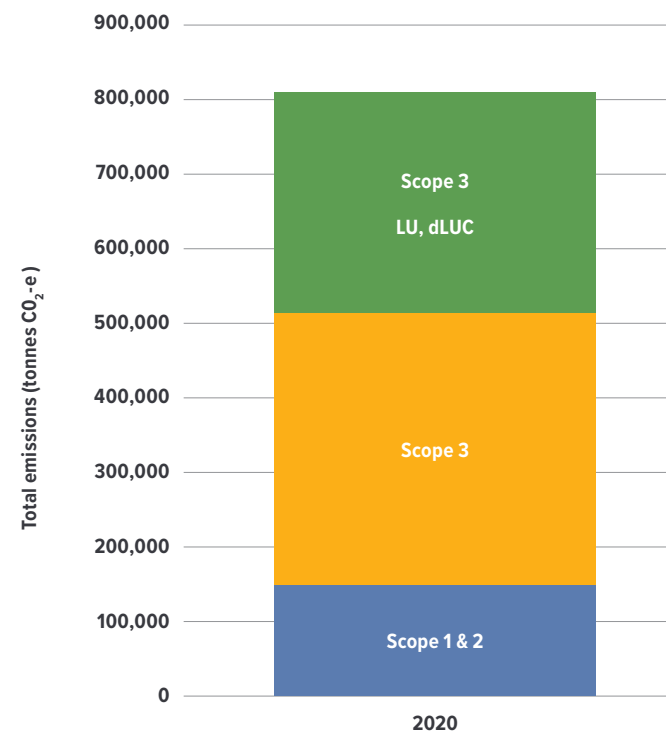


Figure 3 depicts total emissions for the Australian egg industry in 2020, classified by scope 1, 2 and 3 emissions, incl. LU and dLUC.)

Supply chain assessment of the Australian egg industry *cont.*

Scope 1 and 2 emissions

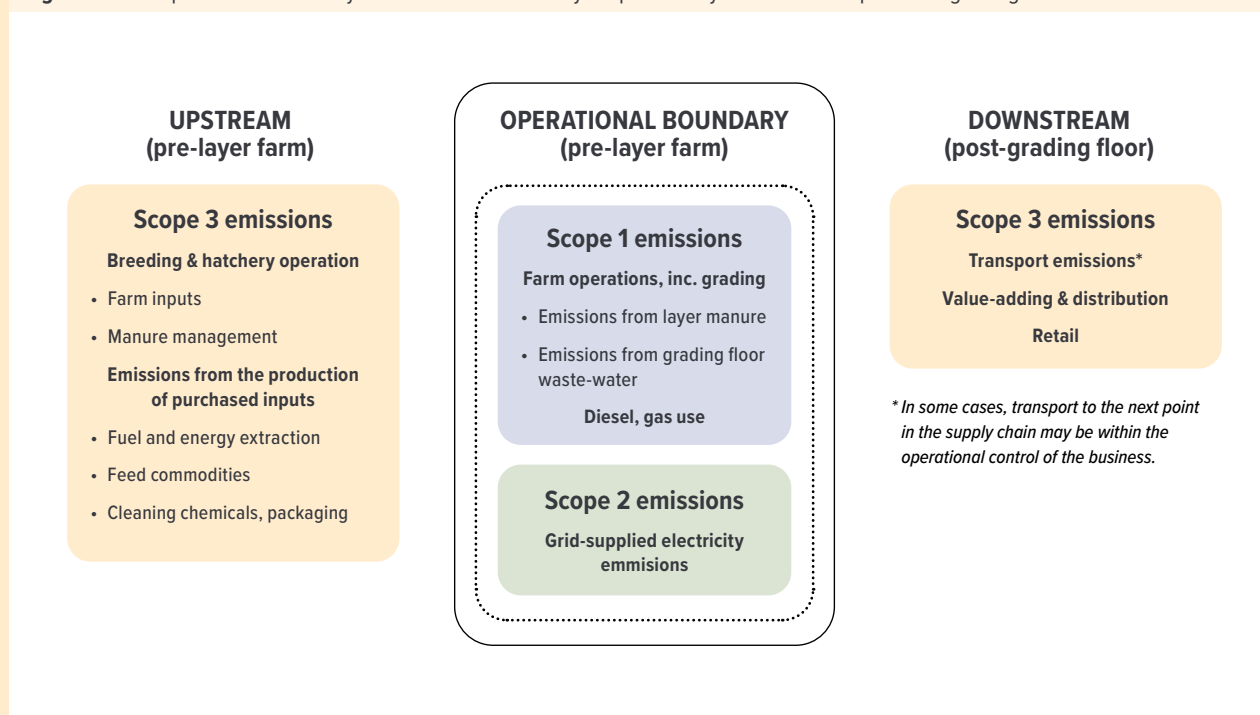
Scope 1 and 2 emissions accounted for 19% of total emissions. Scope 2 emissions were emissions associated with grid electricity consumption, whilst the major contributor to scope 1 emissions was energy (other than grid electricity consumption) with a smaller contribution from manure-related emissions.

Scope 3 emissions

Scope 3 emissions driven by feed production, represented 43% of the total. Feed production, particularly production of cereal grains, was the largest contributor to scope 3 emissions.

Scope 3 – LU and dLUC emissions, which represented 36% of the total, were driven by the inclusion rate of imported soy meal in diets.

Figure 4: The operational boundary and emission sources by scope for a layer farm which operates a grading floor.



Emission benchmarks

GHG emission benchmarks are useful as they allow for comparison between different egg production systems and estimation of the emissions reduction potential of various technologies and strategies.

For egg production, the GHG emissions associated with an individual operation will vary significantly depending on the housing system and its energy requirements, ration composition, bird performance (especially feed conversion), and manure management.

Table 1: Emission intensity vs total emissions – implications of example business targets.

	EMISSION INTENSITY (kg CO ₂ -e kg ⁻¹ eggs)	TOTAL PRODUCTION (kg eggs)	TOTAL EMISSIONS (t CO ₂ -e)
Baseline	1.5	20 million	30,000
Target: 5% reduction in emission intensity 10% growth in production	1.425	22 million	31,350
Target: 10% reduction in emission intensity 10% growth in production	1.35	22 million	29,700

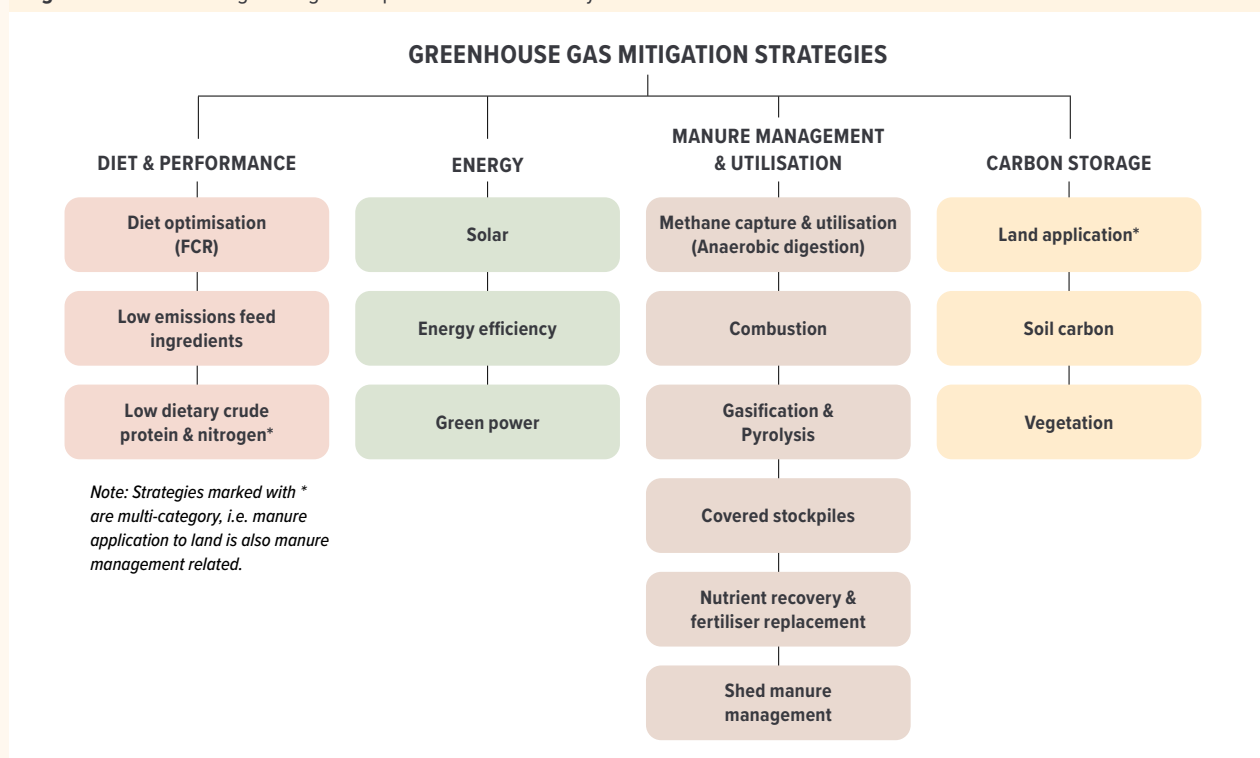


Emission mitigation strategies

Currently, the most effective way to reduce climate impacts associated with egg production is through changing diets to reduce reliance on high environmental-impact feed commodities such as Brazilian soyabean, feed conversion ratio improvements and energy efficiency measures to reduce housing energy demand.

Improved land management is likely to result in isolated small levels of carbon sequestration in Australian cropland, offsetting some GHG emissions. Further reduction in environmental impacts will rely on decarbonisation of feed supply chains and prioritisation of low environmental-impact feed commodities.

Figure 5: Greenhouse gas mitigation options for Australian layer farms.



Comparison with other animal proteins

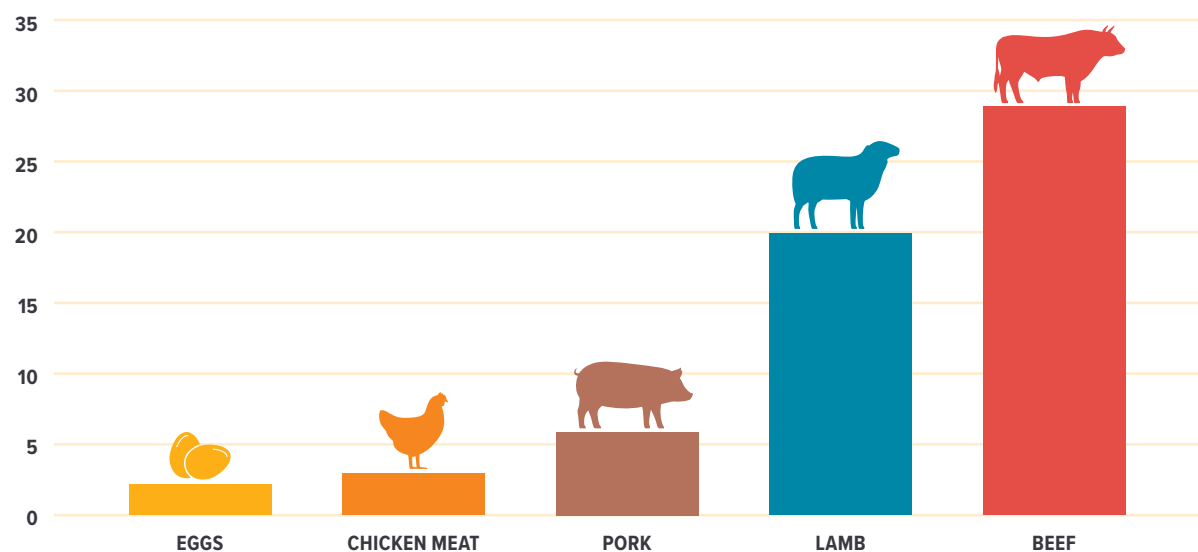
Per kilogram of shell-and protein-corrected eggs, GHG emissions (excl. LU and dLUC) were lower than for boneless Australian chicken meat (2.6–2.8 kg CO₂-e; and the national average for Australian boneless pork (6.5 kg CO₂-e), and substantially lower than for boneless Australian beef (29.5 kg CO₂-e) and lamb (18.3–20.8 kg CO₂-e).

Similarly, fossil energy consumption was lower than the fossil energy footprints for boneless beef, lamb, pork, and chicken meat. Although arable land occupation for eggs was substantially higher than for boneless beef and lamb, the extensive nature of Australian grazing systems means that total land occupation for egg production was far lower. This is consistent with the trend identified for boneless chicken meat, although arable land occupation for eggs was lower.

Stress-weighted water use (WSI) was lower than all four comparison meat proteins; however, AWARE values for boneless chicken meat were in some instances relatively similar to (although still higher than) those for the shell-and protein-adjusted eggs.

Freshwater consumption fell within the range for boneless chicken meat and was substantially lower than for boneless beef. Therefore, compared with other Australian animal proteins, eggs are one of the low environmental-impact products.

Figure 6: GHG emissions (excl LU and dLUC) of animal proteins.



How can egg farms calculate GHG emission & carbon footprint?

Egg production is a relatively low-emission industry. For larger businesses, however, total emissions are still substantial, and pressure exists to reduce the carbon footprint of eggs and business scope 1 and 2 emissions.

From 2024 onwards, an emissions calculator built specifically for the Australian egg industry will support farms to be able to measure their carbon footprint (scope 1, 2 & 3 emissions) and total on-farm greenhouse gases (GHG) emissions (scope 1 & 2), giving a comprehensive overview of the outputs of the entire supply chain. This self-assessment tool has been designed to be user-friendly, efficient, and applicable to farms of all sizes and operational systems. Importantly, all data inputted into the calculator will remain private to each farm, ensuring confidentiality.

The calculator will allow farmers to better understand baseline farm performance, and identify opportunities for improvement, empowering them to aim for and achieve lower-emission production.

The calculator will determine your farm carbon account (total Scope 1 and 2 emissions) for a given year, i.e., your business emissions. The federal government is in the process of developing an agriculture sector specific emission reduction target meaning that, in the future, egg farmers may be expected to demonstrate further reductions in on-farm emissions over time. This calculator will give a clear understanding of farm emissions and identify opportunities to reduce emissions.

The calculator will also determine the carbon footprint of eggs produced on a particular farm. Major retailers have and are continuing to engage with their suppliers and expect producers to be able to report key aspects of production that influence their product carbon footprint. The emissions calculator will measure the carbon footprint of the eggs produced on your farm to allow comparison with industry benchmarks and understand where impacts differ.



How to use the emissions calculator

The information required to use the emissions calculator should be available from farm invoices, management records and farm observations. This includes:

- ◆ Production data (bird numbers, egg numbers etc). This information is used to determine emissions from sheds and manure/spent litter. It is also used to calculate a carbon footprint per kilogram of eggs produced on your farm.
- ◆ Records of purchased inputs such as grid electricity, diesel, litter and feed. This information is needed to estimate GHG emissions resulting from use of fossil energy and from goods purchased from other companies.
- ◆ Tree planting, including area (ha), species and planting date (if relevant/available).
- ◆ General farm information

Inputs to other enterprises (e.g., cropping) operating on the same farm need to be separated as this tool currently only accounts for egg production activities (i.e. cropping is excluded).

The emissions calculator covers rearing, cage, cage-free and free range laying, feed milling, grading, composting/stockpiling, and upstream feed production.

For more information and support on the emissions calculator, please contact Australian Eggs by calling **02 9409 6999** or email at **contacts@australianeggs.org.au**



