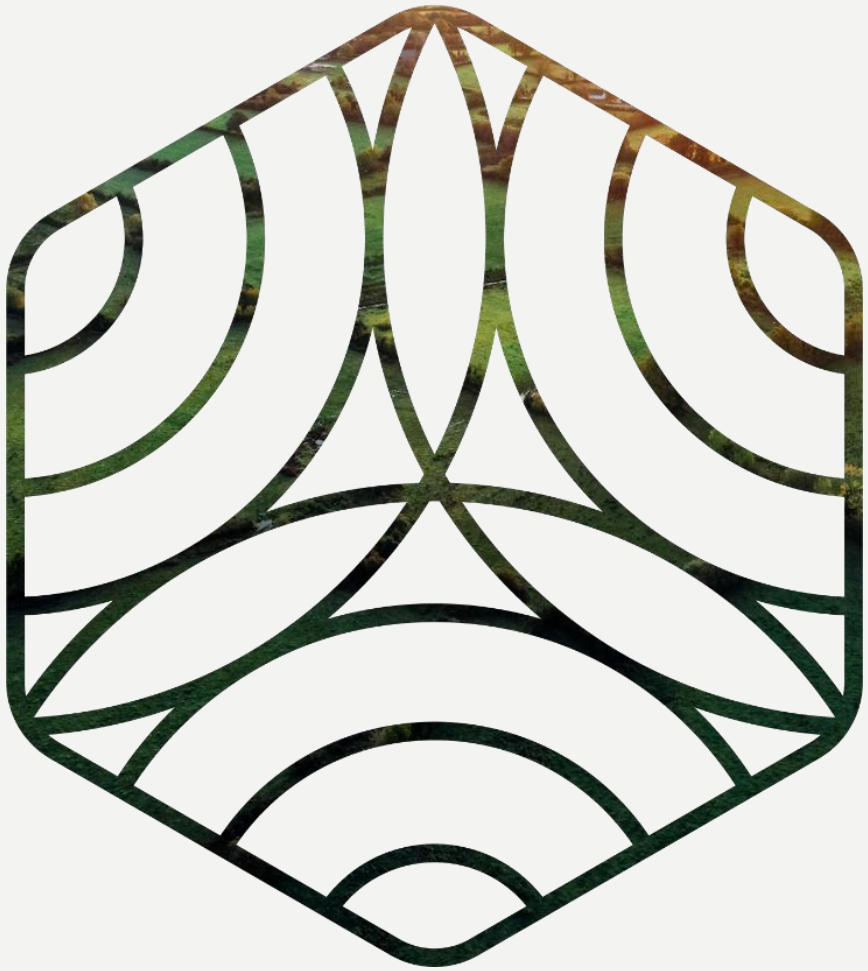


AgriFutures Chicken Meat Program Extension Webinar Series

October 2025

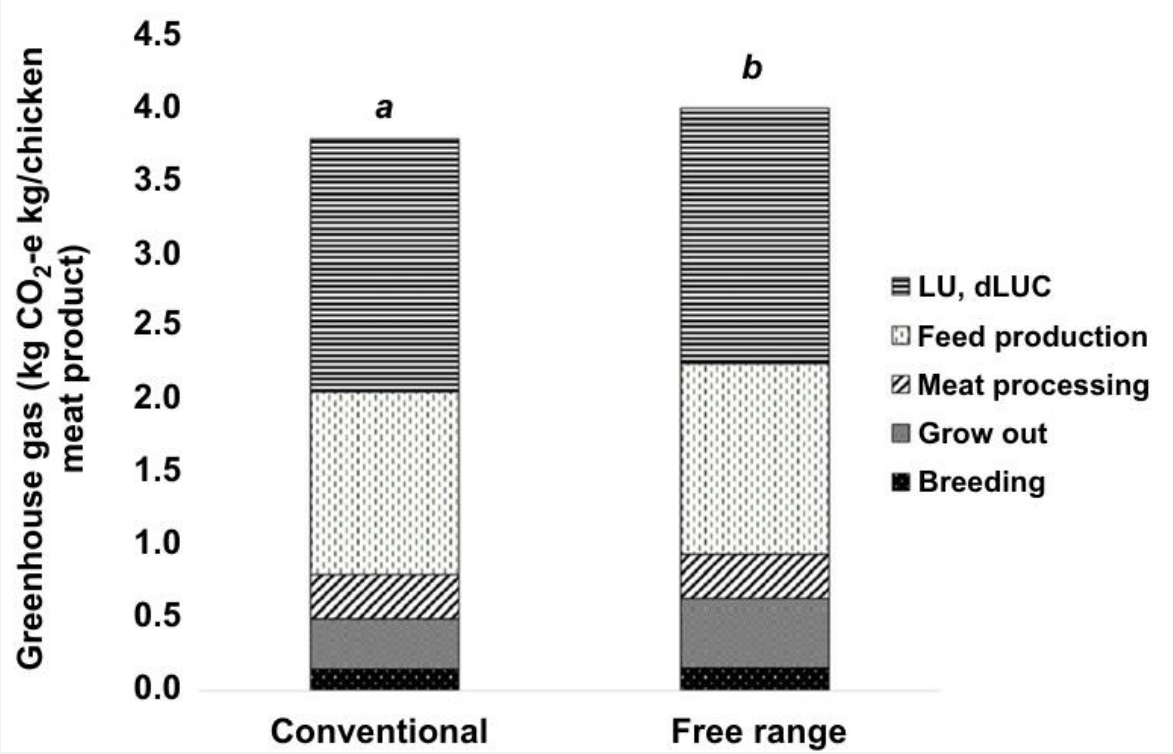
PRO-017713: Techno-economic emission reduction pathways for the chicken meat industry

Mary-Frances Copley, Eugene McGahan & Stephen Wiedemann

Project Background

Commercial chicken meat production generates very low environmental impacts per kilogram, relative to other meat products. Product carbon footprint:

- 79%: upstream feed production (incl. land use and direct land use change emissions)
- 10%: grow-out operations (incl. manure emissions)
- 8%: meat processing
- 4%: breeding & hatchery operations



CSIRO PUBLISHING
RESEARCH PAPER
https://doi.org/10.1071/AN22230
ANIMAL PRODUCTION SCIENCE

Environmental impacts of the Australian poultry industry. 1. Chicken meat production

M. A. Copley[A,*] and S. G. Wiedemann[A]

Megatrends in the carbon space

CUSTOMERS

- Scope 3 (supply chain) emission reduction targets
- Science Based Targets initiative (SBTi)
- Zero deforestation

INVESTORS AND FINANCE

- Mandatory Climate Related Financial Disclosures
- Net Zero Financed Emissions
- Task force for Climate Disclosures (TCFD)
- Science Based Targets (SBTi)
- Task force for Nature Disclosures (TNFD)

GOVERNMENT

- 43% national emission reduction target from 2005 levels by 2030 and net zero emissions by 2050
- Policy settings to drive emission reduction through economy starting with energy and heavy industry

PRIMARY PRODUCTION

- Sustainable and profitable businesses
- Stewards of the land with Carbon and Natural assets and liabilities
- Industry led reporting

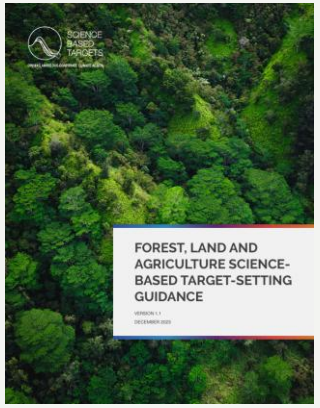
Scope 1, 2 and 3

Emissions defined using to the terms applied by the Greenhouse Gas Protocol:

- Scope 1: are from sources that are owned or controlled by the industry.
- These include emissions associated with manure (in shed/on range), fuel and gas use, wastewater treatment at processing etc.
- Scope 2: are from the generation of purchased electricity consumed by the industry.
- Scope 3: are a consequence of the activities of the industry but occur from sources not owned or controlled by the industry.
- These include emissions associated with extraction and production of purchased inputs and materials, production of feed commodities (upstream), and retail and consumer impacts (downstream).

SBTi FLAG Targets

SCIENCE BASED TARGETS
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION



Supply-chain relevant commitments made by Australian retailers as part of their SBTi certifications

Woolworths

Reduce absolute scope 3 FLAG GHG emissions by 40% by FY33 from FY23 base year

Reduce absolute scope 3 FLAG GHG emissions by 72% by FY20 from FY23 base year

No deforestation across primary deforestation-linked commodities (target date: 31 Dec 2025)

Coles

At least 75% of suppliers by spend to set science-based emission reduction targets by the end of June 2027

No deforestation supply chain for livestock and aquaculture feed (target date: 31 Dec 2025)

ALDI

Reduce absolute Scope 3 FLAG GHG emissions 30.3% by 2030 from 2022 base year

Reduce absolute Scope 3 FLAG GHG emissions 72% by 2050 from 2022 base year

No deforestation across primary deforestation-linked commodities (target date: 31 Dec 2025)

Project Objectives

Aim: map and compare pathways that align with customer and regulatory expectations and conduct an assessment of the cost of implementation (absolute and product-based), all relative to industry baseline GHG emissions.

Projection	Summary
Baseline industry emissions	Projected industry emissions (industry expansion, production changes [FCRs, yields etc]) in the current policy environment (incl. National Renewable Energy Target)
Pathway 1	Net zero Scope 1 and 2 absolute industry emissions by 2050
Pathway 2	SBTi FLAG commodity pathway to 2050 – product carbon footprint (emission intensity) reduction target
Pathway 3	A floating target based on technically and economically viable emission reduction strategies for the chicken meat industry to 2050.

Projected emission reduction pathways rely on several core assumptions, including costs, adoption rates, technology availability, policy drivers, and motivation, ultimately making the analysis inherently speculative by nature, particularly over an extended timeframe.

Project Method

1. Modelled draft pathways for the chicken meat industry to achieve absolute and emission intensity reduction

2. Conducted a first-stage economic assessment of the draft emission reduction pathways.

Incl. marginal abatement cost curves (MACCs) for options that have been pre-screened and deemed technically viable.

3. Presented pathways and key assumptions (costings, adoption rate etc) to the steering committee for review in a workshop.

4. Issued a survey to steering committee members to provide anonymous feedback on the assumptions.

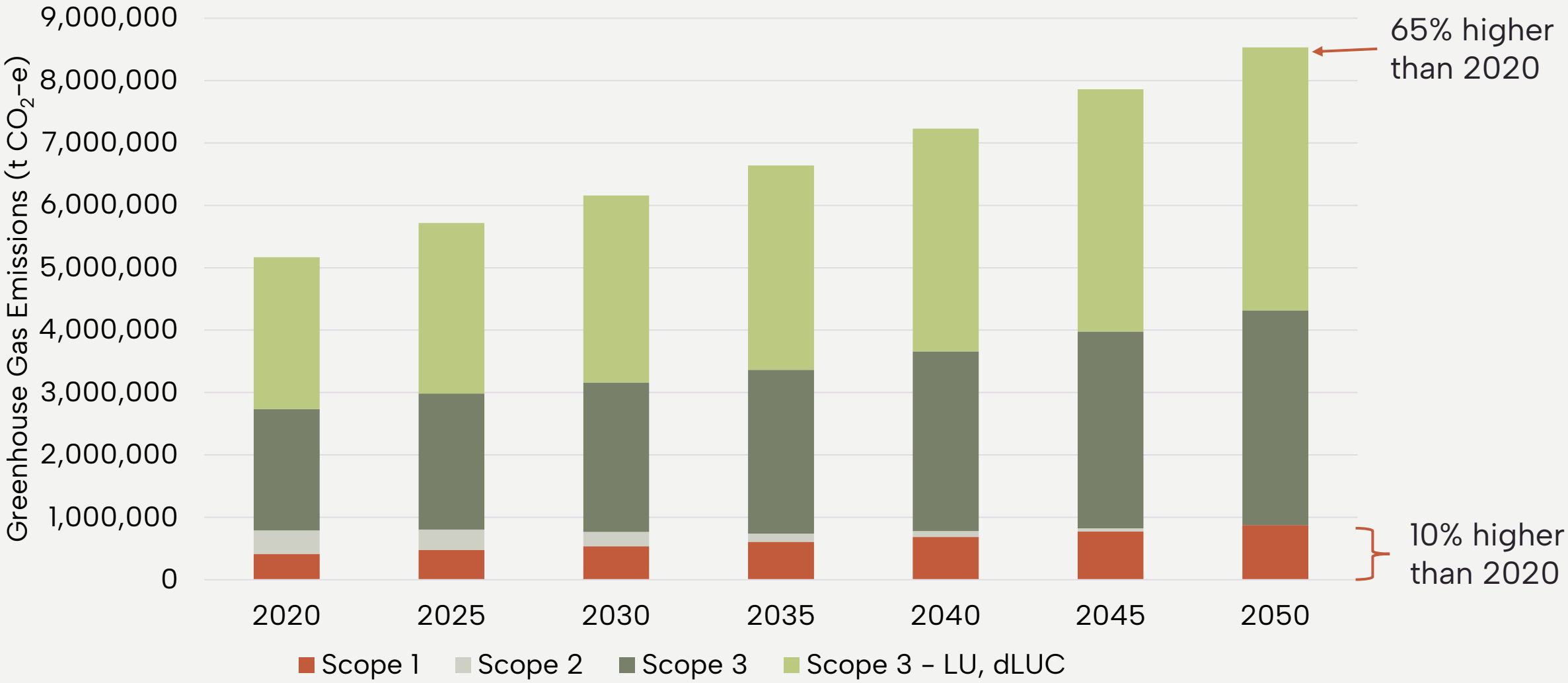
5. Finalised emission reduction pathways and economic assumptions based on the survey feedback.

6. Draft journal paper completed and distributed to the steering committee for feedback.

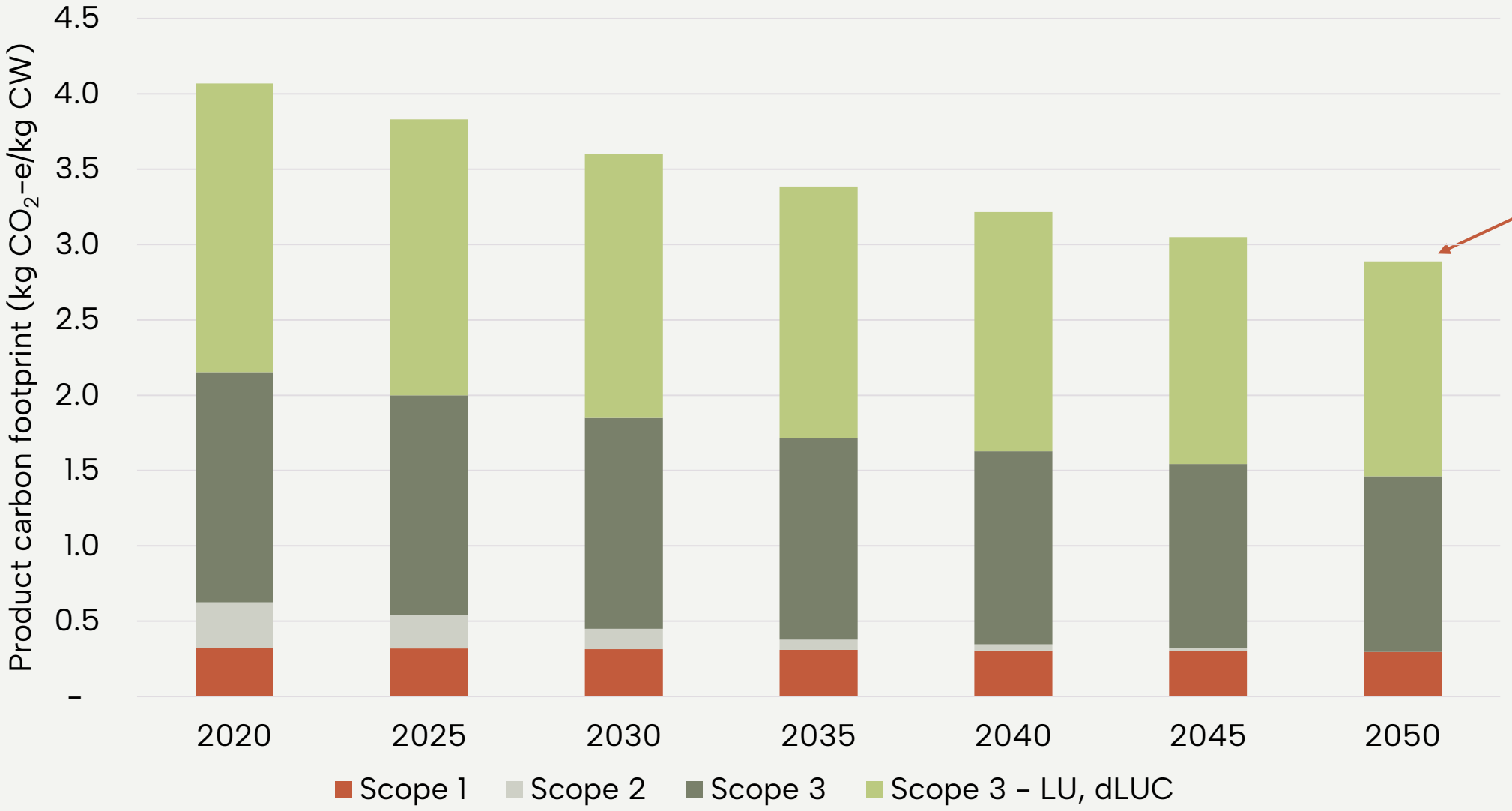
Underlying strategies / assumptions

	Baseline Projection	Pathway 1	Pathway 2	Pathway 3
National Renewable Energy Target	Yes	Yes	Yes	Yes
Ongoing incremental improvement in FCR	Yes	Yes	Yes	Yes
Ongoing incremental improvement in carcass yield	Yes	Yes	Yes	Yes
Reduction in dietary crude protein	N/A	Yes	Yes	Yes
Solar at grow-out farms	N/A	Yes	Yes	Yes
Solar at breeding & hatchery operations	N/A	Yes	Yes	Yes
Electric heaters at grow-out	N/A	Yes	Yes	Yes
Covered anaerobic ponds and heat energy generation at primary processing plants	N/A	Yes	Yes	Yes
Purchase of Green Gas (carbon neutral) gas at feedmills	N/A	Yes	Yes	No
Purchase of Green Gas (carbon neutral) gas at breeding & hatchery operations	N/A	Yes	Yes	No
Purchase of Green Gas (carbon neutral) gas at meat processing	N/A	Yes	Yes	No
Certified soybean meal	N/A	No	No	Yes
Carbon neutral Australian cereal grains	N/A	No	Yes	No
Optimised sourcing of Australian cereal grains to avoid LU and dLUC emissions	N/A	No	Yes	Yes
Net zero feed grains sector	N/A	Yes	No	No
Net zero transport fuels / transport sector	N/A	Yes	No	No
Emission removals (insetting via tree planting)	N/A	Yes	Yes	No

Baseline scenario – Absolute emissions



Baseline scenario – Product

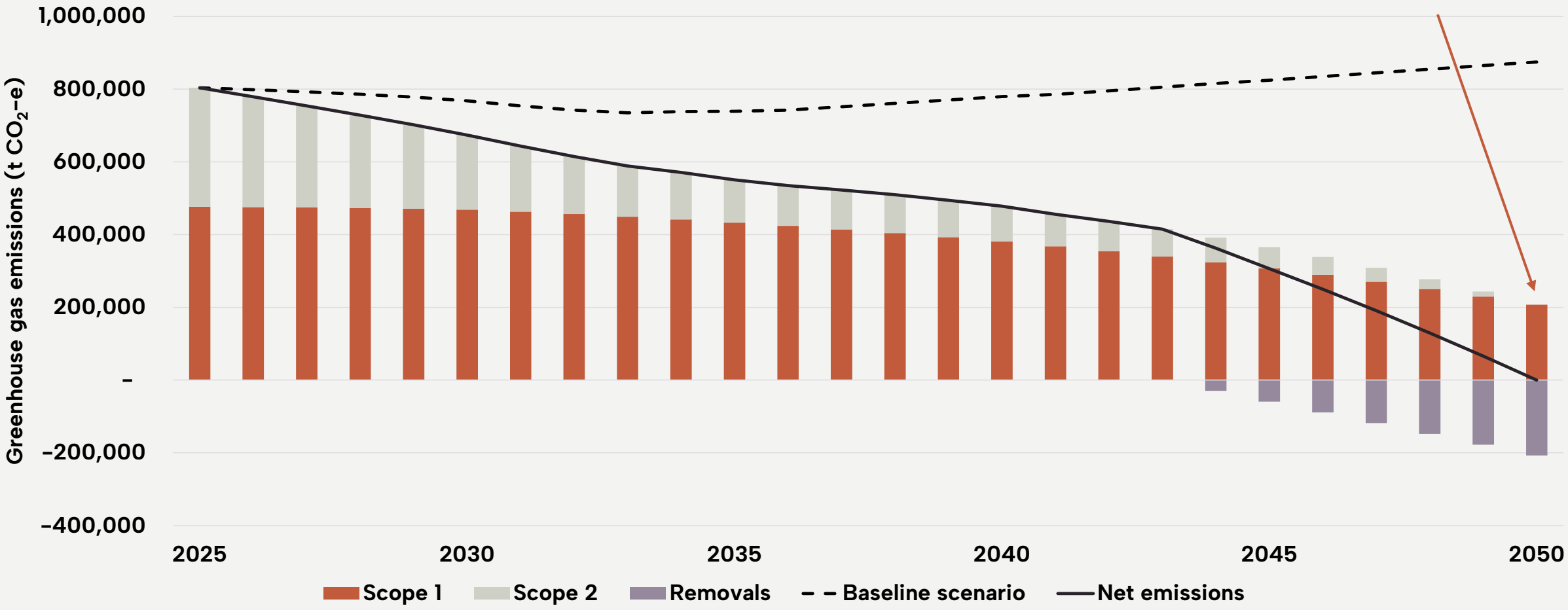


29% lower than 2020

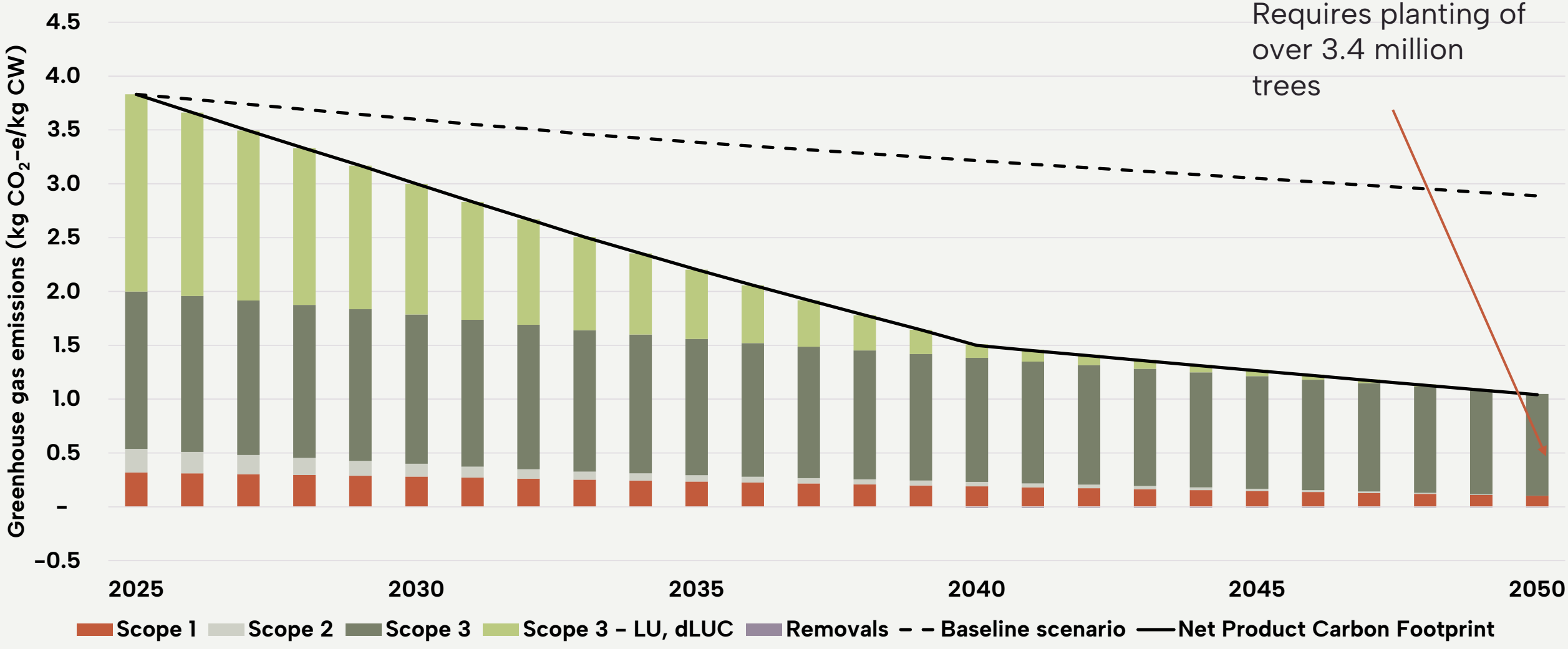
Equiv. to 1.1% reduction per year over 30 years

Pathway 1 – Net zero by 2050

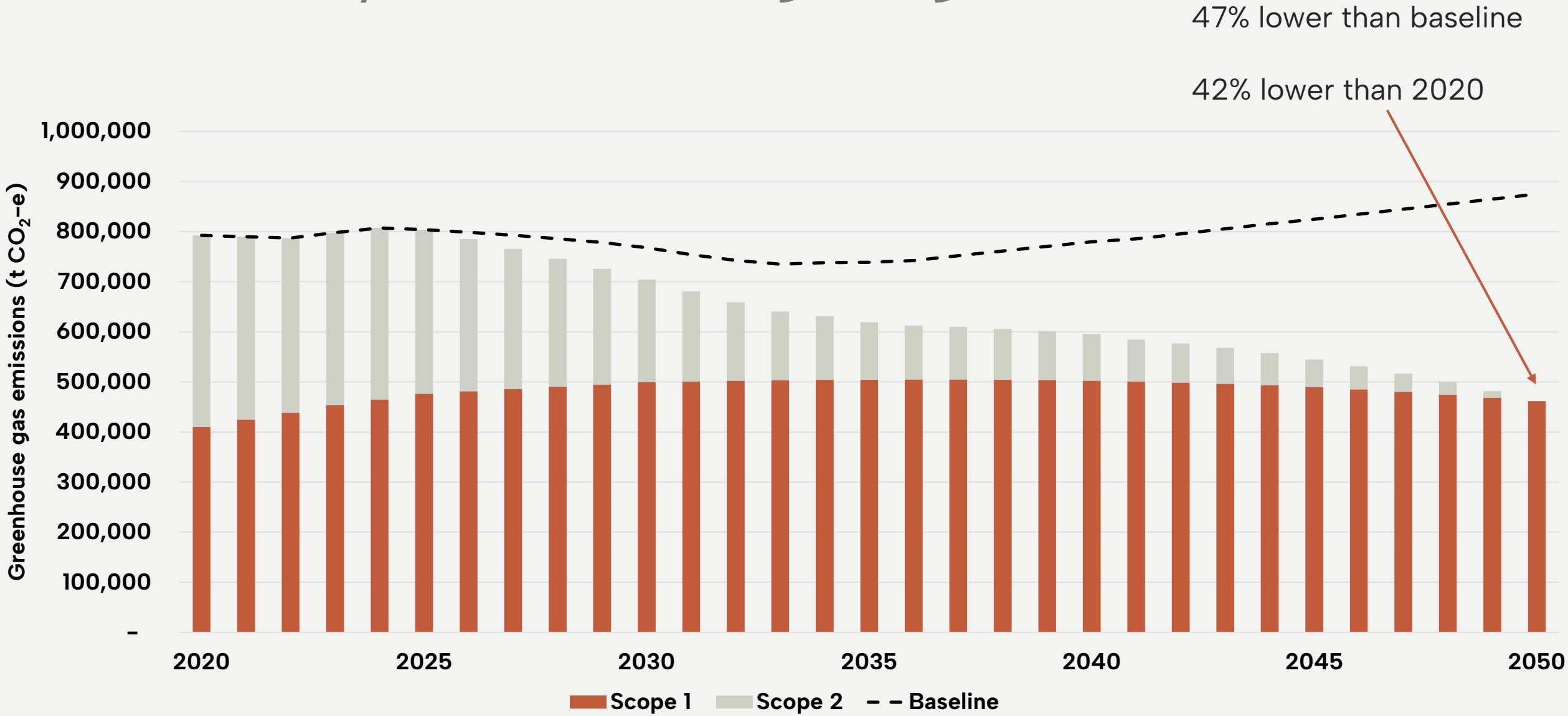
Requires planting of over 28 million trees



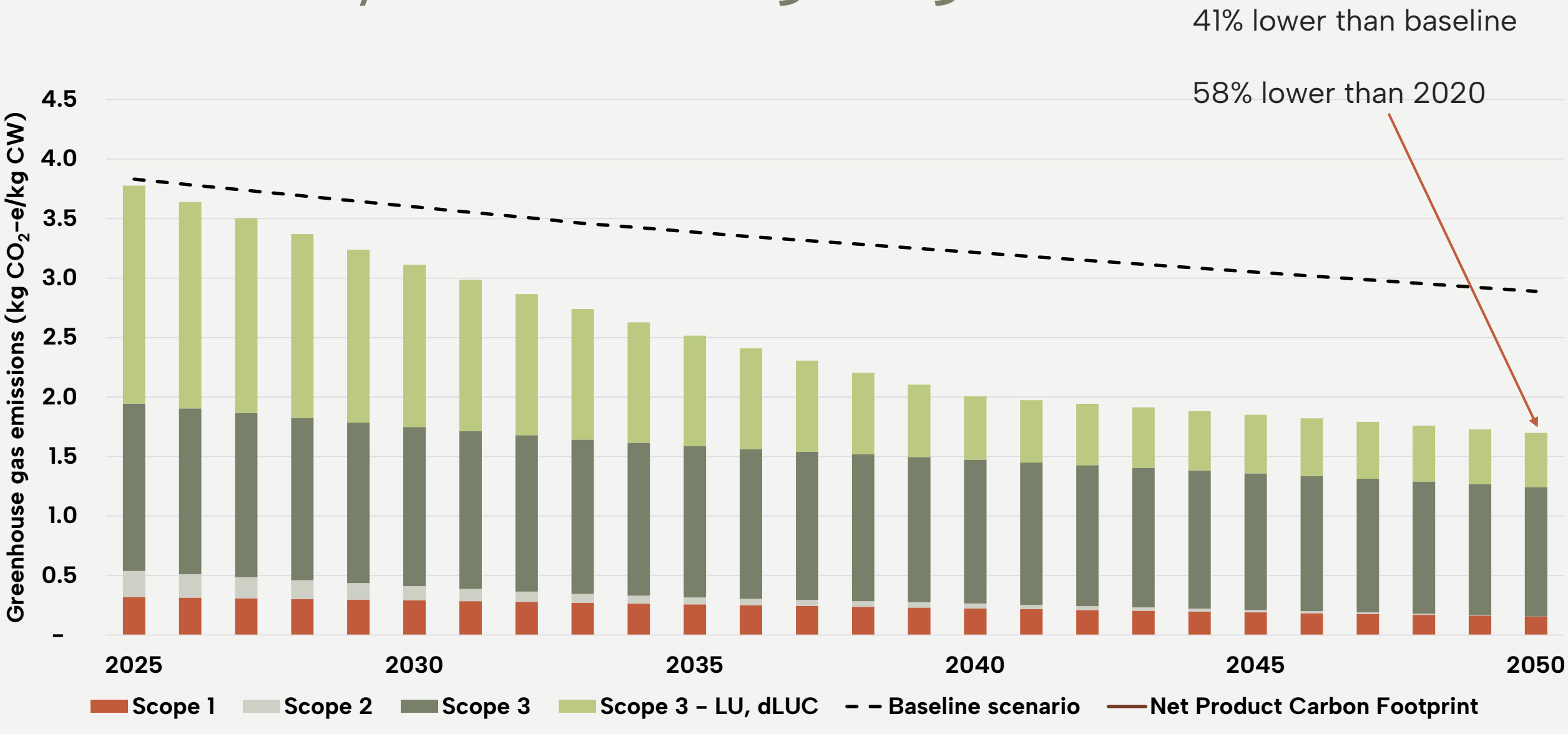
Pathway 2 – SBTi FLAG Commodity



Pathway 3 – Floating target



Pathway 3 – Floating target



Economic assessment

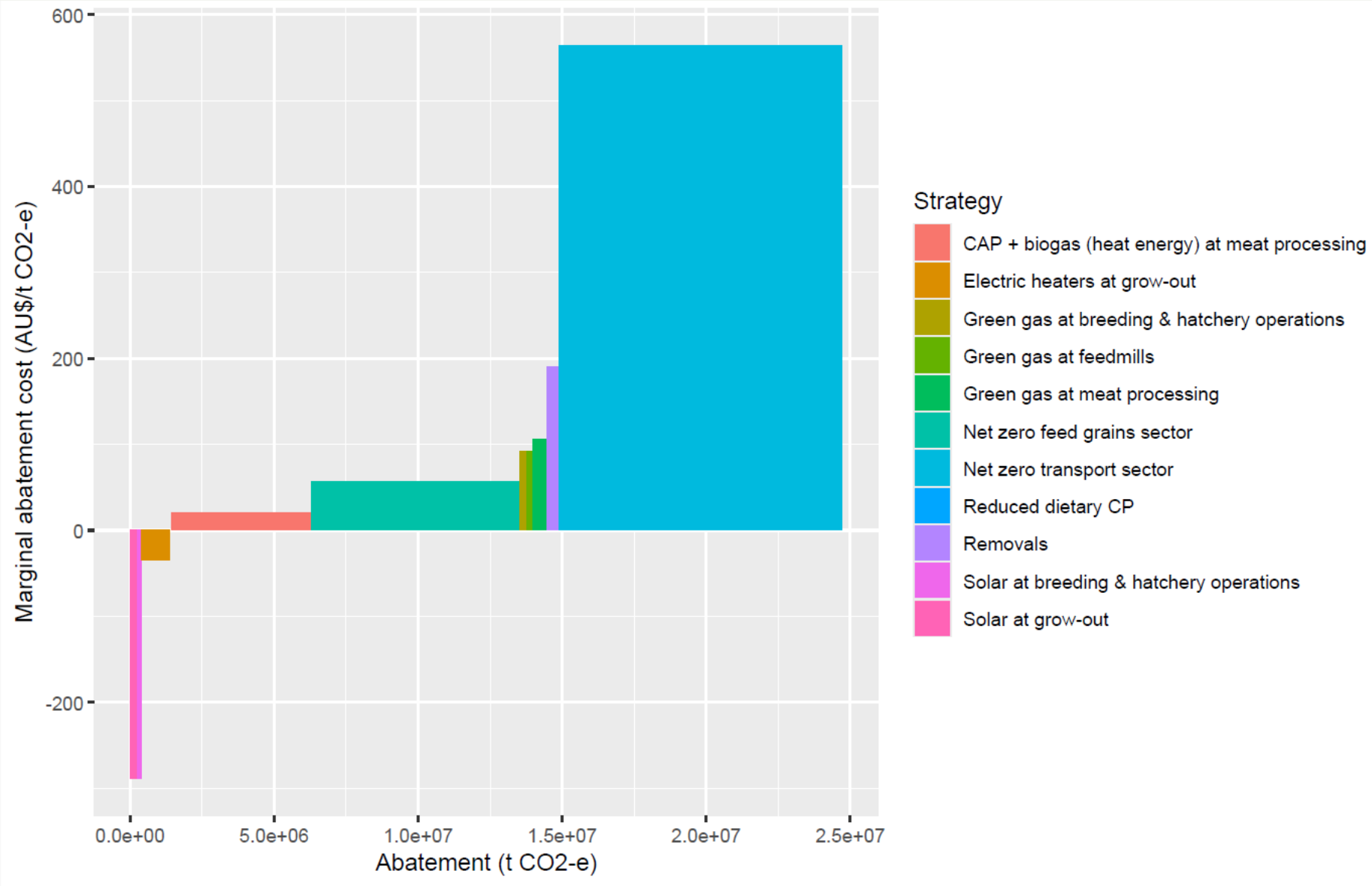
- Determine benefits (if any) and costs associated with each emission reduction strategy and each pathway. Benefits and costs determined as the expected additional benefits and costs that would be experienced or incurred by the industry from 2026 to 2050 relative to the baseline scenario.

- Net present values (NPVs) were determined for each strategy using a discounted cash flow. The NPV analysis used a discount rate of 7%. The NPVs were then annualised and expressed in terms of 2024 Australian dollars, to facilitate comparison between strategies with different project lives.

- Marginal abatement costs (MACs) were determined for each strategy, reflecting the cost (NPV) of each against its mitigation potential (t CO_2-e reduced/avoided). The MACs of each strategy were arranged in ascending order to create marginal abatement cost curves (MACCs) for each pathway.

- In the MACCs, each mitigation strategy / technology is represented by a bar. Height corresponds to the average cost of abatement, width: total abatement achieved. Strategies that would incur a cost appear above the x-axis whilst strategies that would increase profitability appear below the x-axis.

MACC – Pathway 1



Cumulative total cost: $2.8 billion

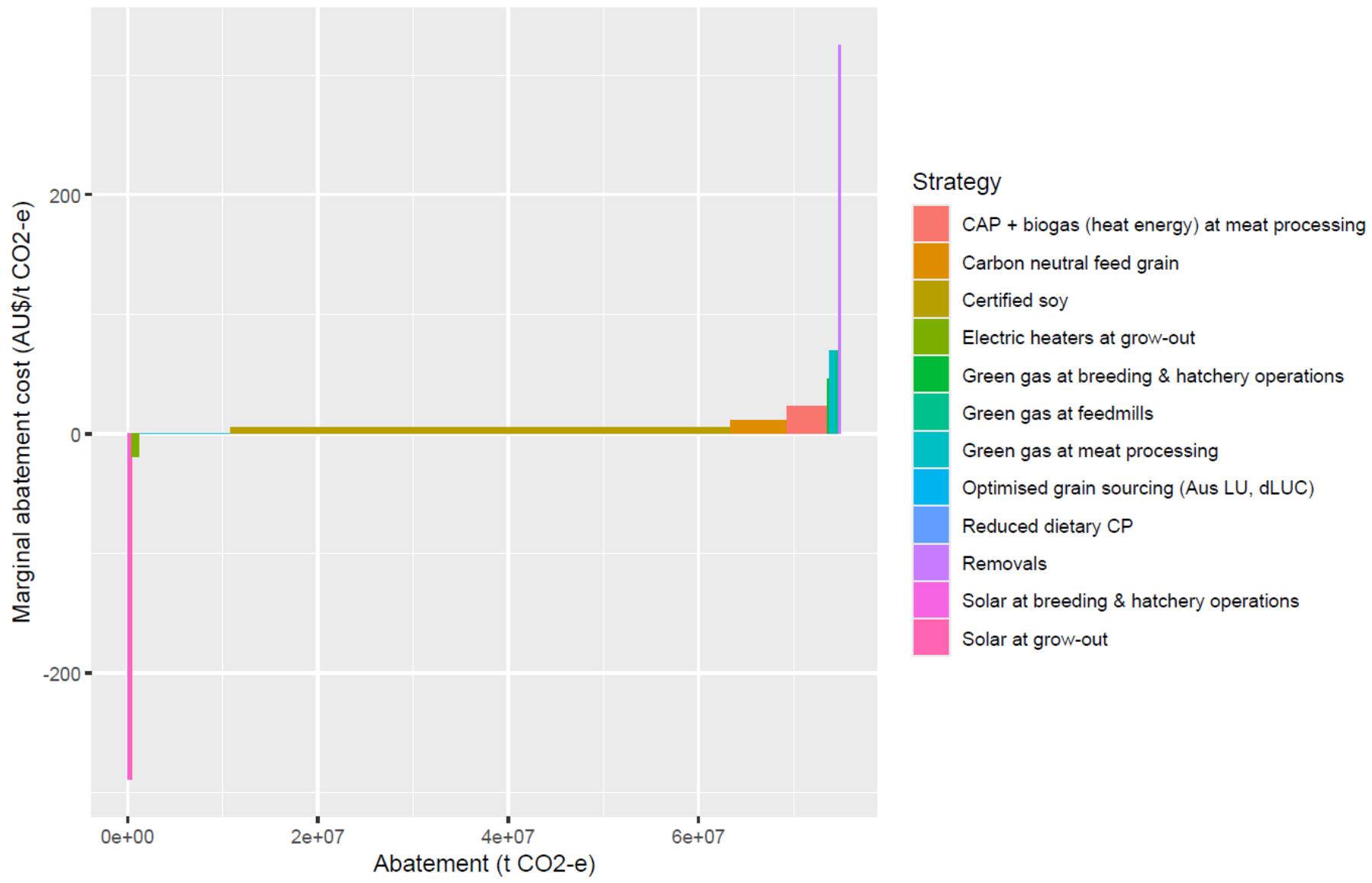
Cumulative total benefits: $1.1 billion

NPV: -$1.7 billion

Eq. to average cost of $30.4/t CW per year over 2025 to 2050

Weighted average MAC: $99/t CO_2-e

MACC – Pathway 2



Cumulative total cost: $1.8 billion

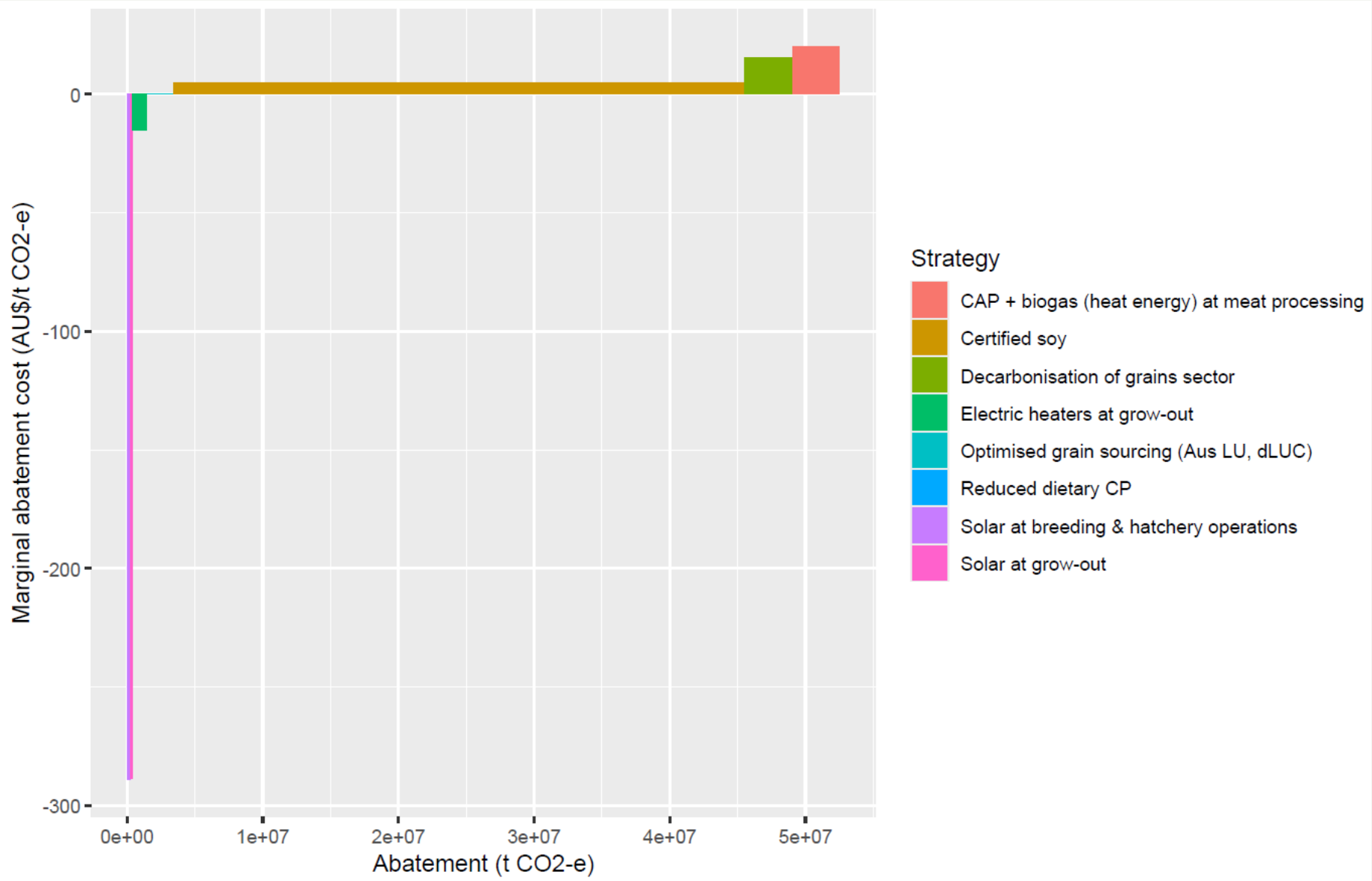
Cumulative total benefits: $992.5 million

NPV: -$911.4 million

Eq. to average cost of $16.4/t CW per year over 2025 to 2050

Weighted average MAC: $12.2/t CO_2-e

MACC – Pathway 3



Cumulative total cost: $1.3 billion

Cumulative total benefits: $857.2 million

NPV: -$447.8 million

Eq. to average cost of $8/t CW per year over 2025 to 2050

Weighted average MAC: $8.6/t CO_2-e

Implications

- Analysis demonstrate that industry is well-placed to achieve **product-based** emission reduction. Also scope to achieve **some** level of reduction in absolute emissions
- Major limitations and uncertainties exist with respect to emission reduction targets
  - Realisation of the National Renewable Energy Target
  - Feasibility of achieving net zero feed grains sector, net zero transport sector
  - Ability to pass costs on to customer, consumers and/or cost-sharing between different supply chain actors
  - Other strategies or technologies theoretically exist but are not affordable / accessible (e.g., cost-effective techniques to verify / measure small amounts of carbon in soil and vegetation)
- **Whilst industry is still motivated to achieve further emission reduction over time, analysis demonstrates there is a considerable gap between what is required to achieve established targets, and what is technically and economically achievable given the available strategies / technologies.**

Takeaways

- Only comprehensive published analysis of emission reduction potential in the Australian chicken meat industry to-date.
- Productivity improvements and decarbonisation of the electricity market were projected to lead to a **29% reduction in PCF** between the 2020 baseline and 2050, but sectoral emissions were projected to increase over this period.
- Findings confirm that **achieving established targets** (e.g., net zero) will be a formidable **challenge**. Substantial investment and research are required to identify new strategies, and reduce costs or other barriers to implementation.
- Raises **key policy implications** for the industry, and the animal **agriculture sector more broadly**, including the need for **ongoing discussions** with major customers and government around **what is achievable in the current environment** whilst c**ontinuing to provide critical goods and services** and investigate and invest in ongoing environmental improvement.