Livestock Improvement Corporation Limited

GHG Inventory Report

2021-**2022**

Executive summary

LIC has committed to becoming carbon neutral by 2050 in line with the New Zealand Government's Climate Change Response (Zero Carbon) Amendment Act 2019, and in accordance with its pledge as a signatory to the Climate Leaders Coalition. This report details LIC's year-three greenhouse gas (GHG) emissions for the period 1 June 2021 to 31 May 2022.

LIC has defined the following science-based climate change targets to reduce greenhouse gas emissions and limit the temperature increase to 1.5°C of pre-industrial levels:

- 46.2% reduction of Scope 1 and 2 emissions (excluding biogenic methane) by 2030 against the 2018/19 base year
- 28.88% reduction of Scope 3 emissions (excluding biogenic methane) by 2030 against the 2018/19 base year
- 10% reduction of biogenic methane by 2030 against 2017 emissions

Below is a summary of LIC's emissions in 2021/22, compared to the 2018/19 base year.

Comparison of total GHG emissions by scope for 2021/22 to base year (2018/19).

Scope	2018/2019 tCO_2-e base year	2019/2020 tCO_2-e	2020/2021 tCO_2-e	2021/2022 tCO_2-e	tCO_2-e Variation from base year
Scope 1 direct emissions	4,452	4,426	4,530	4,279	-3.89%▼
Scope 2 indirect emissions	379	354	328	308	-18.78%▼
Scope 3 indirect emissions	7,801	6,669	5,989	5,991	-23.21%▼
Total emissions	12,632	11,448	10,847	10,577	-16.27%▼

Scope	2018/2019 CH_4 (tCO_2-e) base year	2019/2020 CH_4 (tCO_2-e)	2020/2021 CH_4 (tCO_2-e)	2021/2022 tCO_2-e	CH_4 (tCO_2-e) Variation from base year
Scope 1 biogenic methane emissions	3,231	3,319	3,083	3,426	6.04%▲
Scope 3 biogenic methane	702	44	37	37	-94.66%▼
Total emissions	3,933	3,363	3,120	3,464	-11.93%▼

In the 2021/22 season, LIC's total GHG emissions fell by 16.27% from the base year, and in comparison to the 2020/21 season Scope 1 total emissions rose by 2.49%. Total biogenic methane emissions fell by 11.93% compared to the base year, whilst emissions rose by 11.02% when compared to the 2020/21 reporting year. Scope 1 emission decreases are predominantly the result of less fuel (diesel and petrol) usage.

Some of the decreases in scopes 2 and 3 emissions are likely attributed to the Covid-19 pandemic and limitations set on New Zealand regarding travel and working from home.

Direct methane emission increases are the result of having more animals present on LIC sites in 2021/22 than in previous reporting years.

Indirect methane emissions were reduced significantly as a result of an improvement in the way LIC's waste management emissions are captured. Indirect methane emissions are a very small contributor to LIC's overall GHG emissions, so this significant change does not have a large effect on overall emissions.

This report provides LIC with a comparison of LIC's 2021/22 GHG emissions against the 2018/19 baseline and enables LIC to meet its requirement under the Climate Leaders Coalition to make its greenhouse gas footprint publicly available.

Prepared by: Adrea Noyes, Environmental Advisor

Reviewed by: Cobus Kilian, Health, Safety & Environment Manager

Signed off by: Roz Urbahn, Chief People Officer

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Introduction

At LIC we recognise the importance of the preservation and restoration of the environment to ensure it is safeguarded for future generations. Our GHG inventory report aligns with our company strategy where environment and sustainability are foundational elements. This report guides our Senior Leadership team with their decision-making relating to our environmental sustainability initiatives and transitioning to a low-carbon future.

The impacts of climate change on our company and industry are widespread. Increasingly turbulent weather patterns can lead to intensified precipitation and flooding, whilst the increase in temperature raises the risk of heat stress in cows, reduces pasture growth, increases the risk of drought, and encourages undesirable weed growth and pest proliferation.

If not managed and mitigated, climate change may dramatically change the face of our industry and impact future endeavours.

As proud members of the Climate Leaders Coalition, we are committed to measuring our greenhouse gas footprint, having our data independently verified and making our information publicly available. We also proactively support our staff and suppliers to reduce their carbon footprint and are in the process of assessing our climate change risks.

This GHG inventory report contributes to our commitment to assessing our climate change risks and publicly disclosing them. It forms part of our Sustainable Business Council (SBC) membership requirements to measure the carbon footprint of our New Zealand operations, and report progress to the SBC.

The following report is our year-three GHG emissions inventory report, for the period 1 June 2021 to 31 May 2022.

Statement of intent

This GHG inventory report contributes to part of LIC's commitments to assessing our climate change risks and publicly disclosing them. The report guides the Senior Leadership Team in their decision-making relating to the corporation's environmental sustainability. As signatories of the CLC, LIC intends to make this report publicly available to all stakeholders.

GHG inventory summary for 2021/22

Total GHG emissions for the period 1 June 2021 to 31 May 2022 fell by 16.27% from the base year 1 June 2018 to 31 May 2019 (Table 1)[1]. When comparing the 2021/22 data with the previous reporting year (2020/21) total emissions were reduced by 2.49%. Scope 1 and Scope 2 emissions fell by 5.55% and 5.94% respectively, with a reduction of ~1.5% over the co-op's reduction target of 4.2% year-on-year by 2030. Scope 3 emissions rose by 0.02% but are still tracking below the co-op's reduction target of 28.88% by 2030.

[1] LIC attained further information for all three reporting years in addition to carrying out recalculation of emissions using the New Zealand Governments latest emissions factors. LIC also recalculated its agricultural emissions based on data collated on Overseer.

Table 1: Comparison of total GHG emissions by scope for reporting periods

	FY19 tCO_2-e (base year)	FY20 tCO_2-e	FY21 tCO_2-e	2021/2022 tCO2-e	tCO_2-e Variance of 21/22 to 18/19	tCO_2-e Variance of 21/22 to 20/21
Scope 1 direct emissions	4,452	4,426	4,530	4,279	-3.89%▼	-5.55%▼
Scope 2 indirect emissions	379	354	328	308	-18.78%▼	-5.94%▼
Scope 3 indirect emissions	7,801	6,669	5,989	5,991	-23.21%▼	0.02%▲
Total emissions	12,632	11,448	10,847	10,577	-16.27%▼	-2.49%▼

Some of the decreases observed in this inventory report are likely attributed to the Covid-19 global pandemic and limitations set on New Zealand regarding international travel, as well as more staff choosing to work from home or elsewhere rather than in the office 100% of the time.

Total biogenic methane emissions for the period 1 June 2021 to 31 May 2022 fell by 11.93% from the base year 1 June 2018 to 31 May 2019 (Table 2). However, there was an increase in biogenic methane emissions between the 2021/22 reporting year and the 2020/21 reporting year of 11.02%.

Table 2: Comparison of total GHG emissions by scope for the reporting periods.

Scope	2018/2019 CH_4 (tCO_2-e)[2] base year	2019/2020 CH_4 (tCO_2-e)	2020/2021 CH_4 (tCO_2-e)	2021/2022 CH_4 (tCO_2-e)	CH_4 (tCO_2-e) Variation of 21/22 from base year	CH_4 (tCO_2-e) Variation of 21/22 from 20/21
Scope 1 biogenic methane emissions	3,231	3,319	3,083	3,426	6.04%▲	11.15%▲
Scope 3 biogenic methane	702	44	37	37	-94.66%▼	0.66%▲
Total emissions	3,933	3,363	3,120	3,464	-11.93%▼	11.02%▲

67% of LIC emission source categories saw a reduction for the 2021/22 reporting year from the base year (Table 3). Emissions from international travel had the greatest reduction of 98.48% from the base year. In comparison, 2021/22 and 2020/21 had overall reductions to only 33% of emission source categories, with domestic air travel having the greatest reduction of 61.53%.

Table 3: Comparison of total GHG emissions by category for reporting periods.

	Emission Source	tCO_2-e - 18/19 (base Year)	tCO_2-e - 19/20	tCO_2-e - 20/21	tCO_2-e - 21/22	Variance from 21/22 to 18/19	Variance from 21/22 to 20/21
Scope 1	Stationary combustion	175.07	164.29	182.46	187.59	7.15%▲	2.81%▲
Scope 1	Transport fuel	3,324.05	3,201.71	3,376.53	3,090.23	-7.03%▼	-8.48%▼
Scope 1	Agricultural emissions	952.89	1,059.87	971.18	1,000.95	5.04%▲	3.07%▲
Scope 2	Electricity	379.36	354.01	327.58	308.11	-18.78%▼	-5.94%▼
Scope 3	Domestic Air Travel	259.46	172.39	179.73	69.14	-73.35%▼	-61.53%▼
Scope 3	International Travel	1,200.91	963.87	8.55	18.29	-98.48%▼	113.97%▲
Scope 3	Indirect passenger vehicle travel	6,066.50	5,243.75	5,628.01	5,701.72	-6.01%▼	1.31%▲
Scope 3	Electricity distributed T&D losses	32.53	31.96	29.76	27.99	-13.97%▼	-5.94%▼
Scope 3	Natural Gas distributed T&D losses	10.49	8.71	5.59	5.76	-45.08%▼	2.99%▲
Scope 3	Water supply	2.36	1.59	1.49	3.91	65.24%▲	162.96%▲

[2] Methane and nitrous oxide within this report are expressed in kg or tCO2-e using the conversion factors of 25 and 298 respectively.

	Emission Source	tCO_2-e - 18/19 (base Year)	tCO_2-e - 19/20	tCO_2-e - 20/21	tCO_2-e – 21/22	Variance from 21/22 to 18/19	Variance from 21/22 to 20/21
Scope 3	Freight	228.45	179.29	135.46	162.94	-28.68%▼	20.28%▲
Scope 3	Waste disposal recycling and non-biogenic waste	0.12	66.98	0.80	0.85	619.91%▲	5.79%▲

Biogenic methane emission sources saw an increase in Scope 1 agricultural emissions for the 21/22 reporting year of 6.04% from the base year, with an increase also seen when comparing 21 /22 with the 20/21 reporting year of 11.15%. Scope 1 wastewater treatment from LIC's Newstead site had a reduction of 6.35% from the base year but emissions increased by 1.42% compared to the 20/21 reporting year (Table 4). Scope 3 indirect biogenic methane from wastewater treatment from other sites increased by 26% from the base year and 32% when compared to the 20/21 reporting year. Scope 3 indirect biogenic methane derived from waste fell by 97% from the base year as a result of improved data capture, and by 11% from the 20/21 reporting year.

Table 4: Comparison of total biogenic methane emissions by category for reporting periods.

	Emission source	CH_4 (tCO_2-e) 18/19 (base year	CH_4 (tCO_2-e) 19/20	CH_4 (tCO_2-e) 20/21	CH_4 (tCO_2-e) 21/22	Variance from 21/22 to 18/19	Variance from 21/22 to 20/21
Scope 1 Direct Biogenic Methane	Agricultural emissions	3,229.49	3,317.32	3,081.03	3,424.61	6.04%▲	11.15%▲
Scope 1 Direct Biogenic Methane	Wastewater treatment	1.63	1.407	1.51	1.53	-6.35%▼	1.42%▲
Scope 3 Indirect Biogenic methane	Wastewater treatment	10.454	9.35	9.99	13.16	25.90%▲	31.73%▲
Scope 3 Indirect Biogenic methane	Waste	691.21	34.54	27.21	24.28	-96.49%▼	-10.75%▼

Organisational description and boundary

LIC is a farmer-owned co-operative and world leader in pasture-based dairy genetics and herd management.

LIC exist to deliver superior genetics and technological innovation to help its shareholders sustainably farm profitable animals.

LIC is headquartered in Hamilton, with 25 sites across NZ, Australia, UK and Ireland. With origins dating back to 1909, LIC has a long history of developing and delivering world-leading innovations for the dairy industry. This is even more relevant to farmers today given the rapid change the sector is undergoing.

The co-op is one of the sector's largest private investors in research and development (R&D). LIC's commitment to R&D and new product development continues today, in line with its strategy to deliver value for its farmer shareholders.

LIC shares are listed on the NZX. LIC shareholders must be dairy farmers in New Zealand, supply a New Zealand-based milk processor and buy a minimum amount of qualifying products and services from LIC in any one year.

As a farmer-owned co-operative, all of LIC's profit is returned to their shareholders in dividends, or reinvested into new solutions and R&D.

Following the methodology described in The Greenhouse Gas Protocol the organisational boundaries were set to include LIC New Zealand operations. LIC International operations are excluded. The GHG protocol allows two distinct approaches to consolidate GHG emissions, equity share or control approaches (financial or operations). LIC has opted to disclose its GHG emissions using the operational control approach for the co-op's New Zealand operations.

Inventory boundary

GHG emission source inclusions

LIC has elected to report on Scope 1 - Direct emissions, Scope 2 and Scope 3 – Indirect emissions, and Scope 1 direct biogenic methane emissions and Scope 3 indirect biogenic methane emissions. Table 5 outlines emissions sources and LIC's commitment to reporting on them.

Table 5: Emission sources inclusions.

Scope	Emission sources	Details
Scope 1	Stationary combustion fuel	Data obtained from supplier invoices
Scope 1	Direct travel	Data obtained from Leaseplan
Scope 1	Direct water supply	Data obtained by daily staff meter readings on-farm and data from Halo™ Systems®
Scope 1	Agricultural emissions	N_2O and CO_2 emissions derived from OverseerFM data and calculations
Scope 1	Rental car	Data obtained from Leaseplan[3]
Scope 2	Purchased electricity, heat and steam emission factors	Data obtained from supplier invoices

[3] Previous report excluded this data as *de minimus*, however following advice from Toitū LIC has now add these emissions sources back into the report and have recalculated all reporting years.

Scope	Emission sources	Details
Scope 3	Domestic air travel	Data obtained from Orbit World Travel
Scope 3	Transmission and distribution losses for natural gas	Data obtained from supplier invoices[5]
Scope 3	Transmission and distribution losses for electricity	Data obtained from supplier invoices[5]
Scope 3	International air travel	Data obtained from Orbit World Travel.
Scope 3	Indirect passenger vehicle travel	Estimated data based on census data and Artificial Breeding Technician's travel km reimbursement data.
Scope 3	Water supply	Data obtained from councils. Where data was not available per-capita calculations were used.[5]
Scope 3	Waste	Data obtained for recycling of paper and cardboard, glass and non-biogenic waste from supplier invoices.[5]
Scope 3	Freight transport emissions	Data obtained from supplier invoices.
Scope 1 biogenic methane	Agricultural emissions	CH_4 emissions data derived from OverseerFM data and calculations
Scope 1 biogenic methane	Direct wastewater treatment	Data was obtained from S3 and BPO.[5]
Scope 3 biogenic methane	Waste	Data obtained from supplier invoices.
Scope 3 biogenic methane	Indirect wastewater water treatment	Data obtained from supplier invoices, where data was not available per-capita calculations were used.[5]

GHG emission source exclusions

LIC recognise that a small proportion of its GHG emission sources contribute to total inventory with many individual GHG emissions contributing to less than 1% per emission source category. When collated, these emission sources have totalled less than 2% of total GHG emissions inventory and as such LIC have deemed them *de minimus*. Table 6 outlines the GHG emission source exclusions and justifications.

Table 6: GHG emission sources excluded from LIC inventory.

Scope	GHG emission source	Reason for exclusion
Scope 1	Biofuels and biomass	LIC does not use biofuels or biomass
Scope 1	Fugitive emissions from refrigeration, air-conditioning units and vehicle air-conditioning units	Data was difficult to quantify and was determined to be *de minimus* following the 19/20 assessment.
Scope 3	Indirect business-related emission factors (emissions associated with employees working from home)	LIC has determined that this information will be difficult to quantify due to seasonal fluctuations and a mix of staff working from home and on-site across all business units.
Scope 3	Accommodation	Determined to be *de minimus*.
Scope 3	Public transport and taxi travel	LIC has excluded public transport and taxi travel as it is difficult to obtain data.

Coronavirus disease (Covid-19)

During the 2021 to 2022 reporting year, the globe was still affected by the Covid-19 pandemic. As a result of the pandemic, LIC found a new normal for business-as-usual work which included flexible working, supporting those employees that can work from home and limited international travel. With these elements in play, results from some emissions may be skewed by either over or under-representation of true emissions generated by LIC. LIC has endeavoured to ensure that information provided in this report is as representative as possible given the circumstances.

Methodology

This GHG inventory was prepared in alignment with The Greenhouse Gas Protocol standard guidance (GHG-Protocol, 2015), ISO 14064-1:2018 - Greenhouse gases - Part 1 and Measuring Emissions: A Guide for Organisations (NZGovt, 2022).

LIC used Toitū Envirocare emanage and Toitū Envirocare My Farms software in conjunction with OverseerFM to calculate GHG emissions. LIC managed data using Microsoft Excel.

Significant emission sources 2021/22

LIC's top emission sources are derived from Scope 1 direct emissions - diesel use, Scope 1 biogenic methane - enteric fermentation, and Scope 3 indirect emissions - staff commuting.

The activities that relate to the most significant emissions are indirect transport emissions from staff commuting to, from, and for work. Significant emissions produced by on-farm activities are derived from livestock, fertiliser use and feed, and emissions generated by the diesel used in fleet vehicles to deliver LIC's products and services.

Scope 1 - Direct emissions

Transport fuel represents a large proportion of LIC's total Scope 1 emissions with diesel contributing to 60% and petrol contributing 12%. In the 21/22 reporting year, diesel emissions were reduced by 6.3% from the base year and regular petrol emissions were reduced by 13.2%. Premium fuel was combined in the base year but has now been separated from regular petrol. Premium petrol emissions were reduced by 51% from the 20/21 reporting year to the 21/22 reporting year. Transport fuel emission reductions are related to replacing a large number of LIC's combustion engine fleet vehicles with EVs and PHEVs. Further reductions year-on-year are expected as LIC continue to replace existing combustion engine vehicles (Figure 1).

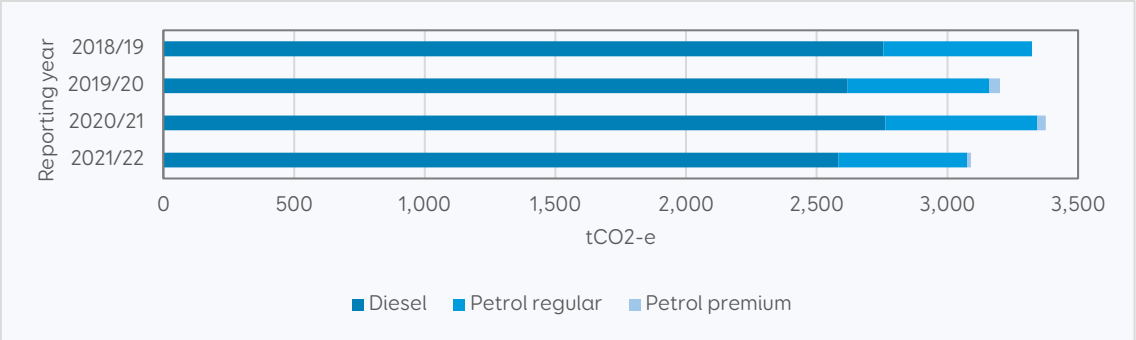

Figure 1: Transport fuel emissions base year to 2021/22 reporting year.

Agricultural N_2O emissions reported as CO_2 contributed to 24% of LIC's total Scope 1 emissions. In the 21/22 reporting year, the co-op's agricultural emissions increased by 5.87% from the base year and

increased by 4.78% from the 20/21 reporting year (Figure 2). The increases are a result of increased animal numbers on-farm and in research trials.

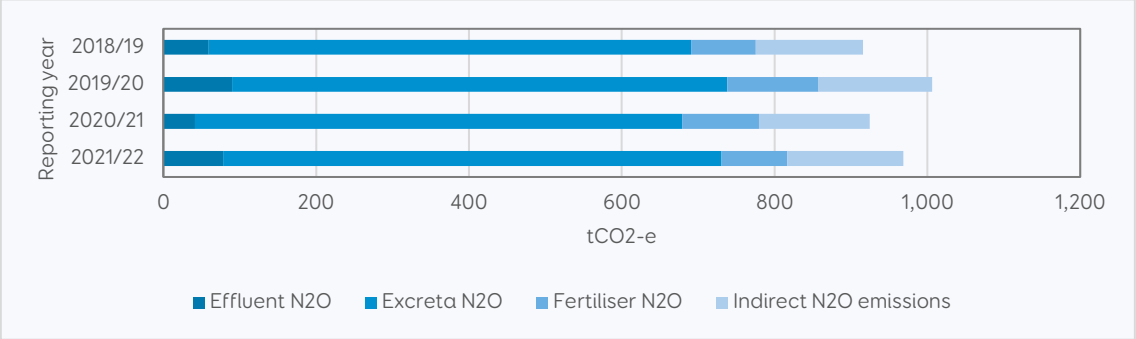

Figure 2: Top agricultural N2O emissions from the base year to the current reporting year.

The third category of top Scope 1 emission source was derived from reticulated LPG and natural gas. In the 21/22 reporting year, these emissions contributed to 4% of LIC's total Scope 1 GHG emissions. In the 21/22 stationary combustion emissions increased by 7.21% from the base year and by 2.83% from the 20/21 reporting year (Figure 3).

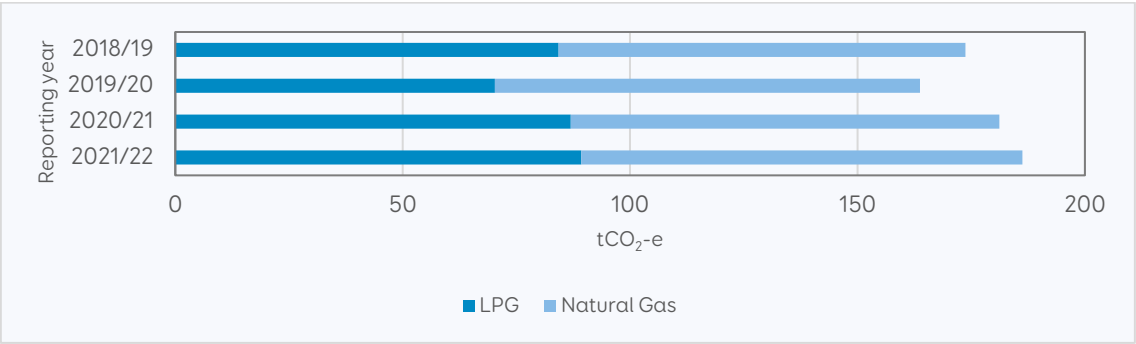

Figure 3: Scope 1 Stationary combustion emissions from the base year to the current reporting year.

Scope 2 - Indirect emissions

Electricity consumption makes up 100% of LIC's Scope 2 emissions. In the 21/22 reporting year, emissions were reduced by 18.8% from the base year and by 5.9% from the 20/21 reporting year (Figure 4).

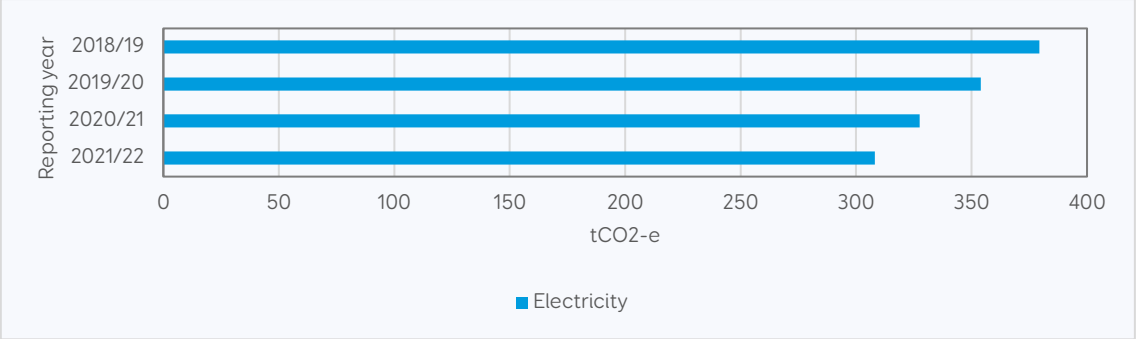

Figure 4: Scope 2 indirect electricity emissions, base year to the current reporting year.

Scope 3 - Indirect emissions

Travel emissions contribute to almost all of LIC's Scope 3 emissions, Figure 5 outlines the top eight contributing sources. Staff commuting and AB travel are the most significant sources. Staff commuting makes up ~75% and travel for Artificial Breeding operations contributes to ~21% overall. In the 21/22 reporting year, emissions associated to staff commute were reduced by 3.8% when compared to the base year and increased from the 20/21 reporting year by 3.8%. The increase from the previous reporting year is likely attributed to staff returning to the office following the ease of Covid-19 restrictions. However, reductions from the base year are also a factor as staff adopt LIC's flexible working style.

Overall, Scope 3 indirect travel emissions were reduced by 22.3% from the base year and increased by 0.15% from the 20/21 reporting year.

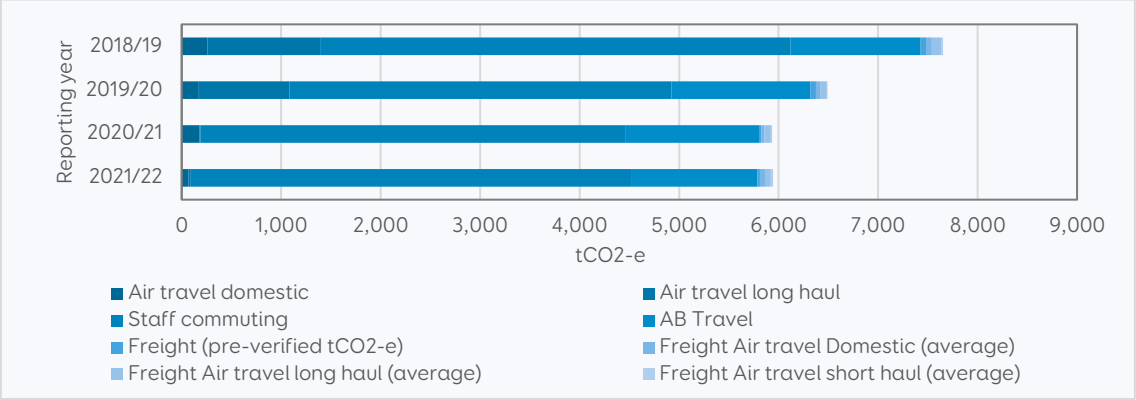

Figure 5: Scope 3 indirect travel emissions, base year to the current reporting year.

Scope 1 and Scope 3 - Biogenic methane emissions

LIC's top contributor to biogenic methane emissions is derived from livestock. Enteric methane is the greatest contributor to Scope 1 biogenic methane emissions contributing to 98%. LIC's total agricultural biogenic methane equate to 99.96% of Scope 1 biogenic methane emissions. Wastewater treatment is as such likely deemed *de minimus* at 0.04% of Scope 1 emissions. Agricultural emissions increased by 6.04% in the 21/22 reporting year when compared to the base year and increased by 11.15% when compared to the 20/21 reporting year. Wastewater treatment was reduced by 6.35% from the base year and increased by 1.4% when compared to the 20/21 reporting year.

Scope 3 biogenic methane is derived from indirect wastewater treatment (65%) and biogenic waste (35%). Wastewater treatment emissions increased by 25.9% in the 21/22 reporting year when compared to the base year and by 31.7% when compared to the 20/21 reporting year. As mentioned previously, LIC's waste emissions were reduced by 96.5% from the base year as a result of improved data capture. Waste emissions were also reduced by 10.7% from the 20/21 reporting year. Moving forward the base year for waste will be the 19/20 reporting year (Figure 6).

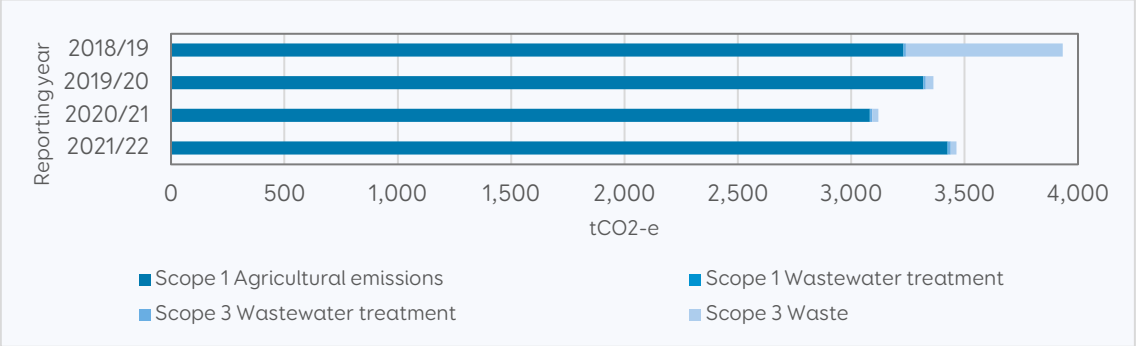

Figure 6: Combined Scope 1 and 3 biogenic methane emissions from the base year to the current reporting year.

Influence over significant emission source activities - overview

LIC are always striving to find ways to improve the way they work. The co-op has influence over several of its emission sources and try and reduce carbon footprint from work activities.

LIC, in association with CRV and NZAGRC, are currently working on a research project which measures the methane emissions expelled from young dairy breeding bulls. Daughters bred from these bulls will also be measured in future to determine the significance of selecting lower-emitting animals and understand if there are adverse effects between animals with different levels of emissions. This research will be critical to understanding the potential to measure and select dairy sires with lower emissions in the future.

LIC work together with Ravensdown to ensure the fertiliser input used on the co-op's owned farms is monitored through a regular fertiliser schedule. By conducting regular soil testing LIC ensures the correct amount of nutrients is used to provide sufficient pasture growth for grazing animals.

In terms of emissions derived from fleet vehicles, LIC ensures that vehicles are kept well-maintained and procure vehicles that generate fewer emissions. Through education of staff and monitoring their driving through systems like EROAD, LIC can see where improvements are required. LIC's procurement team also keeps up to date on technological advances in electric vehicles and are systematically replacing fleet vehicles with EVs when able.

By raising awareness about the impacts of climate change and providing education and guidance to staff, LIC have some influence over the generation of emissions. This awareness, guidance and education will potentially help staff make informed choices about how they can reduce their carbon footprint, including the option to work from home.

Emission reduction targets

LIC has set emission reduction targets based on science using the SBTi methodologies and the NZ Government, Climate Change Response (Zero Carbon) Amendment Act 2019, Part 1B Emission Reduction, Subpart 1 - 2050 target, 5Q Target for 2050 1(b)(i) to limit the temperature increase to 1.5°c of pre-industrial levels to reach the co-op's goal of:

- 46.2% reduction of Scope 1 and 2 emissions* by 2030 (against the 2018/19 base year)
- 28.88% reduction of Scope 3 emissions* by 2030 (against the 2018/19 base year)
- 10% reduction of biogenic methane by 2030 (against 2017 emissions)

*Excluding biogenic methane

What that means for LIC is a 4.2% year-on-year emission reduction for Scope 1 and 2, a 2.63% reduction year-on-year for Scope 3 emissions and a 0.9% reduction year-on-year for biogenic methane emissions.

In the 2021/22 reporting year, LIC has reduced Scope 1 emissions by 3.9% against the 2018/19 base year. This reduction result is less than the projected 4.2% reduction required per year to meet the co-op's 2030 target of 46.2% Scope 1 reduction.

LIC's Scope 2 emissions were reduced by 18.8% from the 2018/19 base year. If reductions continue at this rate, the co-op's 2030 reduction target of 46.2% should be met.

LIC's Scope 3 emissions were reduced by 23.2% from the 2018/19 base year. If reductions at this rate, the co-op's 2030 reduction target of 28.9% (Figure 7) should be met.

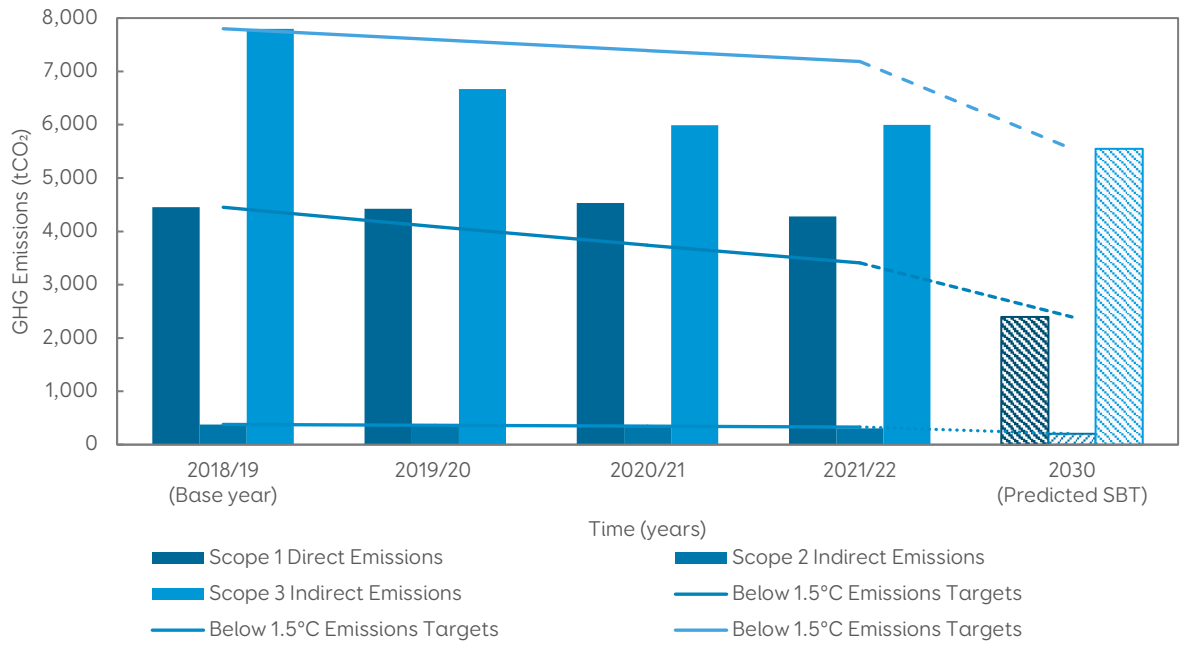

Figure 7: LIC Scope 1, 2, and 3 total emissions vs. how LIC is tracking against emissions targets.

LIC's Scope 1 biogenic methane emissions increased by 6%. The co-op's reduction target of 0.9% year-on-year by 2030 was not met and improvements will need to be made in the coming years to meet the overall reduction target of 10% by 2030 (Figure 8).

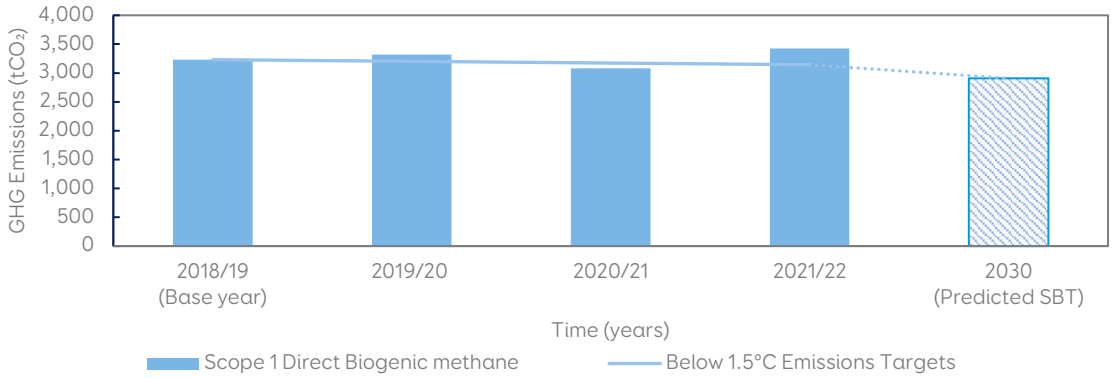

Figure 8: LIC Scope 1 biogenic methane emissions vs. how LIC is tracking against reduction targets.

LIC's Scope 3 biogenic methane indirect emissions were reduced by 94.66% from the 2018/19 base year. This decrease was a result of improved accuracy of its data set dating back to 2019 and as a consequence of this, the 2019/20 reporting year will be used as a base year for Scope 3 biogenic methane emissions moving forward (Figure 9).

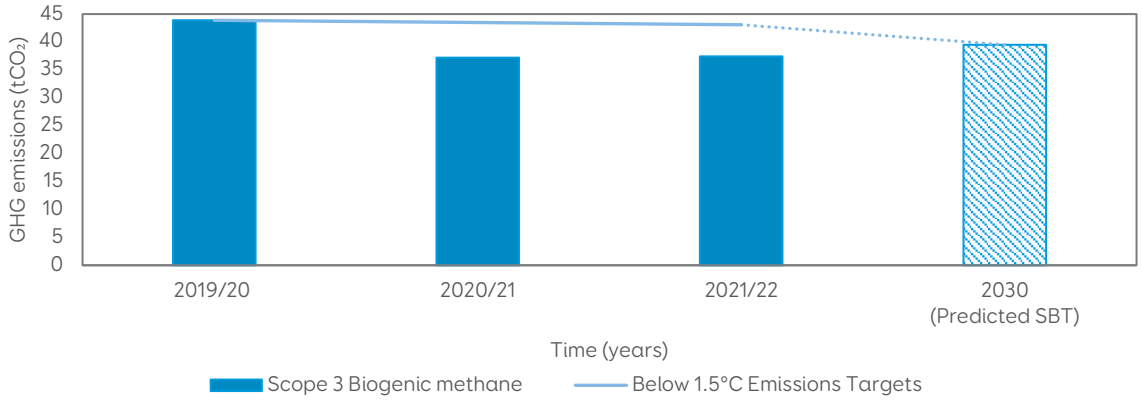

Figure 9: LIC Scope 3 biogenic methane emissions (excluding the base year) vs. how LIC is tracking with emission reduction targets.

GHG information management and monitoring procedures

Information management

LIC's GHG emissions are calculated annually and compared against the base year (2018/19). Procedures detailing methods for, but not limited to data collection, data entry, GHG calculations, and record-keeping are used to prepare the co-op's annual report. The procedures are reviewed on an annual basis to ensure LIC is using the most up-to-date methodology.

Base year recalculation

LIC may in the future be required to recalculate its base year as a result of historical data uncovered, improvements in data gathering, and changes to the reporting boundaries, and changes to calculation methods or other contributing factors. As such the base year is to be reviewed and recalculated and the next GHG inventory report will include an explanation of the changes.

Historical recalculations

Historical recalculations have been conducted in the 21/22 reporting year. Following LIC's audit in April 2022 of the base year, data was obtained to improve the co-op's waste management data set. The data provided did not recalculate the base year as the data set provided only went back as far as the 2019/20 reporting year. Additionally, improvements were made to how data was analysed in MS Excel to provide more accurate data.

Verification of GHG inventory

LIC will have its GHG inventory assessed and verified by an independent third-party verifier. The current inventory has been reviewed and verified internally by competent individuals with experience in this field.

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Appendix 1
Scope definitions

Scope 1 – Direct GHG emission sources
Direct emissions are generated by sources owned or controlled by the company. For example, emissions are derived from the combustion of fuel in vehicles, stationary combustion fuels (generator diesel or piped natural gas), refrigerant use (air conditioning units) or agriculture.

Scope 1 – Biogenic methane
Scope 1 biogenic methane emissions are generated from enteric fermentation, manure and wastewater treatment (WWT). Enteric fermentation emissions are based solely on the methane produced by animals whilst the manure and WWT emissions are divided into methane and nitrous oxide. Methane derived from manure management and WWT are included in Scope 1 biogenic methane emissions, and the nitrous oxide derived from manure is included in Scope 1 direct GHG emissions.

Scope 2 – Indirect GHG emission sources
Indirect emissions are derived from the generation of purchased energy such as steam, heat, or electricity that is used by the company.

Scope 3 – Other GHG indirect emission sources including Scope 3 biogenic methane
Other indirect emissions are derived from the activities that are carried out by the company but from sources not controlled by the company. For example, indirect emissions from travel such as air travel, freight transport, refrigerant use from chilled transport or air conditioning, and passenger-owned vehicles used by AB staff. Other indirect GHG emissions from products the company uses such as water supply and wastewater treatment, transmission and distribution losses, materials and waste (NZGovt, 2022).

Appendix 2

Source inclusions and reliability of data

The following table uses terminology from the ISO standard. Category 1, 2, 3. 4 are equivalent to Scopes 1, 2, and 3.

Table 7: Overview of data per scope, with explanations on data gathering.

GHG emissions category	GHG emissions source or sink subcategory	Overall assessment of uncertainty percentage	Overall assessment of data confidence	Overview of activity data and evidence	Explanation of uncertainties or assumptions around your data and evidence	Use of default and average emissions factors	Pre-verified data
Category 1: Direct emissions and removals	Direct emissions from mobile combustion	90%	Very high	Petrol, petrol premium, and diesel coming from fuel card reports, invoices and GL codes	Assume that LeasePlan data is accurate. There is a potential margin of error when it comes to staff correctly entering in km. Fuel cards can only be used to purchase fuel and as such LIC have a vast understanding of fuel litres purchased.	Base year reports from LeasePlan did not differentiate between petrol types as such a default emissions factor was required to be used this has been described as Regular Petrol in this report to avoid confusion. Future LeasePlan reports are capturing this data more accurately.	No. The Toitū emission factors was used.
Category 1: Direct emissions and removals	Direct emissions from stationary combustion	50%	Medium	Diesel stationary combustion	Estimates of diesel fuel in the generators. LIC struggled to find reports on top-ups. Emails saved to file. Litres used are determined by generator size.	No	No. The Toitū emission factors was used.

GHG emissions category	GHG emissions source or sink subcategory	Overall assessment of uncertainty percentage	Overall assessment of data confidence	Overview of activity data and evidence	Explanation of uncertainties or assumptions around your data and evidence	Use of default and average emissions factors	Pre-verified data
					LIC now 100% own these generators so they are no longer managed by an external company. The maintenance department top them up, but they do not keep records. However, the top-up amounts are minimal annually and require the generators to continue production if power is lost. They are not in continual use.		
Category 1: Direct emissions and removals	Direct emissions from mobile combustion	95%	Very high	Diesel and petrol tanks on-farm for equipment and vehicles	Data kept in Levno. Data used was the amount of fuel taken from the tanks to refuel vehicles and equipment from sensor equipment mounted on each tank. Not based on refilling the tanks.	LIC only have regular petrol and diesel fleet vehicles. Correct emission factors were used.	No. The Toitū emission factors was used.
Category 1: Direct emissions and removals	Agricultural emissions	95%	Very high	Emissions from livestock, fertiliser application etc.	Farms data is determined using stocking rates, fertiliser applications, feed etc. Farmwise consultant enters data into Overseer. Human error when transferring data can lead to miscalculations. Peer review.	No	Yes LIC have linked Overseer to the Toitū farms' programs and data was published there.

GHG emissions category	GHG emissions source or sink subcategory	Overall assessment of uncertainty percentage	Overall assessment of data confidence	Overview of activity data and evidence	Explanation of uncertainties or assumptions around your data and evidence	Use of default and average emissions factors	Pre-verified data
Category 1: Direct emissions and removals	Direct emissions from stationary combustion	95%	Very high	From reticulated natural gas and LPG	Assume supplier invoices are accurate. Missing some data occasionally from emails/invoices misfiled. When that has occurred data average for the period is used for that month.	No	No. The Toitū emission factors was used.
Category 1: Direct emissions and removals	Wastewater Treatment	95%	Very high	Emissions from the Wastewater treatment plant onsite at Newstead	Assume that water samples taken monthly are accurate and that the water meters are functioning correctly. The system is maintained regularly.	Used a separate template calculator provided by Toit	No. The Toitū emission factors was used.
Category 2: Indirect emissions from imported energy	Electricity	95%	Very high	Emissions from purchased electricity	Assume that supplier invoices are correct. Missing some data occasionally from emails/invoices misfiled. When that has occurred data average for the period is used for that month.	No	No. The Toitū emission factors was used.
Category 3: Indirect emissions from transportation	Flights and rental vehicles	85%	High	Emissions from business travel	Assume that data from Orbit are correct. Do not have very good data for rental vehicles as often people do not enter their travel km so under-reporting.	No	No. The Toitū emission factors was used.
Category 3: Indirect emissions from transportation	Freight	85%	High	Emissions from business freight	Assume that data from suppliers are correct. Do not have exact addresses of where some of the freight is going so based on km distance from airport/seaport to airport/seaport.	No	No. The Toitū emission factors was used.

GHG emissions category	GHG emissions source or sink subcategory	Overall assessment of uncertainty percentage	Overall assessment of data confidence	Overview of activity data and evidence	Explanation of uncertainties or assumptions around your data and evidence	Use of default and average emissions factors	Pre-verified data
Category 3: Indirect emissions from transportation	Staff travel	25%	Low	Emissions from staff commuting to and from work	Data is based on estimates from census data and FTEs. Future methods to provide more accurate data will be used.	Yes - As data is based on estimates and vehicle type or age is unknown, default km travel emissions factors were used.	No. The Toitū emission factors was used.
Category 3: Indirect emissions from transportation	Freight	65%	Medium	Emissions from AB staff travelling for work in their own vehicles.	Assume staff are entering data correctly however the exact vehicles or fuel types is unknown, so a default emission factor is used.	Yes - Future efforts to determine vehicle and fuel types used are needed to provide a more accurate picture of these emissions and not use the default km emission factor.	No. The Toitū emission factors was used.
Category 4: Indirect emissions from products used by organisation	Emissions from the use of services not included elsewhere	75%	Medium/high	Water supply	Based on council meter data. Some meters had minor malfunctions but not in the base year.	Yes - for some sites LIC have not been able to obtain water meter readings and are based on per-capita	No. The Toitū emission factors was used.
Category 4: Indirect emissions from products used by organisation	Emissions from the use of services not included elsewhere	75%	Medium/high	Wastewater treatment	Based on council meter data. Some meters had minor malfunctions but not in the base year.	Yes - for some sites LIC have not been able to obtain water meter readings and are based on per-capita	No. The Toitū emission factors was used.
Category 4: Indirect emissions from products used by organisation	Emissions from the use of services not included elsewhere	85%	High	Waste to landfill and recycling facilities.	Based on vendor portal data. Improvements are required for green waste data collected.	No	No. The Toitū emission factors was used.

GHG emissions category	GHG emissions source or sink subcategory	Overall assessment of uncertainty percentage	Overall assessment of data confidence	Overview of activity data and evidence	Explanation of uncertainties or assumptions around your data and evidence	Use of default and average emissions factors	Pre-verified data
Category 4: Indirect emissions from products used by organisation	Emissions from the use of services not included elsewhere	80%	High	Wastewater (industrial) dairy processing	Assume vendor invoices are accurate based on collection from tanks.	No	No. The Toitū emission factors was used.
Category 4: Indirect emissions from products used by organisation	Emissions from the use of services not included elsewhere	80%	High	Electricity distributed T&D losses	Assume that supplier invoices are correct. Missing some data occasionally from emails/invoices misfiled. When that has occurred data average for the period is used for that month.	No	No. The Toitū emission factors was used.
Category 4: Indirect emissions from products used by organisation	Emissions from the use of services not included elsewhere	45%	Medium	Food waste/composting	Estimates based on bin sizes and collections per period. Data improvements are required.	No	No. The Toitū emission factors was used.
Category 4: Indirect emissions from products used by organisation	Emissions from the use of services not included elsewhere	80%	High	Paper and card recycling	Assume that the supplier spreadsheets provided are correct based on collection weights.	No	No. The Toitū emission factors was used.

Appendix 3
Calculating LIC Agricultural emissions

Scope:
LIC have scoped its agricultural emissions as the emissions which come from the farms and animals owned by LIC in New Zealand.

In 2022 this includes:

1. Innovation Farm, dairy farm, Ngahinapouri, Waikato
2. Newstead Bull Farm, Newstead, Waikato
3. Chudleigh Bull Farm, Tauwhare, Waikato
4. Awahuri Bull Farm, Awahuri, Manawatu
5. Feilding Farm, Feilding, Manawatu
6. All animals grazing on LIC-owned farms regardless of ownership
7. External grazing arrangements for:
    a. Innovation Farm dairy cattle
    b. Breeding scheme cattle
    c. Research cattle

It specifically excludes:

1. All animals not owned by LIC (except for a small number of animals grazing on LIC-owned farms)
2. Animals owned by other parties are used for:
    a. periodic contracted mating arrangements,
    b. used for semen collection at third-party semen collection centres,
    c. used for embryo collection at third-party locations,
    d. phenotype data capture,
    e. research measurements.
3. Animals are not in New Zealand.

For LIC-owned farms:
LIC have created OverseerFM files for each of the LIC-owned farms to calculate agricultural emissions. These emissions are predominantly from animals and fertiliser products. It includes direct emissions of enteric methane, indirect emissions from faeces, urine and effluent applied to soils; and direct and indirect emissions from fertiliser and lime products applied.

For external grazing arrangements:
For LIC-owned animals which are not grazing on LIC farms, there has been an estimation of their methane and nitrous oxide emissions directly associated with these animals. It is estimated that this accounts for 80-90% of the total greenhouse gas emissions associated with these animals.

The classes of animals included in this section are:

1. Innovation Farm Cattle:
    a. Wintering off dry cows
2. Breeding Scheme Animals
    a. Short Gestation Length (SGL) breeding scheme animals
    b. KiwiPrime breeding scheme animals
    c. Slick breeding scheme animals
3. Research animals
    a. KiwiPrime Benchmark project animals (from Spring 2021)

These grazing arrangements are contractually based and LIC do not have access to any other emissions associated with the properties these animals graze on regarding other livestock, fertiliser and farm practices. Other emissions associated with these animals have not been assessed.

These emissions have been estimated by using feed intake requirements per animal over the periods they are subject to external grazing arrangements and multiplied by emissions factors for both methane and nitrous oxide.