Low Carbon Emission Roadmap

INTRODUCTION

There is growing pressure in Australia to reduce greenhouse gas (GHG) emissions from agricultural outputs to maintain community and consumer trust.

The Australian Government has a target to reduce emissions towards a net-zero goal, and retailers have already moved to benchmark and reduce emissions, including pork supply chains.

The Australian pork industry has committed to developing a low carbon target by 2025, working with producers to secure a sustainable future.

This document serves to help you, as a producer, to lessen your greenhouse gas emissions.

It covers:

- Understanding emissions: what they are, and how the industry is responding
- Benchmarking: how can you measure your current output
- Implementation: how can you reduce your output
- Monitoring: how can you track your progress
- Reporting: how to communicate your progress

UNDERSTANDING EMISSIONS

Greenhouse gases

Greenhouse gases are defined as atmospheric gases responsible for causing global warming and climate change (UN Climate change glossary - UNFCC, 2021). GHGs in the atmosphere increase the retention of the Earth's outgoing energy, thus holding heat in the atmosphere, altering the climate and weather patterns at global and regional scales.

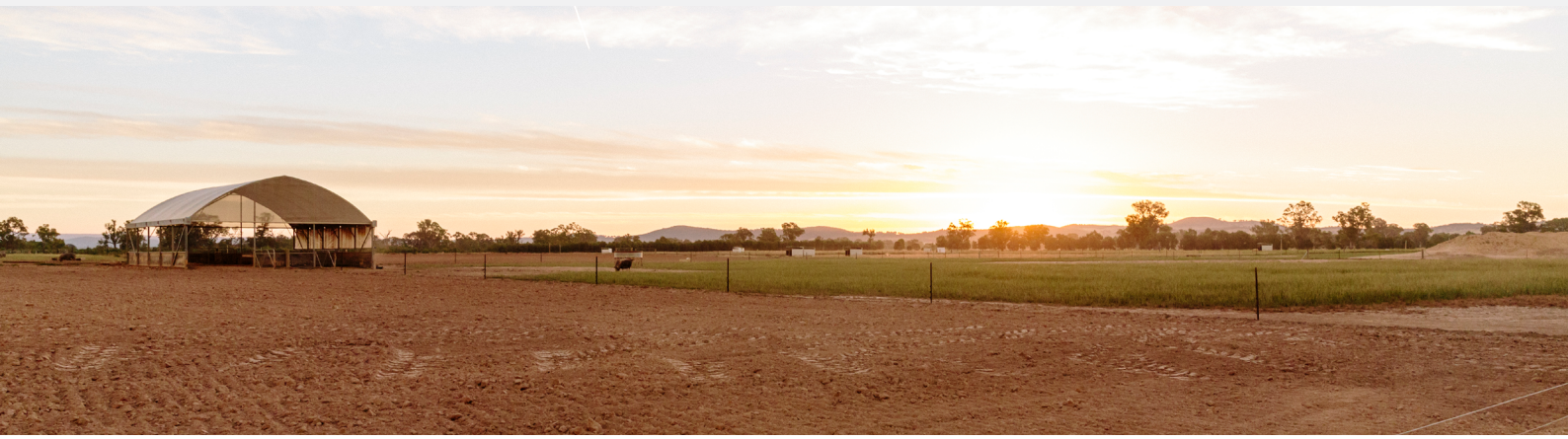
GHGs include:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Sulphur hexafluoride (SF_6)
- Other hydrofluorocarbons and perfluorocarbons

GHG emissions from businesses (including piggeries) are classified as Scope 1, 2, or 3:

- Scope 1: emissions from owned sources
- Scope 2: emissions from electricity generation
- Scope 3: subsidiary emissions from auxiliary and adjacent activity

The Australian pork industry has a long history of emissions reduction. A 69 per cent reduction in emissions intensity was achieved from 1980 to 2020, with a 44 per cent reduction in total emissions (Watson et al., 2018). While total emissions refers to the absolute quantity of greenhouse gas emissions, emission intensity is measured against the amount of pork produced.



The main GHG emissions from pig production are shown below.

Upstream
Pre-farm emissions

Scope 3 emissions

- Emissions from purchased pigs
- Emissions from the production of feed, including grain and supplements
- Emissions from the production of straw bedding

On-farm
Piggery emissions

Scope 1 emissions

- Piggery emissions
  - Enteric methane
  - Manure management emissions including nitrous oxide and methane
- Piggery services including diesel, petrol, gas

Scope 2 emissions

- Grid-supplied electricity emissions

Downstream
Post-farm emissions

Scope 3 emissions

- Emissions from transport of pigs to meat processing
- Meat processing
- Retail
- Emissions from manure/sludge exported offsite

Carbon storage

Any process, activity or mechanism which removes GHG, or a precursor of a GHG from the atmosphere is termed 'carbon storage' or a 'carbon sink'. Trees and other vegetation are considered sinks because they remove carbon dioxide, as is soil which can store organic carbon through cultivation of certain crops or the addition of soil amendments, such as manure.

BENCHMARKING

To meet consumers' expectations around sustainability and work towards APL's 2025 target, all producers must begin benchmarking current greenhouse gas emissions - a baseline to measure the success of reduction methods.

Types of benchmark

Carbon accounting looks at only Scope 1 and 2 emissions, while the carbon footprint (measured in kilograms per unit of product) looks at Scope 3 emissions as well.

Emissions from agri-food supply chains also differentiate 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 leads to CO_2 emissions from soil.

These sources are often reported separately from a carbon footprint because there is an acknowledged higher level of uncertainty in these emission sources.

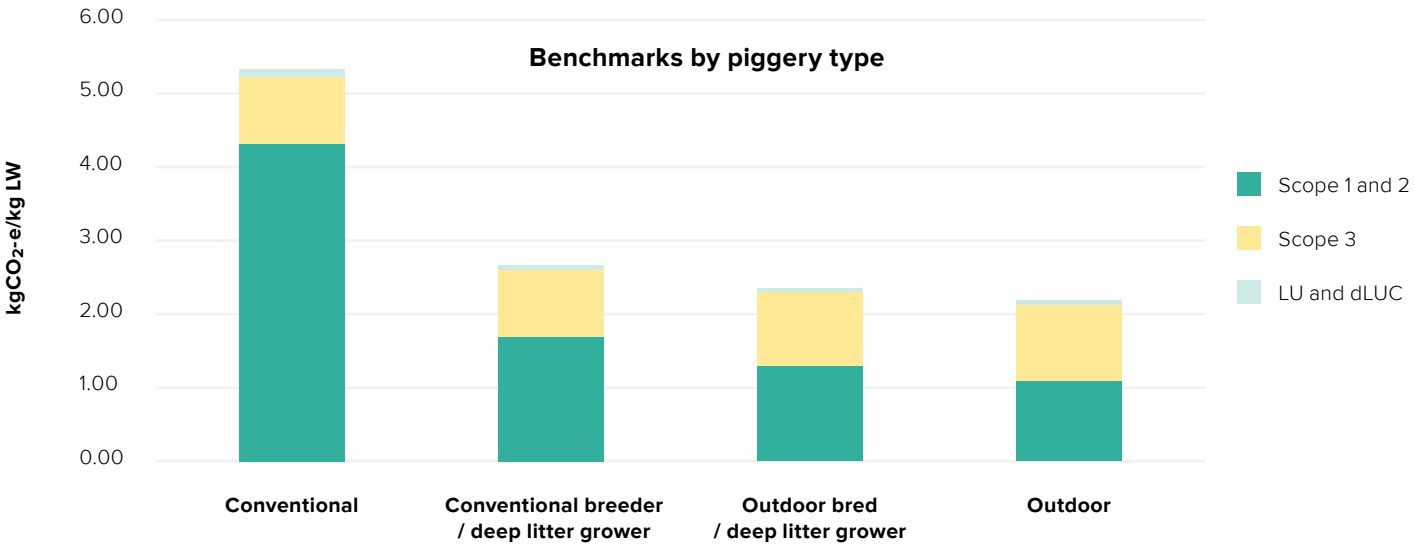
Baseline

To baseline your operation, you can follow the process outlined in APL Project 2020/00086 – Manual, using methods that are based on the National Greenhouse Gas Inventory for Scope 1 and 2 emissions.

For best results, however, you should consider engaging a consultant who has experience working with other piggeries.

This roadmap defines the system boundary for the assessment of GHG emissions as including all Scope 1 and 2 emissions (i.e. on-farm), all upstream Scope 3 emissions (i.e. feed production, purchases) and downstream Scope 3 emissions to the point of delivery to meat processing. The assessment includes Scope 3 impacts from LU and dLUC associated with feed production. Based on the proposed boundary, emissions intensity will be reported in kilograms of CO_2-e per kilogram of live weight (LW).

Once you have baselined your operation, you can compare with benchmarks and track performance over time. Benchmarks are provided below.



IMPLEMENTATION

There are many options available for you to implement that will reduce your impact on the environment and improve sustainability outcomes. Some are also likely to give you production gains as well. Broadly, these fall within four categories: production/feed, manure, energy efficiency and carbon storage, each of which will be explored in this section.

Greenhouse gas mitigation options

Production/feed

- Improved feed conversion
  - Reducing feed wastage
  - Reducing mortalities
  - Production improvements
- Using by-products
- Low GHG diets

Manure

- Methane capture
  - Methane destruction
  - Heat utilisation
  - Electricity generation
- Short hydraulic retention
- Solids separation
- Minimum stockpiling of waste
- Land application
  - Nutrient recovery for fertiliser

Energy efficiency

- Biogas
- Solar/Wind
- Improved efficiency

Carbon storage

- Vegetation carbon storage
- Soil carbon storage

Production/feed

Improved HFC

GHG emissions may be reduced by improving feed efficiency, for example via improved growth rates, improved breeding rates, lower feed waste or improved herd health. This roadmap uses the production parameter of live weight herd feed conversion (HFC), representing the whole herd feed conversion per kilogram of live weight delivered to the point of processing. As a rule of thumb, a one per cent improvement in HFC delivers about a one per cent decrease in GHG emission intensity.

Using by-products

The expected reduction in Scope 1 and 3 emission intensity for replacing a standard wheat/barley diet with approximately 35 per cent by-products and waste products (carbohydrates, dairy and fish waste) is 10 per cent in a conventional piggery. This reduction, however, is dependent on the digestibility and protein content of the by-products. Lower digestibility ingredients and ingredients with excessive protein will increase volatile solids and nitrogen excretion rates and lead to higher manure emissions.

Low GHG diet

Soybean meal imported from Brazil or Argentina is a high emission feed source because of dLUC emissions. Conversion from a relatively high imported soybean meal content diet (~ 9 per cent) to a reduced soybean meal diet (no soybean meal content) can result in reductions in emission intensity of up to 24 per cent.

Manure

Methane capture

The expected reduction in GHG emissions from including a covered anaerobic pond (or anaerobic digestor) and combined heat and power system to a conventional farrow to finish piggery operation is 53 per cent of Scope 1, 2 and 3 emission intensity. It is assumed the power generated offsets 100 per cent of the Scope 2 electricity requirements.

Methane from effluent ponds is the major source of Scope 1 emissions for conventional piggeries. Installing a covered anerobic pond (or anaerobic digestor) and combined heat and power system will reduce Scope 1 and 2 emissions by 65 per cent. Even covering the pond without generating power has the potential to reduce emissions.

Short Hydraulic Retention Time (HRT)

Short HRT systems consist of a pond, or tank, sized and designed to retain liquid effluent onsite for less than 30 days. This short HRT reduces methane generation by decreasing the opportunity for the development of anaerobic conditions, and as a result can reduce GHG emission by up to 53 per cent compared with a conventional pond system.

Solids separation

The inclusion of a solids separation process to an effluent stream, such as a sedimentation basin or screen has the potential to reduce the GHG emissions. A 31 per cent reduction in Scope 1, and a 25 per cent reduction in Scope 1 and 3 emission intensity would be expected from the installation of a screw press separator (37 per cent volatile solids removal) into a conventional piggery treatment process.

Minimum solids stockpiling

For a conventional breeder and deep litter grower operation, the contribution to the carbon footprint from both methane and nitrous oxide emissions from stockpiles is typically about 12 per cent of Scope 1 emissions, and eight per cent of the total emissions. If a producer converts to a no stockpile or litter off farm system, it is expected Scope 1, and 3 emission intensity reduction would be eight per cent.

Energy efficiency

Solar

Solar power is a sustainable energy solution that uses sunlight to charge photovoltaic cells that can be installed in piggeries. Australia, as a nation with a high amount of sunlight, is in an excellent position to use solar power to offset the emissions created through traditional power generation that relies on fossil fuels such as coal.

Biogas

Using methane capture technology to turn waste from piggeries into usable biogas for power is part of closing the waste loop, a long-term solution that will also reduce the operating cost of the piggery as energy can be generated to offset Scope 2 emissions.

Improved efficiency

Ensuring that your piggery does not have poor insulation, outdated lighting, heating or cooling technology or outdated generators will help prevent power leakage and improve the efficiency of your electricity use.

Carbon storage

Vegetation carbon storage

Carbon storage through tree planting is a long-term strategy as it requires several years of establishment to receive carbon benefits. The age of the tree, species, environmental conditions (soil type, rainfall) and management influences the rate of carbon storage. An average level of 7-10 t CO_2-e/ha.yr is reasonable to help estimate carbon potential once a tree reaches maturity however, it stops sequestering carbon from the atmosphere and simply becomes storage.

Soil carbon storage

Soil carbon storage results from the movement of carbon dioxide from the atmosphere into the soil via plant biomass processes. Compost, manure and effluent application promote soil carbon storage in two ways: firstly by directly adding carbon to the soil, and secondly by increasing nutrient levels to promote plant growth, resulting in more carbon inputs.

DO NOW:

Identify measures that can be used on your piggery and plan how to implement them to meet emission reduction targets.

MONITORING AND REPORTING

Agribusinesses across the nation have been directed to address emission targets through monitoring reduction and mitigation.

It is important that, once a benchmark has been set, you continue to monitor for changes in emissions. This is the best way to track progress against targets, identify which strategies are working, and change those that are not.

Parameters

For piggeries, the following parameters should be tracked to help in monitoring GHG emissions:

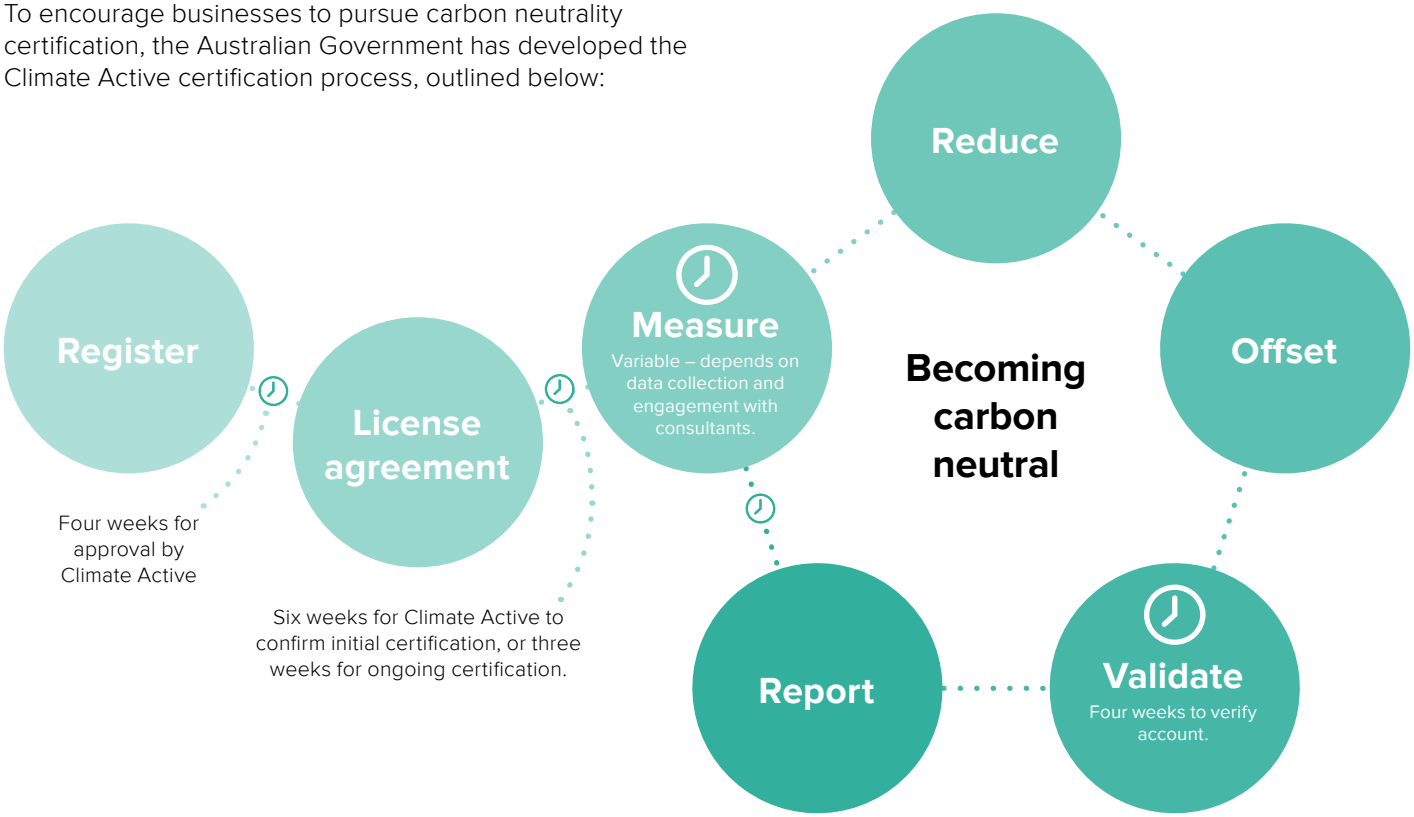
Operational factor	Comment
Herd composition	Breakdown of pig numbers and housing Annual average
Pigs weaned/sow / year	Annual average
Finisher pig weight	Average weight at delivery to processing
Electricity/Diesel/LPG Usage	Usage in piggery operations
Feed composition	Key feed ingredients
HFC	kg feed across whole herd per kg LW delivered for processing
Soymeal content in feed	% content in feed and origin
Distance to services (feed, fuel, processing)	Distance for delivery
Feed substitutions	Use of material other than manufactured pig rations
Manure management	Details of how manure id managed across site

OTHER CONSIDERATIONS

Certification

While it is possible to become carbon neutral without certification, there are benefits to being certified.

To encourage businesses to pursue carbon neutrality certification, the Australian Government has developed the Climate Active certification process, outlined below:



Climate Active's certification requires independent third-party to verify the carbon footprint and offset strategies. Businesses are required to meet ongoing certification and reporting requirements (e.g. annual reporting) to use the Climate Active trademark on their products.

Carbon offsetting

For most businesses, residual emissions may be difficult to limit or eliminate.

This makes it difficult to achieve carbon neutrality. In recognition of this, a process called carbon offsetting can manage these emissions.

Carbon offsetting can be achieved by purchasing approved carbon credits or retiring existing carbon offset credits that have been purchased earlier.

There are multiple types of carbon credits that can be generated or purchased. Eligible carbon credits for the Climate Active program currently include:

- Australian Carbon Credit Units (ACCUs) are regulated financial products under the Carbon Credits (Carbon Farming Initiative, CFI) Act 2011 administered by the Clean Energy Regulator through the ERF.
- Non-ACCU Offsets allowed under the Australian Government Climate Active Carbon Neutral Standard.
- The carbon market is regulated by the Clean Energy Regulator (CER) which administers national carbon markets for the Emission Reduction Fund and the Renewable Energy Targets.

Emissions reduction fund

The Emissions Reduction Fund (ERF) supplies Australian carbon credit units (ACCUs) and is a voluntary program that provides financial incentives for companies to adopt approved methodologies to reduce emissions, or by removing carbon dioxide from the atmosphere and sequestering carbon in soil or vegetation. Further details about the application of methods can be found at:

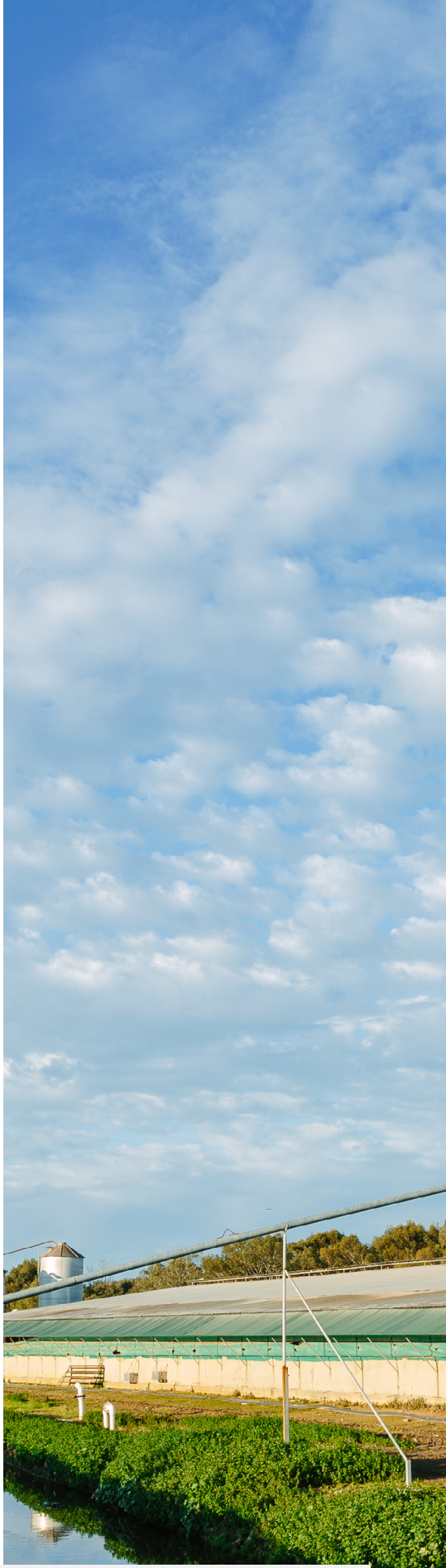
http://www.cleanenergyregulator.gov.au/ERF/Choosing-a-project-type/Opportunities-for-the-land-sector/Agricultural-methods

Renewable energy target

The Renewable Energy Target, which creates tradable large-scale renewable energy certificates (LGCs) and small-scale technology certificates (STCs). Within a piggery operation power generation from an anerobic digestor would, in most cases, be eligible for LGCs. Further information can be found at:

http://www.cleanenergyregulator.gov.au/RET/About-the-Renewable-Energy-Target/How-the-scheme-works/Large-scale-Renewable-Energy-Target

Get a life cycle assessment to understand your current emissions before implementing measurable changes on farm.



MORE INFORMATION

For a copy of the Sustainability Framework have a look on **APL's website** or contact Rowena Davis at **rowena.davis@australianpork.com.au**

For technical information, contact Gemma Wyburn at **gemma.wyburn@australianpork.com.au**