He Pou a Rangi
Climate Change Commission

Technical Annex

to the Monitoring report: Emissions reduction

Approach, modelling, and analysis for assessing progress towards meeting Aotearoa New Zealand's emissions budgets and the 2050 target

July 2026

Contents

1. Introduction

He Pou a Rangi Climate Change Commission (the Commission) is publishing this technical annex to provide further information on the modelling, data, and analysis that underpins our 2026 *Monitoring report: Emissions reduction – Assessing progress towards meeting Aotearoa New Zealand's emissions budgets and the 2050 target*.

This technical annex should be read alongside the full report and other supporting material published on our website, including:

- Report figures and data
- Stats NZ Quarterly greenhouse gas emissions by sector: December 2025 quarter
- Electric vehicle business case scenarios
- Low carbon process heat scenarios

The supporting material can be found on the webpage for the 2026 emissions reduction monitoring report: climatecommission.govt.nz/ERM-2026

1.1. About this document

This document provides further technical information for readers who want to learn more about the method, analysis and modelling underpinning our monitoring report.

It covers the following aspects of our analysis and findings that support our recommendation:

- Our approach to monitoring including: our framework and tools; how we monitor emissions by sector; how we consider emissions, removals and projections; and how we assess progress, adequacy, and new opportunities for emissions reduction plans
- Detail about progress in reducing emissions
- Information gaps that affected our analysis.

2. Our approach to monitoring

This section sets out our approach for assessing Aotearoa New Zealand's progress towards meeting the country's emissions budgets and the 2050 target.

To create its first monitoring report in 2024,[1] the Commission developed and applied a framework for monitoring. The approach and tools we created provide a clear view of how the country is tracking to its emissions reduction goals. The following reports have built on the foundation repeating the core methodology with improvements. We will continue to build on this approach through future reporting cycles.

Our assessment of the adequacy and implementation of the emissions reduction plans, and identification of areas for attention and new opportunities to reduce greenhouse gas emissions, can in turn contribute to the Government's evolution of planning and policy.

This section outlines how we have designed our approach, based on international best practice and models. It shows how we combine analysis of the latest available data and emissions reduction plans and policies to create the progress assessment required under the Climate Change Response Act 2002 (the Act).

Drawing connections is key to our monitoring work. Our analysis considers the many links between government policies, economy, industry, people and the environment. Taking this kind of 'systems view' means we also consider adaptation to climate change alongside emissions reduction.[i]

This recognises that work in one area can benefit the other or conversely make it more difficult to achieve. Making the links between different approaches can reduce the cost of action and avoid working at cross purposes. The strength of this systems approach to monitoring will build over time, enhanced through engagement and future work to deepen our understanding of these complex interdependencies and connections.

2.1. Working from evidence: research, analysis and engagement

As an independent Crown entity, we base our work on research, evidence and analysis, and draw on the expertise of our staff, our Board of Commissioners and He Pou Herenga – a Māori advisory body to the Board.

In designing the approach for emissions reduction monitoring we reviewed international research as well as other countries' reporting of emissions reductions and progress against their policy goals. The examples we have drawn on include other monitoring systems used within Aotearoa New Zealand, and some international examples in use by independent climate bodies.

Our approach is based, in particular, on work by the UK Climate Change Committee, which has produced an annual emissions reduction progress report since 2009, evolving its framework considerably in this time.[2]

While our work is evidence based, that does not just mean quantitative data. To assess progress on emissions reduction, and the adequacy of the plan and its implementation, we have combined a review of the available data on greenhouse gas reductions with analysis of the effects of government policy and action. Our assessment, including the part that looks at wider systems and issues, is focused primarily on tracking government action. It also draws on our previous work and engagement with iwi/Māori, communities, councils, businesses, and other interested people to inform our understanding of how impacts of policies can affect emissions reduction. Over time, the reports will evolve as we refine our monitoring approach. How we best identify and measure the right things will develop as part of refining our approach.

[i] Section 5ZG(3)(b) of the Act requires the emissions reduction plan to include a multi-sector strategy to meet emissions budgets and improve the ability of those sectors to adapt to the effects of climate change.

2.2. Our monitoring framework and tools

The Commission has two distinct functions under the Act, providing independent advice and a monitoring role. Both support successive governments to achieve the country's climate change goals. This section sets out the Act's requirements for monitoring emissions reductions. The Commission is required under the Act to regularly monitor and report on progress to meet emissions budgets and the 2050 target. The Act outlines the reports that must be delivered and lists matters that must be considered.

The Act requires annual monitoring reports to include these elements:

- measured emissions and removals for the most recent year where data are available from New Zealand's Greenhouse Gas Inventory (GHG Inventory)
- the latest projections for current and future emissions and removals
- an assessment of the adequacy of the emissions reduction plan and progress in its implementation, including any new opportunities to reduce emissions.

The Act requires monitoring and reporting of progress towards meeting emissions budgets and the 2050 target, and must consider, where relevant, these issues and impacts:

- current available scientific knowledge
- existing technology and anticipated technological developments, including the costs and benefits of early adoption of these in New Zealand
- the likely economic effects
- social, cultural, environmental, and ecological circumstances, including differences between sectors and regions
- the distribution of benefits, costs and risks between generations
- the Crown–Māori relationship, te ao Māori (as defined in section 5H(2)), and specific effects on iwi and Māori
- responses to climate change taken or planned by parties to the Paris Agreement or United Nations Framework Convention on Climate Change.

This 2026 report provides a view of progress towards reducing the country's greenhouse gas emissions at a particular point in time, showing progress to date and an assessment of how Aotearoa New Zealand is tracking towards its emissions budgets and the 2050 target. Details on timeframes and the report's focus can be found in the full report in *Chapter 1: Introduction*.

2.3. How we monitor emissions by sector

Monitoring maps

Monitoring maps show the building blocks which set out a 'theory of change' or 'intervention logic' for the sector. They make visual the various elements of a change and the connections between outcomes, enablers, and policies for emissions reduction. The maps are also used to derive the wider set of indicators we use to show and assess real-world progress towards pathways outcomes and enablers for emissions reductions.

We have used monitoring maps in our monitoring of emissions reductions to make our assumptions clear. They are relatively static year-to-year to provide continuity over time of our approach. The Monitoring maps can be found in the Technical Annex to the 2025 emissions reduction monitoring report.[3]

Different layers of information make up a monitoring map for each sector we report on.

- **Emissions goal.** This is a working 'target' for the mapping exercise, which is used to measure emissions reduction progress (for example, "electricity generation emissions reduce 48% by 2035"). Where available, the goals are based on Government plans; otherwise the goal on the map draws on the ERP2 path, set in the second emissions reduction plan.

- **Pathway outcomes.** These are the specific changes within sectors that contribute to achieving the emissions reduction goal (for example, "reduce electricity generation emissions").
- **Enablers.** These are the critical factors that need to be in place for the pathway outcomes to be achieved (for example, "Information and data" and "Infrastructure and consenting").
- **Policies.** These are policies and strategies that implement or action the enablers. They may drive emissions reductions or address barriers (for example, "Pricing and incentives" or "R&D and innovation").
- **Contextual factors.** These are changes outside Government climate policy that could have major effect on the ability of the sector to achieve the pathway outcomes (for example, "Global technology advancement" and "Domestic context").

2.4. How we consider measured emissions and removals and projections

New Zealand's Greenhouse Gas Inventory

As required under section 5ZK of the Act, we evaluate the measured emissions and removals in the most recent year of the emissions budget period for which data is available from New Zealand's Greenhouse Gas Inventory (GHG Inventory).[4] To assess progress in emissions reduction to date within the first emissions budget period (2022-2025), we have used the historical data in the GHG Inventory.

The GHG Inventory published in April 2026 provides data up until the end of the 2024 calendar year: the third year of the first emissions budget. This includes the use of 100-year time horizon global warming potential (GWP100) values from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5).

In 2026, net target accounting[ii] contributions from the land use, land use change and forestry (LULUCF) sector were published in the GHG Inventory, to facilitate reporting under the Nationally Determined Contribution (NDC). This was in addition to the reporting of emissions and removals using the GHG Inventory approach for the LULUCF sector. New Zealand's Emissions budgets and targets apply the net target accounting approach.

Government projections

Revised Government emissions projections were published in January 2026[5] and were developed using the 2025 GHG Inventory methodology. Projections are used in our measurement of progress and in our adequacy assessment.

We have used the Government's "with additional measures" (WAM) central pathway to understand the Government's ambition under the emissions reduction plan. A low and high estimate is also provided which are estimates of the sensitivity in the projections. Beyond 2030, the Government presented three different scenarios which reflect different levels of efficacy and uptake of agricultural mitigation technologies. We have used the Government's Scenario B as part of the WAM-central scenario in our adequacy assessment for EB3.

An ENZ model used in the Government's modelling of projections was made available to the Commission. We engaged with Government agencies to understand assumptions used within the modelling.

[ii] There are two accounting approaches used in Aotearoa New Zealand for assessing forest removals. Land use, land use change and forestry (LULUCF) inventory accounting, used in the national greenhouse gas inventory, reports emissions and removals from all land-use changes. Target accounting uses only a subset of emissions and removals in the LULUCF sector. Target accounting is the methodology used for tracking progress against national emissions budgets and targets.

Stats NZ emissions data

We supplement GHG Inventory data with provisionally estimated emissions for the 2025 calendar year. The data was provided by the Climate Change Interdepartmental Executive Board via a customised data request from Stats NZ. The estimates provided are quarterly GHG emissions and use the methodology aligned with the GHG Inventory published in 2025. The Stats NZ emissions data uses the most recent data for energy-related emissions and combines these with Government projections for other sources and sectors. The provisional data from Stats NZ was not used directly due to methodological differences compared to the data we've used from latest GHG Inventory, published in 2026. Instead, we calculated the percentage change between 2024 and 2025 from the Stats NZ dataset and applied this to the 2024 values from the GHG Inventory.

The Stats NZ quarterly data allows us to assess the most recent progress on gross emissions reductions. Removals from forests are not in the scope of the Stats NZ emissions accounts and therefore net emissions are not reported for the 2025 year.

2.5. How we measure progress

Indicators

We have compiled a wide-ranging set of indicators to measure real-world progress. These indicators, or key measures, enable a deeper understanding of the drivers underpinning observed changes in emissions and show visually the direction of travel in underlying trends. The indicators facilitate the tracking of progress over time and our intent is that these sets of indicators remain largely consistent year-to-year. Some changes are necessary, however, as we refine the indicator sets either with new data or dropping indictors which may no longer be maintained or informative of progress.

A sub-set of the indicators are shown in the full report to highlight key areas of progress. This Technical Annex contains an extended set of indicators, and which are intended to aid comparison to last year's monitoring report.

Indicators are grouped by sector. The indicators show historic data from 2010, and where useful or available may contain projections from the Government's WAM path or the Commission's fourth emissions budget (EB4) demonstration path. Some indicators may show other projected data if appropriate. The indicators also show a status of progress via the background colour to historical data and a label of "Too early to say", "On track", "Slightly off-track" or "Off-track".

Policy

Under the Act, the Commission is required to assess "the adequacy of the emissions reduction plan and progress in its implementation" (section 5ZK). For this monitoring report, we have analysed current emissions reduction policies and plans in the 12 months up to 1 April 2026.

The Act requires, as part of monitoring and reporting of progress on emissions reduction, that the assessment considers a range of issues and impacts. Our assessment of these broader elements falls into two streams.

- We have looked at the overarching approach and framework to address challenges at system level (see these chapters in the full report: *Chapter 3: Economy and emissions pricing*, *Chapter 4: Benefits and impacts*, *Chapter 5: Whakahekenga rehukino* and *Chapter 6: Adaptation and nature*.
- We have integrated consideration of how barriers and enablers have been addressed and whether they present any ongoing risk to delivery of emissions reduction outcomes, as part of the policy scorecard assessment.

How the planned actions in emissions reductions interconnect with adaptation and nature is considered in our analysis and forms part of our assessment of the adequacy of current emissions reduction policies and plans. Policies that recognise and act on these interconnections can provide opportunities across all sectors. Taking integrated action can reduce risks, lower costs and deliver greater co-benefits. This type of climate action can

provide a wide range of co-benefits to improve people's lives and to reduce the unevenness of impacts across different communities

We use data collated by the Climate Change Chief Executives Board for their quarterly reports, to assess implementation progress. These data sources provide information on whether actions in the first emissions reduction plan (including any new actions announced by the Government since the release of that plan) are being implemented as planned, or if they have been delayed or discontinued. The data informed our scorecard assessment on the strength of current government policies to achieve emissions reduction outcomes.

2.6. How we measure adequacy

Benchmark

The Commission quantifies the emissions reductions expected to be achieved in the Government's WAM path by comparing to a counterfactual baseline representing how emissions may track in future in the absence of climate policies or related actions. A new approach was used this year to create the baseline. The WAM path represents the Government's ambition for meeting the second emissions budget (2026-2030) and is the benchmark we have used for tracking progress. We have used the same path to assess how policies and plans intend to meet the third emissions budget (2031-2035), whilst acknowledging that there is currently a shortfall in the Government's plan for this period. The difference between the baseline and the WAM path quantifies the emissions at risk as we assess the adequacy of the Government's plan.

Developing the baseline

The baseline is developed by the Commission to be used solely for the adequacy assessment in emission reduction monitoring. The baseline was developed using the following principles:

- The Government's With Existing Measures (WEM) pathway was reproduced in the Commission's version of ENZ.
- Policy effects on historical years are retained i.e. the reported emissions from the GHG Inventory remain unmodified.
- The effect of climate policy or actions to reduce emissions are instantly "backed out" from the WEM pathway after the final year of actual emissions data.

The baseline is a hypothetical pathway which may not be appropriate to use within other contexts. The real-world effects of removing policies instantly would be far more complex and impacts on emissions would, more realistically, take time to readjust. We would also not expect all changes to occur simultaneously. It is intended as a way of understanding relative impact by outcome area rather than cumulative impacts. Some policy effects are complex to disentangle, especially if they are long-standing policies which have become functionally embedded. Whilst acknowledging these limitations, the approach we've taken is reproducible and serves to enable a more comprehensive quantification of emissions at risk than would other pathways. The key parameter changes we've made with respect to the Government's WEM pathway in devising the baseline is shown in **Table 1** and **Table 2**.

Table 1: Input parameters with assumption differences between WEM and baseline paths

<table>
<tr><th>Scenario parameter</th><th>Revision details</th></tr>
<tr><td>Long-lived gas exogenous carbon price</td><td>This parameter has an impact on emissions in multiple sectors. See Table 2.</td></tr>
<tr><td>Demand projection – Coal Industrial boiler heat</td><td>The policy is modelled as a straight-line reduction until a complete phase out by 2037. The baseline assumes no policies are in place and coal demand can resolve itself endogenously in the model.</td></tr>
<tr><td>Geothermal Carbon Capture & Storage (CCS)</td><td>The baseline removes geothermal CCS, including Ngawha, and ensures carbon price will not incentivise build.</td></tr>
<tr><td>Steel scenario</td><td>WEM assumes Electric Arc Furnace (EAF) commissioned by 2027. Baseline has EAF not occurring.</td></tr>
<tr><td>HFC scenario</td><td>These were flagged as confidential. For the baseline we used the Without Measures (WOM) projection, the same as was used last year.</td></tr>
<tr><td>Energy efficiency improvements</td><td>
<table>
<tr><th colspan="3">Retrofit energy intensity c.f. new-build</th><th colspan="3">Annual rate of improvement in new-build energy intensity</th></tr>
<tr><td></td><td>WEM</td><td>Baseline</td><td></td><td>WEM</td><td>Baseline</td></tr>
<tr><td>Res</td><td>115.6%</td><td>119%</td><td>Res</td><td>1.0%</td><td>0.4%</td></tr>
<tr><td>Com</td><td>87.5%</td><td>113%</td><td>Com</td><td>1.0%</td><td>0.4%</td></tr>
<tr><td>Ag</td><td>87.5%</td><td>113%</td><td>Ag</td><td>0.8%</td><td>0.4%</td></tr>
</table>
</td></tr>
<tr><td>Electric Vehicle (EV) road user charge (RUC) exemptions</td><td>Year when EV RUC exemption expires:
In the WEM this is 2024 for light vehicles and 2028 for heavy vehicles.
The baseline has no RUC.</td></tr>
<tr><td>Clean car standard (CCS)</td><td>The year when target removed is assumed to be 2024 under the baseline.</td></tr>
<tr><td>Aviation</td><td>See Table 2.</td></tr>
<tr><td>Rail</td><td>See Table 2.</td></tr>
<tr><td>Pastoral emissions composite mitigations</td><td>Baseline has 0% values for effectiveness and uptake, impacts enteric emissions, agricultural soils and manure management for dairy, sheep & beef. See Table 2 for enteric emissions effects.</td></tr>
<tr><td>Exogenous exotic forestry</td><td>Baseline is hectares afforested assumed at a $0/t$CO_2$e carbon price defined by MPI. See Table 2.</td></tr>
<tr><td>Exogenous native forestry</td><td>Baseline is hectares afforested assumed at a $0/t$CO_2$e carbon price defined by MPI. See Table 2.</td></tr>
</table>

Table 2: Timeseries of assumption data for WEM and baseline paths

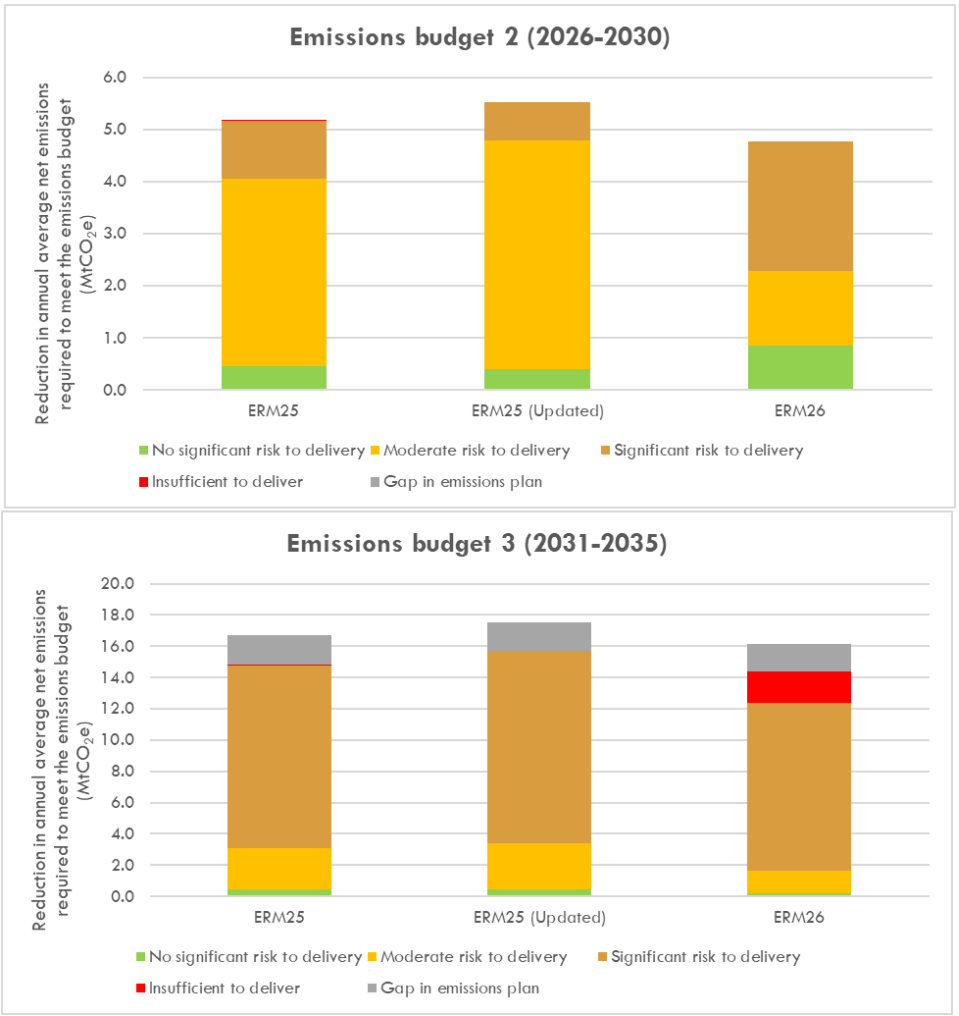
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
1.Carbon price ($/tCO$_2$)											
WEM	66.3	68.8	71.4	74.1	77.0	79.9	78.4	76.9	75.4	74.0	72.6
Baseline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.Aviation: Proportion of Sustainable Aviation Fuel (SAF)											
WEM	0%	0%	0%	0%	0%	0%	1%	2%	3%	4%	5%
Baseline	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3.Aviation: Proportion of alternative propulsion ASK – domestic battery											
WEM	0%	0%	0%	0%	0%	0%	2%	3%	5%	6%	8%
Baseline	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4.Rail: Proportion met by different fuels – battery											
WEM	12.0%	14%	16%	19%	21%	23.0%	23%	23%	23%	23%	23.0%
Baseline	2.0%	3%	4%	5%	6%	7.0%	8%	8%	9%	9%	10.0%
5.Rail: Change in energy efficiency relative to previous year											
WEM	-0.25%	-0.25%	-0.25%	-0.25%	-0.25%	-0.25%	-0.25%	-0.25%	-0.25%	-0.25%	-0.25%
Baseline	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6.Farming: Pastoral mitigation emissions effect from sum of all technology uptake (Dairy, Enteric)											
WEM	0.00%	0.00%	0.00%	0.60%	1.98%	3.94%	4.38%	4.82%	5.19%	5.28%	5.29%
Baseline	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
7.Farming: Pastoral mitigation emissions effect from sum of all technology uptake (Sheep & Beef, Enteric)											
WEM	0.00%	0.00%	0.00%	0.00%	0.25%	0.45%	0.66%	0.90%	1.10%	1.21%	1.47%
Baseline	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
8. Afforestation exotic forestry (Ha)											
WEM	60,600	27,200	27,200	27,200	27,200	27,200	27,200	27,200	27,200	27,200	27,200
Baseline	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
9. Afforestation native forestry (Ha)											
WEM	2,200	400	200	100	100	100	100	100	100	100	100
Baseline	0	0	0	0	0	0	0	0	0	0	0

Comparison to the benchmark used in the 2025 ERM report

In the 2024 and 2025 emission reduction monitoring reports[1,3] the benchmark for the adequacy assessment used a modified version of the Commission's 2022 Current Policy Reference (2022-CPR).[iii] The modification to that pathway involved backing-out policy effects relating to carbon price on afforestation and electricity. That pathway was the original path developed when the emissions budgets were set. Over time, underlying modelling assumptions diverged from recent modelling assumptions, making this approach increasingly difficult to maintain and interpret.

To enable like-for-like comparison with last year, the ERM 2025 results were recalculated using the new benchmark approach. The ERM 2025 'updated' analysis uses the same model as last year and with a new baseline derived using the same method adopted in ERM 2026. The impact on the adequacy assessment for emissions budget 2 and emissions budget 3 are shown in **Figure 1**. The tabulated data can be found in **Table 3**.

Figure 1: ERM25 adequacy assessment updated to align with the ERM26 methodology[iv]



[iii] The 2022-CPR path was the Commission's Current Policy Reference path used in the *Ināia tonu nei* advice, as updated in 2022.

[iv] Note: the overall assessment of risk has a grey ( ) area on the bar chart for the third emissions budget. This represents a gap between the plan and what is required to meet the emissions budget.

ERM25 – This is the baseline used in our ERM reporting in 2025, it is based on the inventory released in 2024 (covering the years 1990-2022). It was a further adaptation of the '2022-CPR' baseline we used in our 2024 ERM report.

ERM25 (Updated) – This is a hypothetical baseline applying the same methodology as in the 2026 ERM report. It was developed by starting from the WEM pathway used in the 2025 ERM project, it is therefore also based on the inventory released in 2024 (covering the years 1990-2022).

ERM26 – This is the baseline used in our 2026 ERM reporting, it is based on the inventory released in 2025 (covering the years 1990-2023). It applied the new method which is to start with the WEM and back-out emissions relating to policy effects we want to quantify.

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Figure 1 shows the shifts in emissions at risk and risk ratings that reflect the change in approach. Some of the observations include:

- The amount of emissions in both budget periods increased, as seen in ERM 2025 (Updated) bars compared to ERM25.
- The proportion found to be at moderate risk within the second emissions budget increased in ERM 2025 (Updated). This came from more moderate-risk reductions relating to Energy and Industry and Agriculture
- The proportion found to be at significant risk and no significant risk both fell in ERM 2025 (Updated)
- ERM26 has lower emissions at risk in total
- ERM26 has higher proportion of emissions at significant risk in EB2 and EB3 compared to last year
- In the second emissions budget period there is slightly more emissions with No significant risk to delivery in ERM26 compared to last year. This improvement relates to Industry emissions.

Table 3: Comparison of ERM 2025 and ERM 2025 (Updated) methodologies on expected contributions to emissions reductions by outcome area

Outcome area	ERM 2025		ERM 2025 (Updated)		Risk rating	
	EB2	EB3	EB2	EB3	EB2	EB3
Electricity generation	8%	10%	36%	17%		
Industry emissions	36%	19%	15%	11%		
Gas networks	0%	0%	0%	0%		
Oil and gas	6%	2%	-1%	0%		
Building emissions	11%	7%	0%	0%		
Passenger transport demand	0%	0%	0%	0%		
Passenger transport emissions intensity	14%	8%	-1%	2%		
Freight emissions intensity	-1%	0%	0%	1%		
Freight demand	0%	0%	0%	0%		
Aviation	-1%	0%	0%	0%		
Farming emissions	-21%	1%	-1%	13%		
Low-emissions land uses	0%	0%	7%	5%		
Organic waste	1%	1%	1%	0%		
Landfill gas	6%	4%	6%	2%		
F-gases	9%	3%	7%	3%		
Forestry removals	33%	46%	32%	45%		
Total ($MtCO_2e$)	**25.8**	**74.0**	**27.6**	**78.6**		

Assigning risk

The emissions impact difference between the Government's WAM and Baseline path was evaluated for each of the 16 Outcome Areas. Collectively, these Outcome Areas cover all sectors present in the national inventory. Last year we had Outcome Areas for gas networks and upstream emissions from oil and gas, these have now been combined into the Outcome Area called Gas supply chain emissions.

i) Electricity generation (Energy & Industry)
ii) Electricity networks (Energy & Industry)
iii) Industry emissions (Energy & Industry)
iv) Gas supply chain emissions (Energy & Industry)
v) Building emissions (Energy & Industry)
vi) Passenger transport demand (Transport)
vii) Passenger transport emissions intensity (Transport)
viii) Freight emissions intensity (Transport)
ix) Freight demand (Transport)
x) Aviation (Transport)
xi) Farming emissions (Agriculture)
xii) Low emissions land uses (Agriculture)
xiii) Organic waste to landfill (Waste)
xiv) Landfill gas (Waste)
xv) F-gases (F-gases)
xvi) Forest removals (Forests)

A risk rating was applied to the quantified reduction in emissions from each Outcome Area:

- No significant risks
- Moderate risks
- Significant risks
- Insufficient

The assignment of a risk rating is done qualitatively alongside the Scorecard analysis. The risk ratings are defined in the following section on Scorecards.

Scorecards

Our analysis of sectors uses 'policy scorecards' to summarise the strength of government policies and plans to achieve emissions reductions within each sector outcome area. This helps us answer how the country is tracking towards meeting emissions budgets under current policies and plans.

The scorecard assessment provides a clear, methodical and transparent framework for assessing the strength of emissions reduction policies and plans to drive change in each sector. Specifically, the scorecards gauge the ability of current policies and plans to achieve the identified benchmark outcomes within sectors (based on the WAM path) that contribute to meeting emissions budgets. Scorecards help 'show our workings', and they provide a useful way of signalling where there are risks to meeting the emissions budgets and the nature of those risks.

We produce scorecards for the selected benchmark outcomes within sectors – for example, in passenger transport we produce one scorecard looking at reducing the emissions intensity of vehicles, and one scorecard looking at changes in the amount and mode of travel. The scorecard assessment uses four criteria, with sets of questions, which are intended to reflect the different elements that are needed to drive towards effective outcomes.

- **Main tools:** what are the key current policies that fundamentally drive the emissions reductions or removals projected in the outcome area, and are they credible?
- **Funding and finance:** are levels of public funding sufficient and sources durable, and are plans to mobilise private finance credible and likely to provide sufficient certainty and incentives?

- **Timeline:** are timelines sufficient to achieve the key current policies, is there a process for policies undergoing further investigation, and would any potential delays put delivery at risk?
- **Barriers and enablers:** are there specific barriers or opportunities that could prevent or support the key policies delivering emissions reductions, and are they being addressed?

This includes examining barriers and enablers that relate specifically to iwi/Māori and/or have implications for equity, including how impacts of change are distributed across different communities and regions. It also includes consideration of the ability to adapt to climate change. **Table 4** shows the full scoring criteria for our policy scorecard, including descriptions for each score level.

Table 4: Scoring criteria used in the policy scorecards

Score	Main tools	Funding and finance	Barriers and enablers	Timeline	Overall assessment
No significant risks	Main policy(s) is/are capable of delivering the outcome for this area, with no significant risks identified around their effectiveness or settings.	Together, public funding and plans to encourage private finance are capable of delivering the pathway outcome for this area, with no significant risks identified.	Key enablers (e.g. infrastructure, workers and skills) and key barriers are addressed, with no significant risks identified.	Timelines are sufficient, and there is a clear roadmap (see footnote) for future decisions and policy development, with no significant risks identified.	There is no significant risk to delivery. If implemented, the current policies and plans, and their respective settings, are capable of delivering the outcome for this area.
Moderate risks	Main policy(s) is/are largely capable of delivering the outcome for this area, with some risks identified around their effectiveness or settings.	Together, public funding and plans to encourage private finance may be capable of delivering the pathway outcome for this area, with some risks identified.	Some of the enablers are addressed and/or some key barriers remain.	There are some timeline risks or questions around the roadmap for future decisions and policy development.	There is moderate risk to delivery; work is needed to address risks and uncertainties.
Significant risks	There are significant risks around the effectiveness or settings of the main policy(s).	There are some funding commitments, but many risks are identified, or it is unclear where a significant portion of the necessary funding and finance will come from.	Several key enablers and barriers are not addressed.	There are significant timeline risks and questions around the roadmap for future decisions and policy development.	There is significant risk to delivery; plans are unclear and/or work is needed to implement policies and address significant risks and uncertainties
Insufficient	There is no clear policy, plan or strategy for how to deliver the outcome for this area.	It is unclear where most of the necessary funding will come from, and/or plans to encourage private finance are insufficient.	There is negligible or no consideration of the key enablers and barriers.	There is no clear timeline or roadmap for future decisions and policy development.	Plans are either missing, clearly inadequate, or lack funding. New proposals are needed.

Note: A roadmap may not be necessary for some outcome areas where the timelines for key policy tools are sufficient and short-term timelines may not be required if there is a clear roadmap for getting to a long-term change.

Economy, emissions pricing and impacts and benefits

The Act requires the emissions reduction plan to include a 'a multi-sector strategy to meet emissions budgets and improve the ability of those sectors to adapt to the effects of climate change' (section 5ZG(3)(b)) – this is what we assess in the full report. The domains covered in the report are listed below along with their Chapter location. The list of domains is informed by those included in government emissions reduction plans to date and in the Commission's previous advice:

- *Chapter 1: Introduction*: Governance
- *Chapter 3: Economy and emissions pricing*: Workforce
- *Chapter 3: Economy and emissions pricing:* Research, science, technology and innovation
- *Chapter 3: Economy and emissions pricing*: The circular economy and bioeconomy
- *Chapter 3: Economy and emissions pricing*: Funding and finance
- *Chapter 3: Economy and emissions pricing*: Emissions pricing
- *Chapter 5: Whakahekenga rehukino:* Crown–Māori relationship
- *Chapter 5: Whakahekenga rehukino:* The Māori economy
- *Chapter 6: Adaptation and nature*: Adaptation
- *Chapter 6*: *Adaptation and nature:* Nature

There is a broad range of ways in which combinations of actions across these domains could be effective in supporting climate objectives. In recognition of the diverse approaches possible, we do not assess adequacy in terms of specific benchmarks in particular areas. Instead, where there is sufficient information to do so, our assessment is based on:

1) **Coverage:** The extent to which the Government's approach addresses the main barriers, opportunities and issues discussed in previous Commission advice
2) **Effectiveness:** Any risks to effectiveness of government policies in these areas.

Impacts and benefits

The Act requires the emissions reduction plan to include 'a strategy to mitigate the impacts that reducing emissions and increasing removals will have on employees and employers, regions, iwi and Māori, and wider communities, including the funding for any mitigation action' (section 5ZG(3)(c)).

For *Chapter 4: Benefits and Impacts* in the full report, in addition to the two elements above (coverage and effectiveness), our assessment is informed by any new evidence about impacts that may have emerged since our 2025 report.

2.7. Our assessment of new opportunities

Quantifying where the Government could reduce emissions further

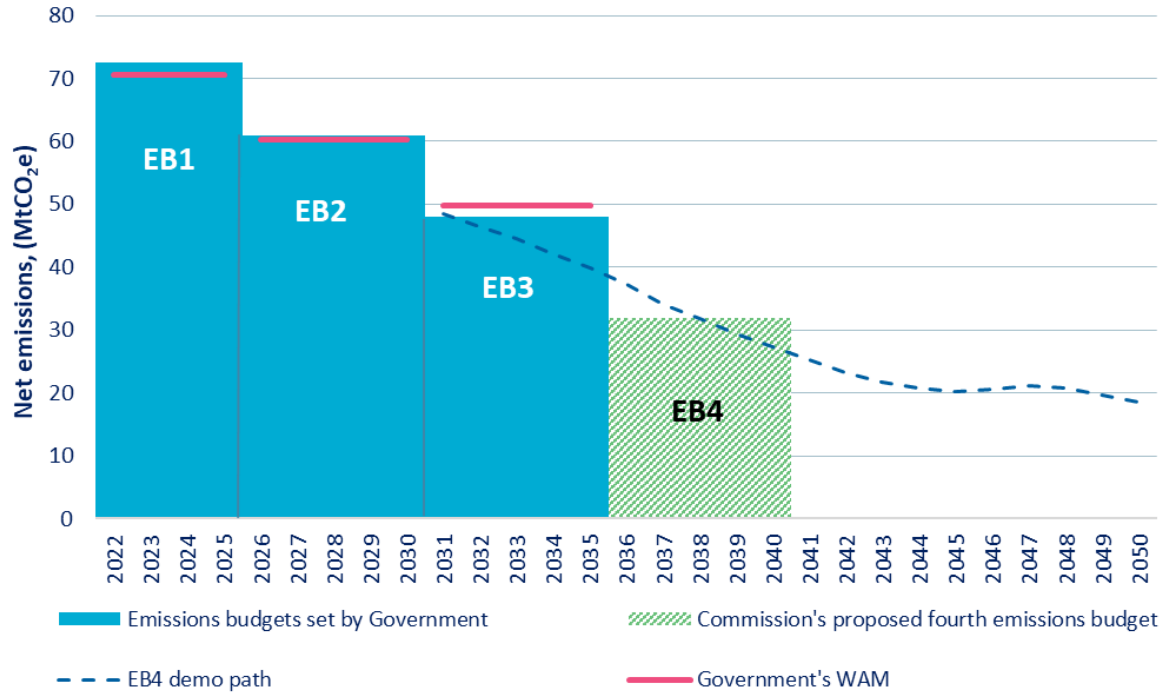
Section 5ZK of the Act requires that our report includes any new opportunities to reduce emissions. For the third emissions budget period (2031-2035) the Government's WAM path shows a shortfall in emissions necessary to meet the budget. It is particularly important, therefore, that the Government identify areas where they could reduce emissions further.

Figure 2 shows the latest Government's plan (WAM path) against our advice on the fourth emissions budget level and how the EB4 demonstration path is projected through to 2050.

In the 2025 Emissions Reduction Monitoring Report we assessed opportunities to go further in the third emissions budget period by comparing the Government's plan (ERP2 path) to the Commission's EB4 demonstration path.[3] This remains useful to visualise the further ambition to remain on-track to meet future

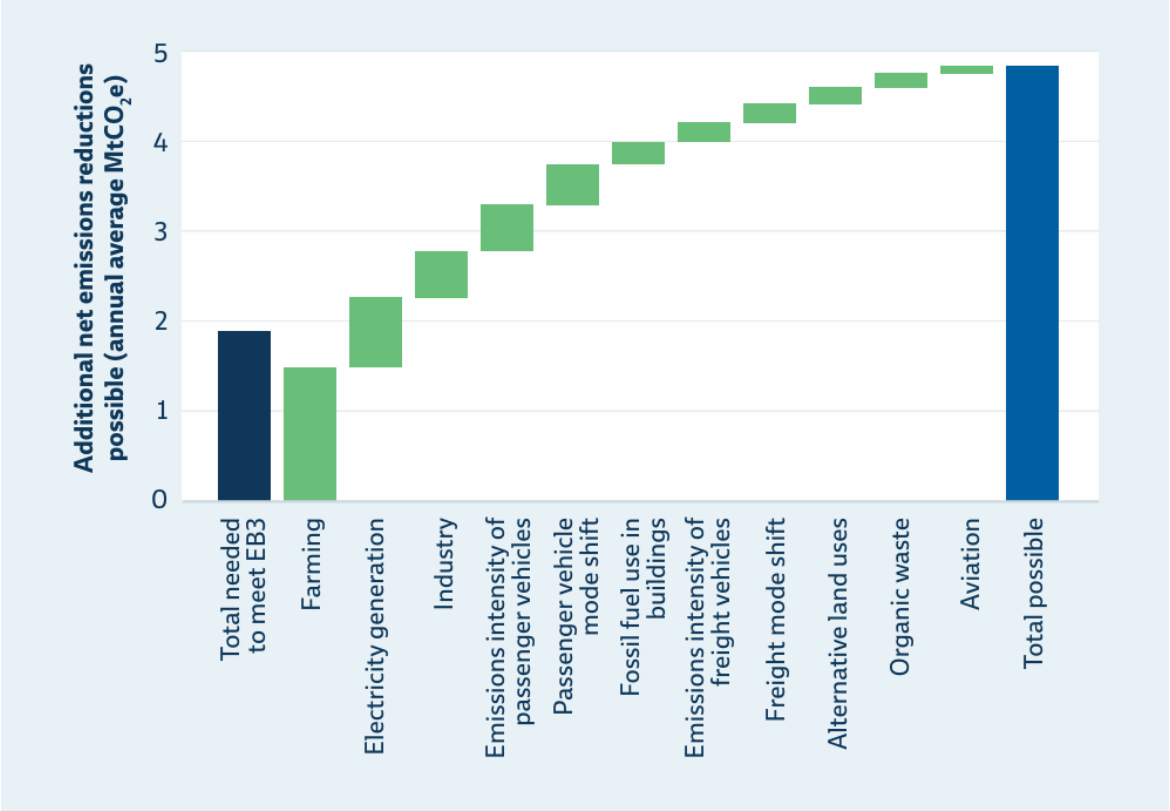
budgets and the 2050 target, and is reproduced in **Figure 3**. Note though, that **Figure 3** does not represent the latest Government's plan.

Figure 2: Government's WAM path compared to EB4 demonstration path, projected to 2050



Source: Commission analysis, New Zealand's second emissions reduction plan[6]

Figure 3: Further reductions possible in the third emissions budget period



Source: Commission analysis of the original second emissions reduction plan path compared to the Commission's demonstration path from its advice on the fourth emissions budget [3]

We have taken a different approach to quantifying new opportunities for this year's Emissions Reduction Monitoring Report. We have used more targeted analysis undertaken for the Commission on new opportunities as they relate to i) electric vehicles and to ii) industrial heat pumps.

The Sector chapters contain summaries of these new opportunities. Analysis results can be found in supplementary materials on our website. An overview of the methodology for these new opportunities is provided below.

Electric vehicles

An interactive spreadsheet was built to calculate and compare the Total Cost of Ownership (TCO) for different light vehicle models. The spreadsheet was designed to enable ease of testing with different assumptions and the addition of new vehicle models or categories in the future.

Given the wide variation in vehicle models and prices, we focus on the most popular models of ICE vehicles (including hybrids) in different categories, based on 2025 vehicle registrations. We compare these against a sample of EV models selected for similar performance and characteristics. The aim is to demonstrate a reasonable range of comparable vehicle options representing the current market. In each case, we estimate the vehicles' TCO over an assumed 5-year ownership period based on best available data and test the sensitivity to key variables.

The TCO calculations include:

- purchase price, taken from manufacturer websites in February 2026
- resale value at the end of the ownership period
- interest paid on the vehicle loan (if applicable)
- petrol and diesel, including fuel excise duty and ETS price component
- electricity, including charging costs
- Road User Charges (RUCs)
- maintenance, repairs, and tyres.

Other operating expenses such as insurance, licensing, and warranting were excluded on the basis that these should not significantly affect the comparative cost of EVs and ICE vehicles in general.

For the comparison, we calculate the Net Present Value (NPV) of the TCO by discounting the annual costs at an assumed private discount rate.

We also consider the lifetime vehicle costs from the national economic perspective, excluding all taxes and transfers (i.e. GST, excise duty, ETS, RUCs, loan interest). We assume average lifetime travel of 200,000 km for passenger cars and 250,000 km for light commercials with a social discount rate of 4%.

Low-carbon process heat

An interactive spreadsheet was built to calculate and compare the costs of different heat technologies. The main metric used for comparison is the *Levelised Cost of Heat* (LCOH): the average lifetime cost of generating one unit of heat (expressed as $/GJ). The LCOH is calculated as the total discounted lifetime cost of the heating system divided by the total heat delivered. This includes:

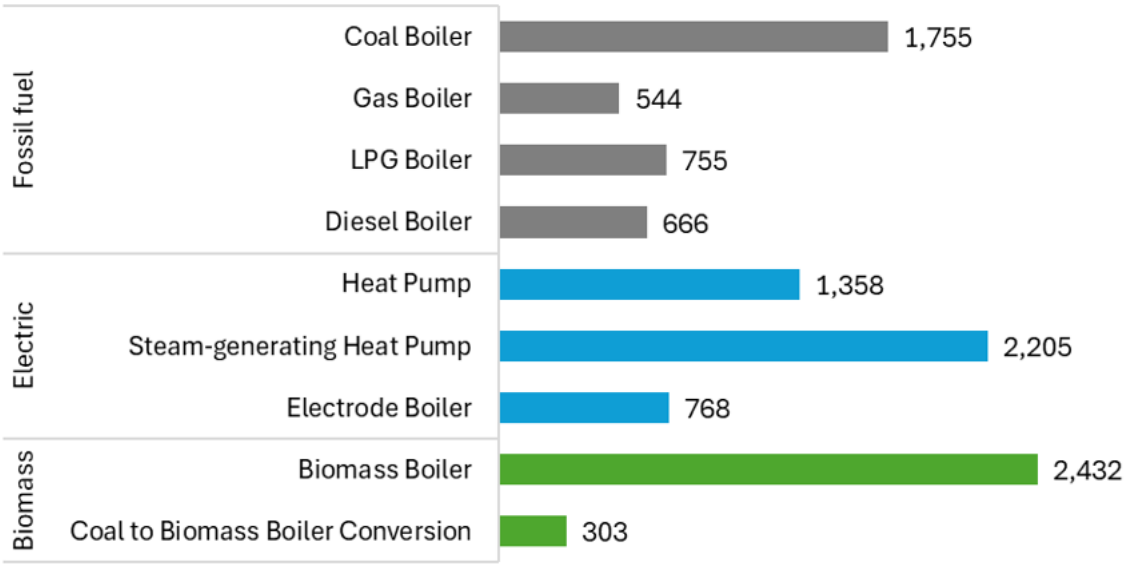
- Initial capital investment in the heating system and installation.
- Fuel costs, taking into account the system's efficiency.
- Operating and maintenance costs.

Assumptions and sources are described in **Table 5**, with capital cost and fuel price assumptions presented in **Figure 4** and **Figure 5** below.

Table 5: Description of assumptions and sources

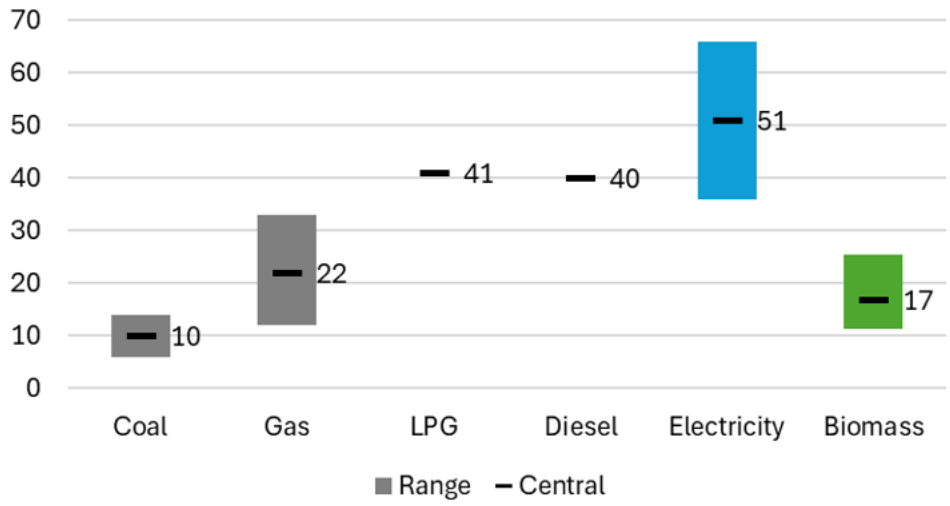
Variable	Assumption source	Central values
Capital costs	EECA TIMES-NZ 3.0,[7] inflation adjusted to 2025 NZD. These cost assumptions draw on average capital costs from GIDI-funded projects, excluding the cost of electricity network upgrades.	See Figure 4
Discount rate	Reflects a typical weighted average cost of capital	8%
Utilisation factor	Information provided by EECA	0.5
Equipment lifetime	EECA TIMES-NZ 3.0, except heat pumps based on NDIGHG Cost Assessment tool [8] and Danish Energy Agency [9]	25 years for boiler systems, 20 years for heat pump systems
Coefficient of performance (COP) / Efficiency	EECA TIMES-NZ 3.0[7] and NDIGHG Cost Assessment tool	Heat pump: 4.05 Steam-generating heat pump: 2.30 Electrode boiler: 0.94 Gas, diesel and LPG: 0.85 Coal and biomass: 0.78
Fuel costs	Information provided by EECA and 2025 prices from MBIE energy prices December 2025 dataset.[10]	See Figure 5
NZ ETS price	2026-2045 average, Government ERP2 New Measures scenario	$75/tonne
Emissions factors	Current NZ ETS regulations[11]	
Operating and maintenance costs	NDIGHG Cost Assessment tool. Schedules are converted to annualised values. Note these assumptions vary by boiler capacity.	
Boiler heat output	Illustrative. Note the impact of changing boiler output on LCOH results is relatively small and unlikely to change the cost hierarchy.	5 Megawatt thermal (MW_{th})

Figure 4: Capital cost assumptions ($/kW$_{th}$, 2025 NZD)



Source: Commission analysis

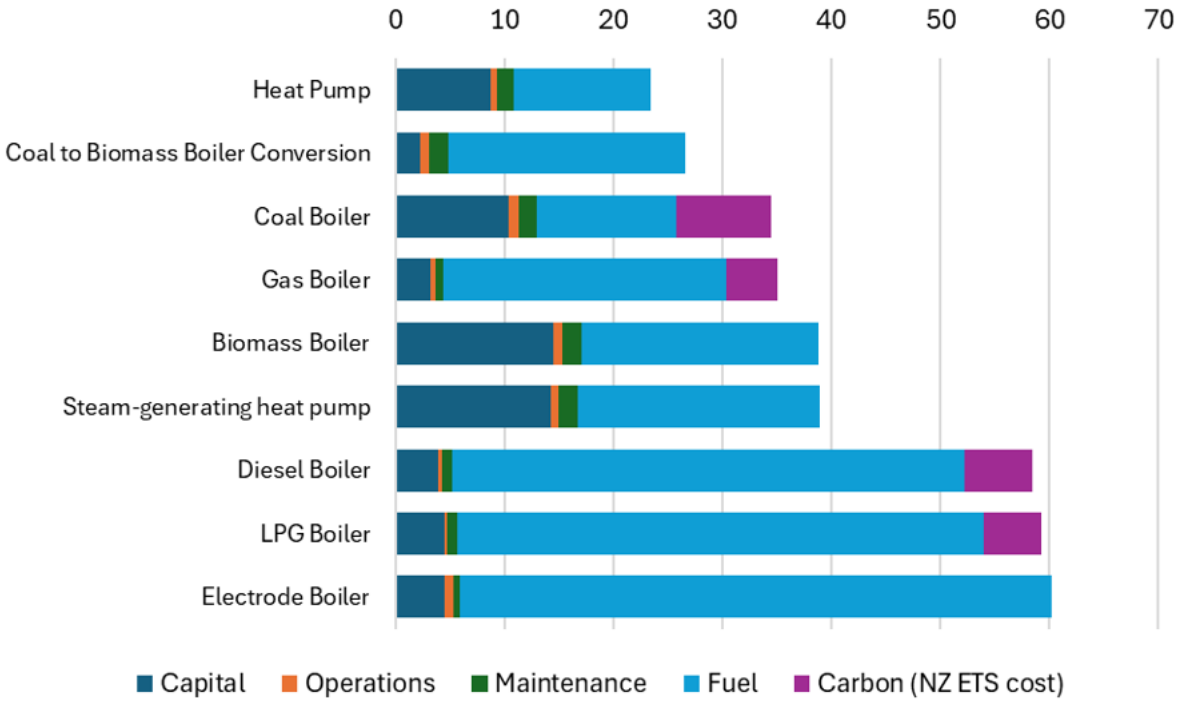
Figure 5: Fuel price assumptions ($/GJ, 2025 NZD). NZ ETS price impact is excluded except for electricity



Source: Commission analysis

Results of the levelised cost of heat analysis are summarised in **Figure 6** below.

Figure 6: Lifetime cost for new boiler systems or replacement at end-of-life, for < 100 °C applications with central assumptions (NZD, excl. GST)



Source: Commission analysis

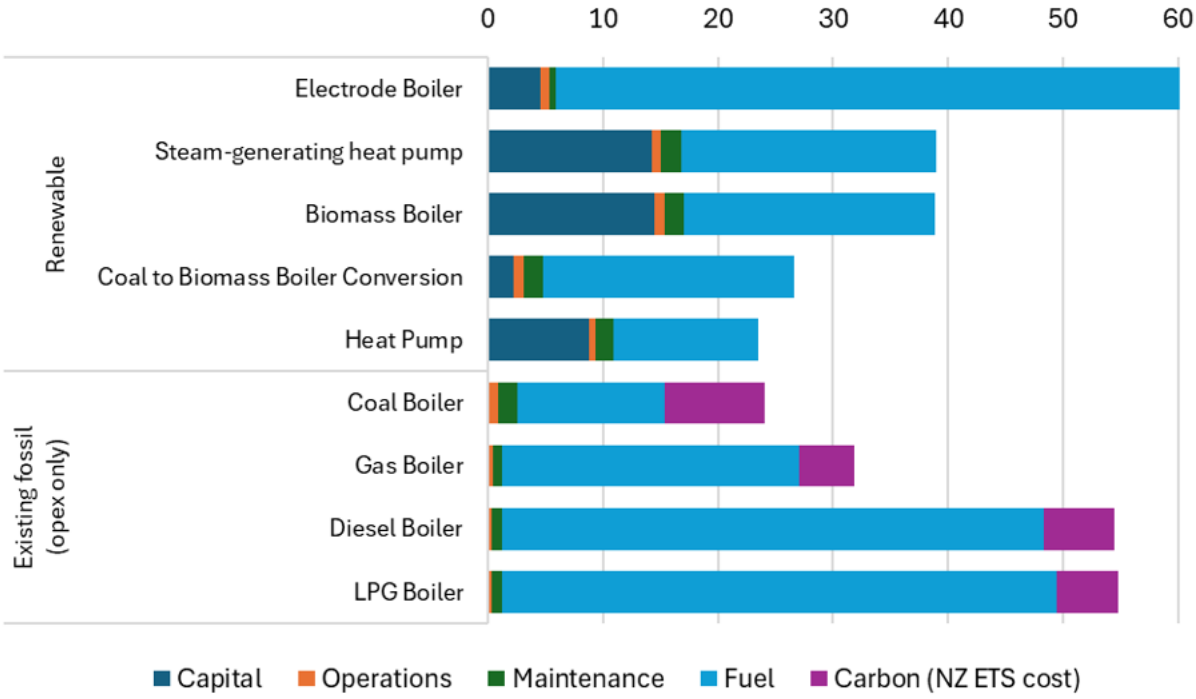
The results in Figure 6 show that, for low-temperature applications (<100°C), industrial heat pumps have the lowest lifetime cost of all major technology options. This means they are generally cheaper than fossil fuel boilers for greenfield installations and for replacement at end-of-life. This outcome is driven by the high efficiency of heat pumps, which use electricity to move heat rather than generate it directly. As a result, their lower operating costs increasingly outweigh higher upfront capital costs over the system lifetime.

Heat pumps can meet a large share of industrial demand, as most low-temperature heat use in sectors such as food processing falls within their operating range. However, many industrial sites have a mix of temperature requirements, with a portion of demand exceeding 100°C. In these cases, heat pumps can still play a critical role as part of an integrated system. An efficient configuration is to use heat pumps to supply the low-temperature load, reducing overall fuel demand, while retaining or replacing the high-temperature supply with an alternative technology.

For the remaining higher-temperature (>100°C) demand, suitable options include biomass boilers, electrode boilers, or higher-temperature steam heat pumps, depending on site conditions and fuel availability. This hybrid approach can significantly reduce emissions and operating costs while maintaining process requirements, and reflects current best-practice decarbonisation pathways identified in industrial heat studies.[12]

To consider the case for switching from an existing fossil fuel boiler system to a new low-carbon heat technology, we compare the ongoing costs of operating the fossil fuel system (i.e. excluding the initial capital investment) against the total LCOH of the low-carbon alternatives. The analysis finds that heat pumps are significantly cheaper than continuing to run gas, LPG and diesel systems, and are comparable to or slightly cheaper than the marginal cost of coal ($23.50/GJ for capital and operating costs of a heat pump versus ~$24.10/GJ operating costs for coal alone). This finding is based on the central assumptions set out above, with a gas price of $22/GJ, and is shown in **Figure 7**.

Figure 7: Cost per GJ of heat output (NZD/GJ, excl. GST) of installing and running new low-carbon heating systems compared with running existing fossil fuel boilers, with central assumptions

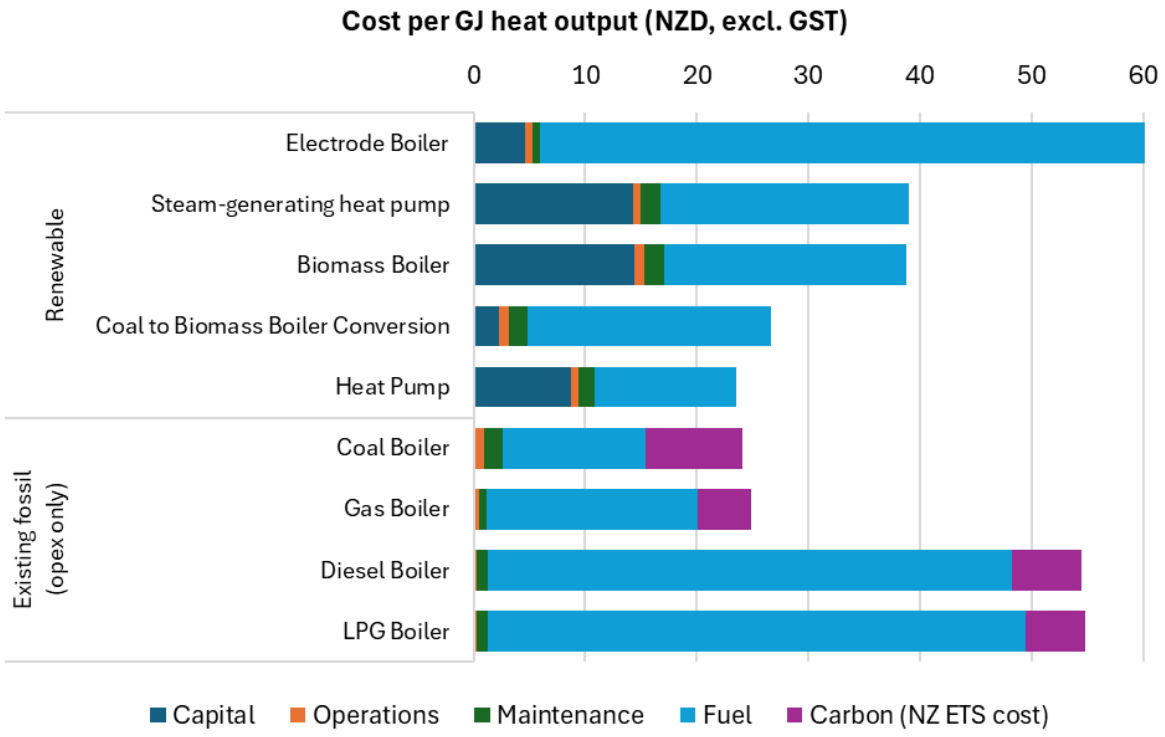


Source: Commission analysis

The $22/GJ gas price assumption comes from analysis provided to the Commission by the Energy Efficiency and Conservation Authority, which averages MBIE-reported gas prices for commercial and industrial users. Many gas users (particularly commercial entities) pay more than this. For example, 40% of respondents to a recent Business New Zealand Energy Council survey reported paying more than $25/GJ.[13] Conversely, industrial users, particularly large ones, may pay less, which is reflected in MBIE's reported average industrial gas price of $16/GJ. However, we note that this figure itself may be skewed downward by the relatively much lower prices paid by a small number of very large users. Given this, and in light of expectations of ongoing gas depletion driving prices higher in future, or of higher-priced LNG entering the supply mix, $22/GJ was considered a reasonable representative user price.

That said, the finding that switching to a heat pump is cheaper than continuing to run an existing fossil-fuel boiler holds across a range of gas prices. For example, **Figure 8** repeats the results shown above, but at a gas price of $16/GJ.

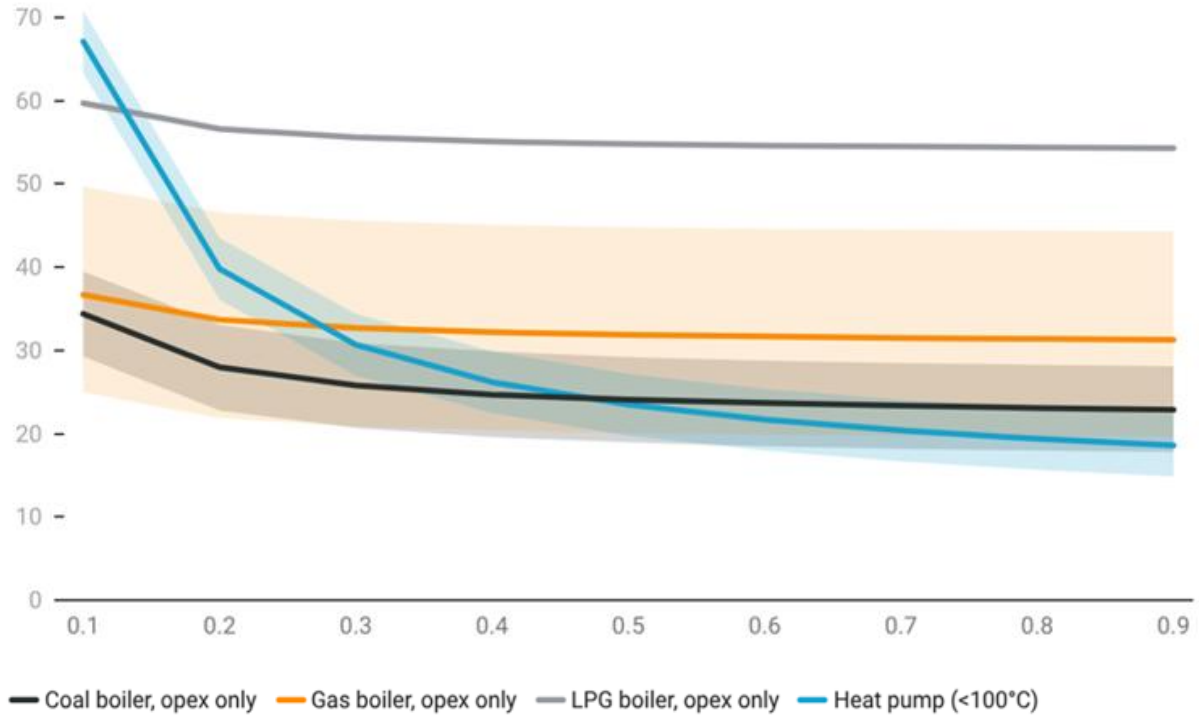
Figure 8: Cost per GJ (NZD/GJ, excl. GST) of heat output of installing and running a new heat pump compared with running existing fossil fuel boilers under central assumptions but with a low gas price



Source: Commission analysis

Other than fuel prices, the assumed *utilisation factor* is an important element in the LCOH calculation. That is, the proportion of time the heat system is operating on average, which will vary from sector to sector and from factory to factory. Highly utilised heat plants have a lower LCOH, because the capital investment and other fixed costs are spread over more heat production. Conversely, low-utilisation plants will have a higher LCOH. The analysis explores how the utilisation factor affects the relative economics of the different heat technologies. For example, see **Figure 9** below.

Figure 9: LCOH ($/GJ) vs utilisation rate of new heat pump vs existing fossil fuel boiler



Source: Commission analysis

3. Detail about progress in reducing emissions

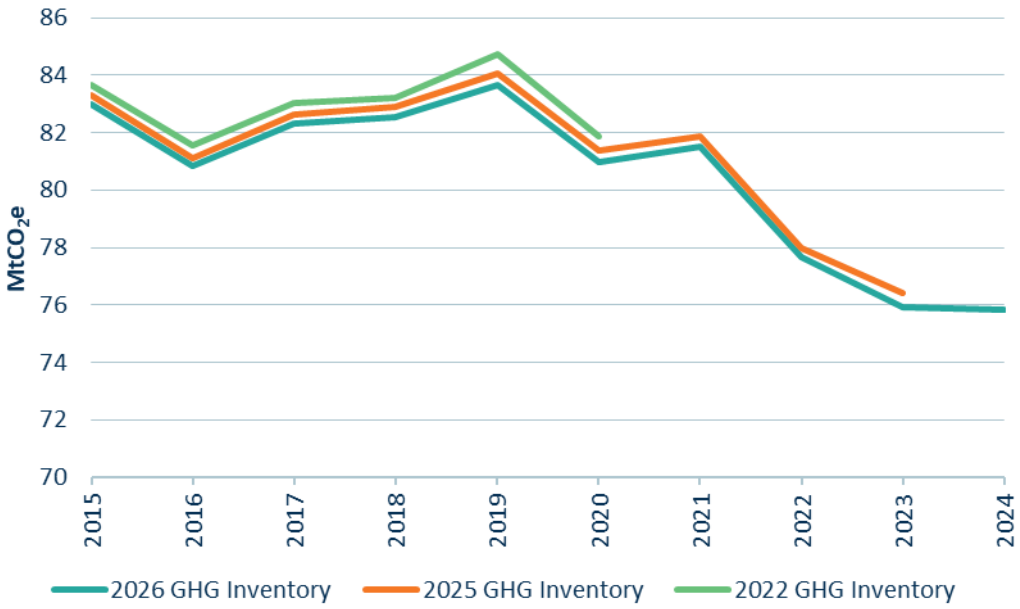
3.1. Impacts of methodological improvements in the 2025 GHG Inventory

Methodological improvements lead to revisions to GHG Inventory data over time. The emissions data in the GHG Inventory represent the current best estimates of real-world emissions, based on the latest available input data and estimation methods. These estimates are subject to refinement each year through methodological improvements. Revisions to input data sets, such as energy statistics, are also common.

Aotearoa New Zealand's emissions budgets are legislated as a set number (for example, 290 $MtCO_2e$ for the first emissions budget period from 2022 to 2025). This means that methodological improvements to the GHG Inventory and revisions to input data sets can make it easier or harder to meet the emissions budgets.

The latest gross emissions estimates align very closely with the GHG Inventory data published in 2025, albeit at a slightly lower level (**Figure 10)**. The difference against the GHG Inventory published in 2022 is greater. Prior to 2023 the GHG Inventory used GWP100 values from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4), whereas now the Fifth Assessment Report (AR5) values are used. We therefore converted values in the GHG Inventory published in 2022 to be consistent with AR5.

Figure 10: Gross emissions since 2015, as reported in the GHG Inventories published in 2022, 2025 & 2026



Source: Commission analysis of GHG Inventories published in 2022 [14], 2025 [15] and 2026 [4]

Methodological improvements led to a decrease in gross emissions of 0.5 $MtCO_2e$ (0.7%) for the 2023 year. The most notable change from methodological improvements between GHG Inventories published in 2025 and 2026 was for Forest removals, with 0.7 $MtCO_2e$ (14%) more removals calculated to have occurred in 2023. These relate to improvements in modelling of harvest age, permanent forest area and areas of deforestation.

Recalculations of aviation emissions resulted in a reduction of 0.4 $MtCO_2e$ (27%) for the 2023 year. This occurred due to revisions to data provided by fuel companies in how jet A1 fuel is allocated between

international aviation (outside of emissions budgets) and domestic aviation. This change only affected emissions in 2022 and 2023.

Agricultural emissions in 2023 reduced by 0.3 $MtCO_2e$ (0.8%) due to methodological improvements. These differences were predominantly from decreases in the agricultural soils category (0.3 $MtCO_2e$) and manure management category (0.2 $MtCO_2e$), which were offset by smaller increases in emissions from enteric fermentation and urea application. Recalculations occurred from updates to dairy manure and effluent management practices, with Ecopond added as a new mitigation technology. The emission factor value for non-urea synthetic fertiliser was also modified.

In the Commission's final advice on the fourth emissions budget,[16] we recommended that existing emissions budgets be revised to reflect methodological improvements.

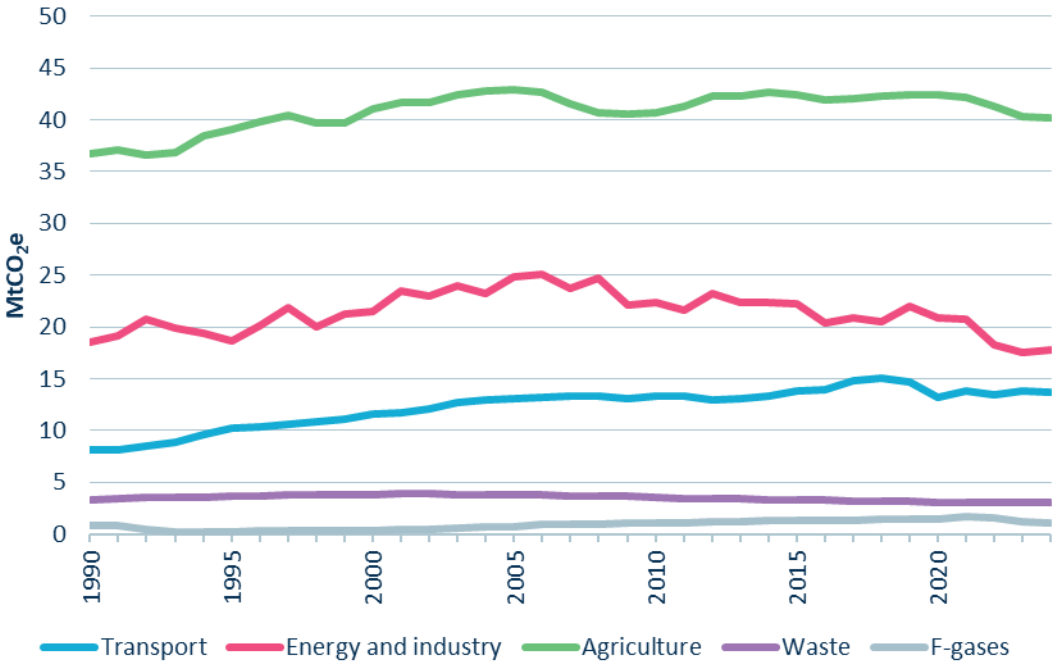
For our adequacy assessment modelling, both the Government's WAM path and the Commissions baseline pathway used the Inventory published in 2025 as its basis.

3.2. Overall progress

Where emissions reductions have come from

Our assessment of measured emissions and removals are based on the GHG Inventory published in April 2026 (1990-2024). Gross emissions by sector are shown in **Figure 11**. This shows the long-term trends occurring in each sector.

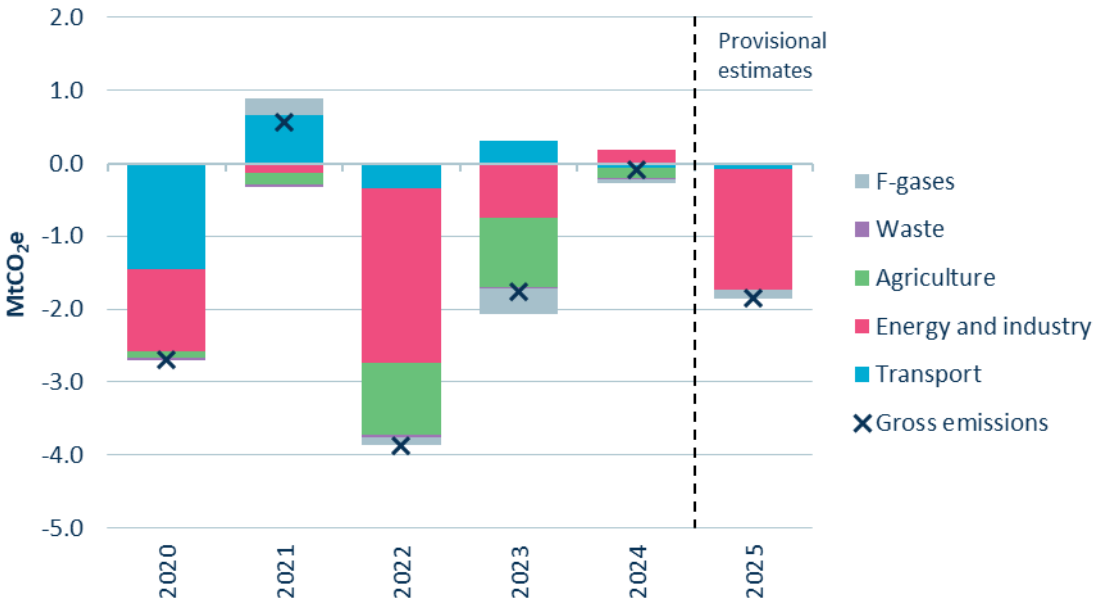
Figure 11: Emissions by sector



Source: Commission analysis of GHG Inventory 1990–2024 [4]

Figure 12 shows the annual change in gross emissions for each sector. In 2024 gross emissions showed little change. On a sectoral basis, emission changes were small and emissions fell in every sector apart from energy and industry, which increased by 0.2 $MtCO_2e$. Provisional estimates for 2025 indicate this will reverse and energy and industry emissions will reduce by 1.7 $MtCO_2e$ compared to 2024. **Figure 12** shows that emissions have, or are expected to, decrease in each year of the first emissions budget period (2022-2025).

Figure 12: Annual changes in gross emissions by sector since 2020



Source: Commission analysis of GHG Inventory 1990–2024, [4] Stats NZ

Biogenic methane emissions fell 0.4% (0.15 $MtCO_2e$) from 36.12 $MtCO_2e$ in 2023 to 35.97 $MtCO_2e$ in 2024.

Explanatory note on figures in the main report

Figure 2.4 of the main report shows gross and net emissions across the first emissions period (2022-2025). This explanatory note is intended to help interpret the chart, since it uses data from multiple sources. The Figure uses latest inventory data published in 2026 when showing emissions from 2020-2024. It uses StatsNZ data for gross emissions in 2025. However, there are no net emissions data published with the StatsNZ dataset, so in this instance the net values default to the Government's projections. The upper and lower range for 2025 are recalculated relative to those published in the government projections. Figure 2.7 shows gross and net emissions across the first three emissions budgets (2022-2035), and is derived from the Government's projections. The Government's projections are based on the 2025 inventory, so this is not directly comparable to Figure 2.4.

3.3. Energy, industry and buildings

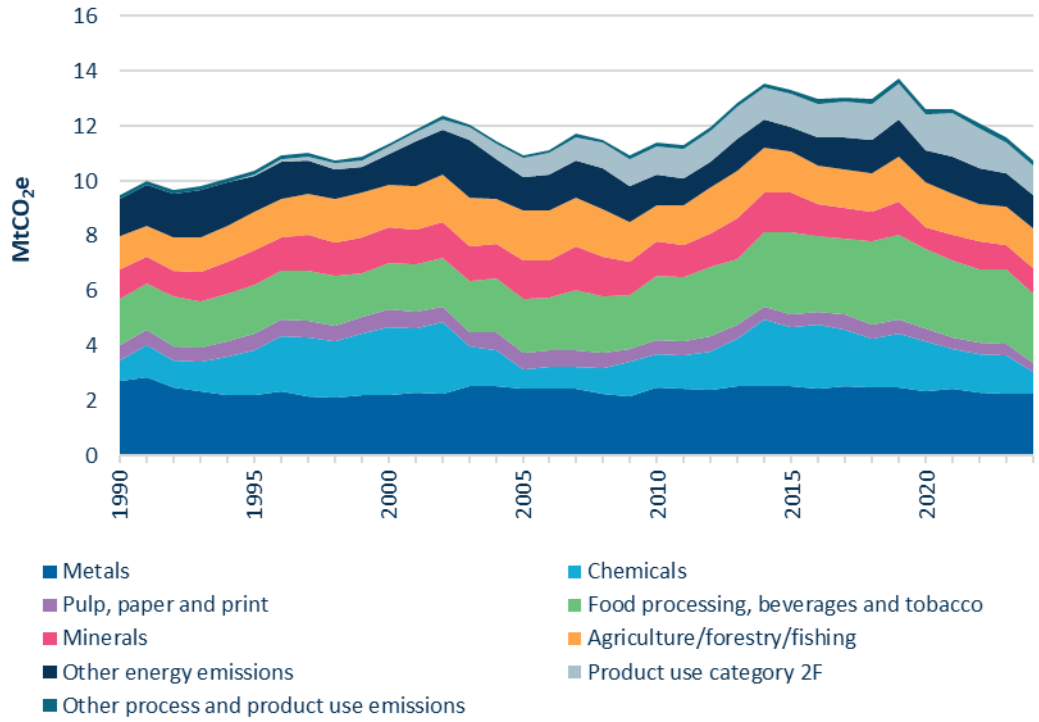
This section summarises the progress to reduce greenhouse gas emissions in the energy and industry sector, which includes industry, buildings, electricity supply, and domestic fossil fuel supply.

Industry contributed 10.8 $MtCO_2e$ of emissions in 2024 (**Figure 13).** Between 2023 and 2024, emissions from industry reduced by 7% (0.8 $MtCO_2e$) from 11.6 $MtCO_2e$ to 10.8 $MtCO_2e$. This change was driven by a 44% (0.6 $MtCO_2e$) reduction in emissions in the chemicals industry, predominantly from a reduction in gas fuel use

affecting industries including methanol production. The food processing, beverages and tobacco sectors saw a reduction of 0.2 $MtCO_2e$ (8%) between 2023 and 2024. This was driven by a reduction in liquid and solid fuel use. F-gases within the 2.F category of the inventory reduced by 0.08 $MtCO_2e$ (7%) between 2023 and 2024.

An increase in emissions between 2023 and 2024 was observed in the Minerals sector (0.04 $MtCO_2e$) and energy use in agriculture/forestry/fishing sector (0.06 $MtCO_2e$).

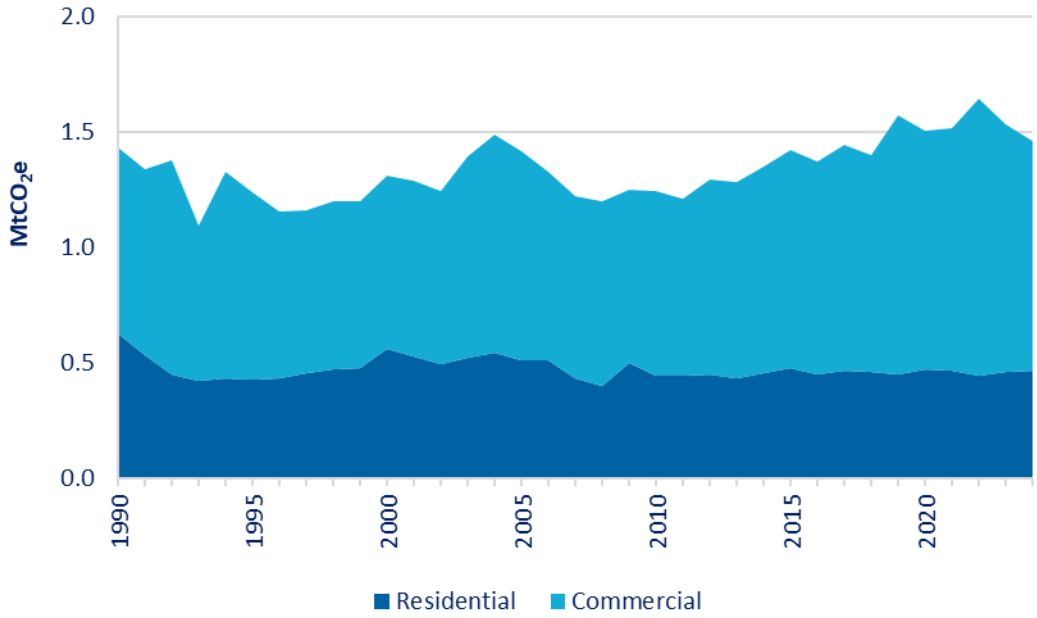
Figure 13: Emissions by industrial sector



Source: Commission analysis of GHG Inventory 1990–2024 [4]

Between 2023 and 2024, emissions from direct fossil fuel use in buildings decreased by 5% (0.07 $MtCO_2e$) (**Figure 14**). This was driven by a decrease of 0.08 $MtCO_2e$ in the commercial sector which was offset by an increase of 0.01 $MtCO_2e$ in the residential sector.

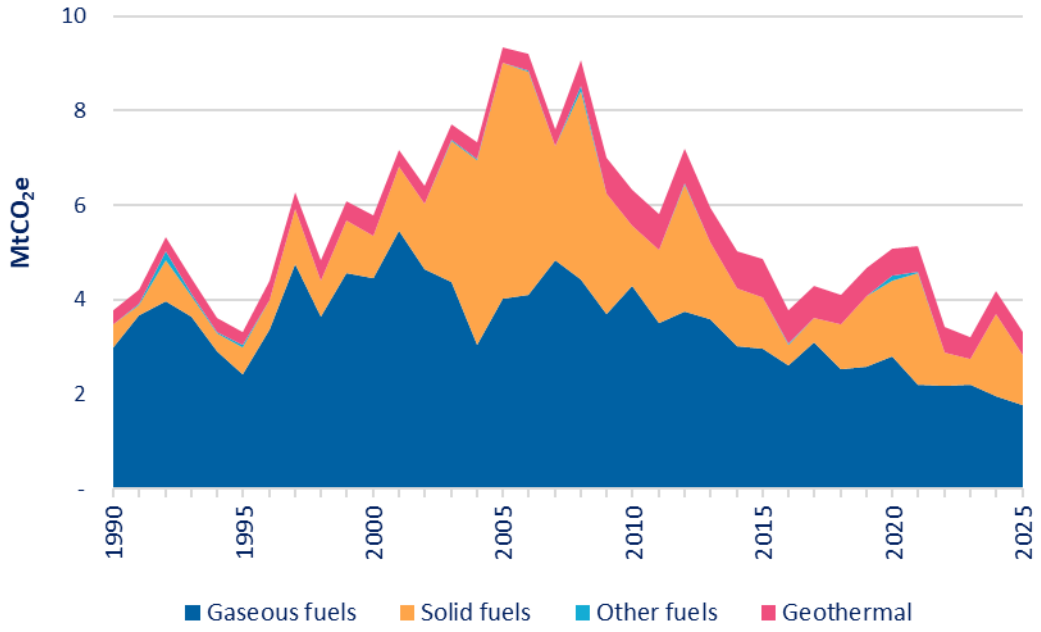
Figure 14: Residential and commercial buildings emissions



Source: Commission analysis of GHG Inventory 1990–2024 [4]

Electricity supply emissions increased by 30% (1.0 $MtCO_2e$) in 2024 compared to 2023, and then reduced 21% (0.9 $MtCO_2e$) in 2025 compared to 2024. In 2024, there was a 225% increase in use of coal for electricity generation due to low hydro inflows and reduced gas supply. In 2025, compared to 2024, emissions from gaseous fuels decreased 11% (0.2 $MtCO_2e$), solid fuels decreased 38% (0.7 $MtCO_2e$) and other fuels decreased by 76% (0.02 $MtCO_2e$) (**Figure 15**). In 2024, there was a 556 MW increase in renewable generation capacity[17] which helped offset some of the shortfall from lower hydro supply. Emissions from electricity generation have largely been trending downwards since peaking in 2005 at 9.3 $MtCO_2e$.

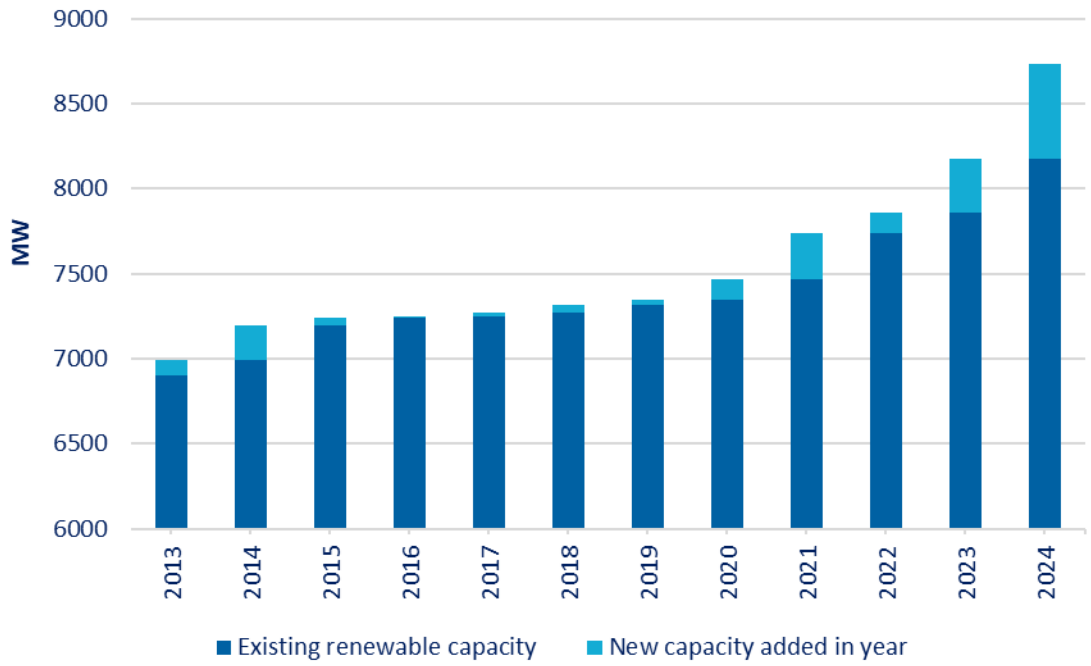
Figure 15: Electricity supply emissions by fuel type



Source: Commission analysis of GHG Inventory 1990–2024,[4] MBIE energy data[18]

The MBIE electricity statistics[18] showed that in 2024 a record amount of electricity was generated from wind (3.9 TWh or 9% of total generation), geothermal (8.7 TWh or 20% of total generation) and solar (0.6 TWh or 1% of total generation). However, in 2024 electricity generated from hydro was at its lowest since 2013. There was an additional 557 MW of renewable generation capacity built in 2024 (**Figure 16**).

Figure 16: Total renewable generation capacity[v]



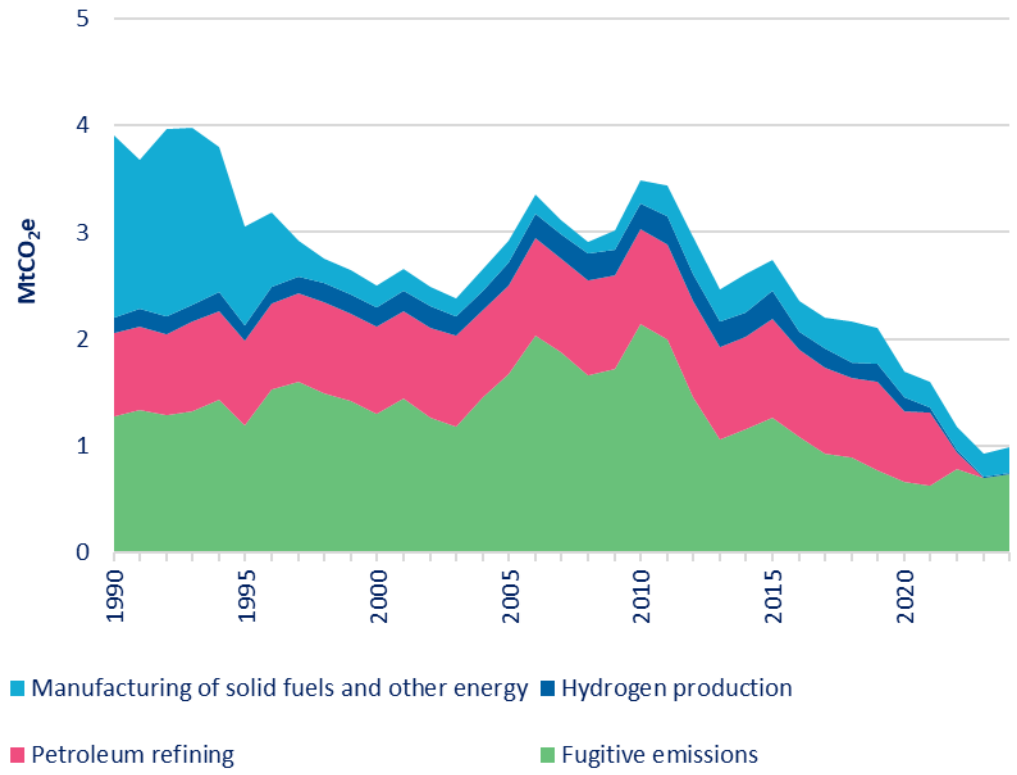
Source: Commission analysis, MBIE electricity statistics [18]

[v] Note: The axis starts at 6,000 MW. The existing renewable capacity is not shown below this point to emphasize new capacity additions.

Overall emissions from fossil fuel supply increased by 6% (0.06 $MtCO_2e$) in 2024 to 1.0 $MtCO_2e$ (**Figure 17**). Despite the increase in 2024 there has been a strong trend since 2010 of emissions decreasing.

Since 2023 emissions from oil refining have reduced to zero, reflecting the closure of Marsden Point oil refinery. Between 2023 and 2024 there was a 10% (0.02 $MtCO_2e$) increase in emissions from the manufacturing of solid fuels and other energy. Between 2023 and 2024 there was a 5% (0.04 $MtCO_2e$) increase in fugitive emissions. Most of these related to increasing fugitive emissions from oil and fossil gas and other energy production.

Figure 17: Fossil fuel emissions in industry



Source: Commission analysis of GHG Inventory 1990–2024 [4]

A set of indicators are shown for electricity supply (**Figure 18**), Buildings (**Figure 19**) and Industry (**Figure 20)**; these help us track progress to the goals and pathway outcomes as outlined in the monitoring maps. *Section 2.6: How we measure progress* for an explanation of the indicators and *Section 2.4: How we monitor emissions by sector* have a description of the monitoring maps.

Figure 18: Progress indicators dashboard for electricity supply

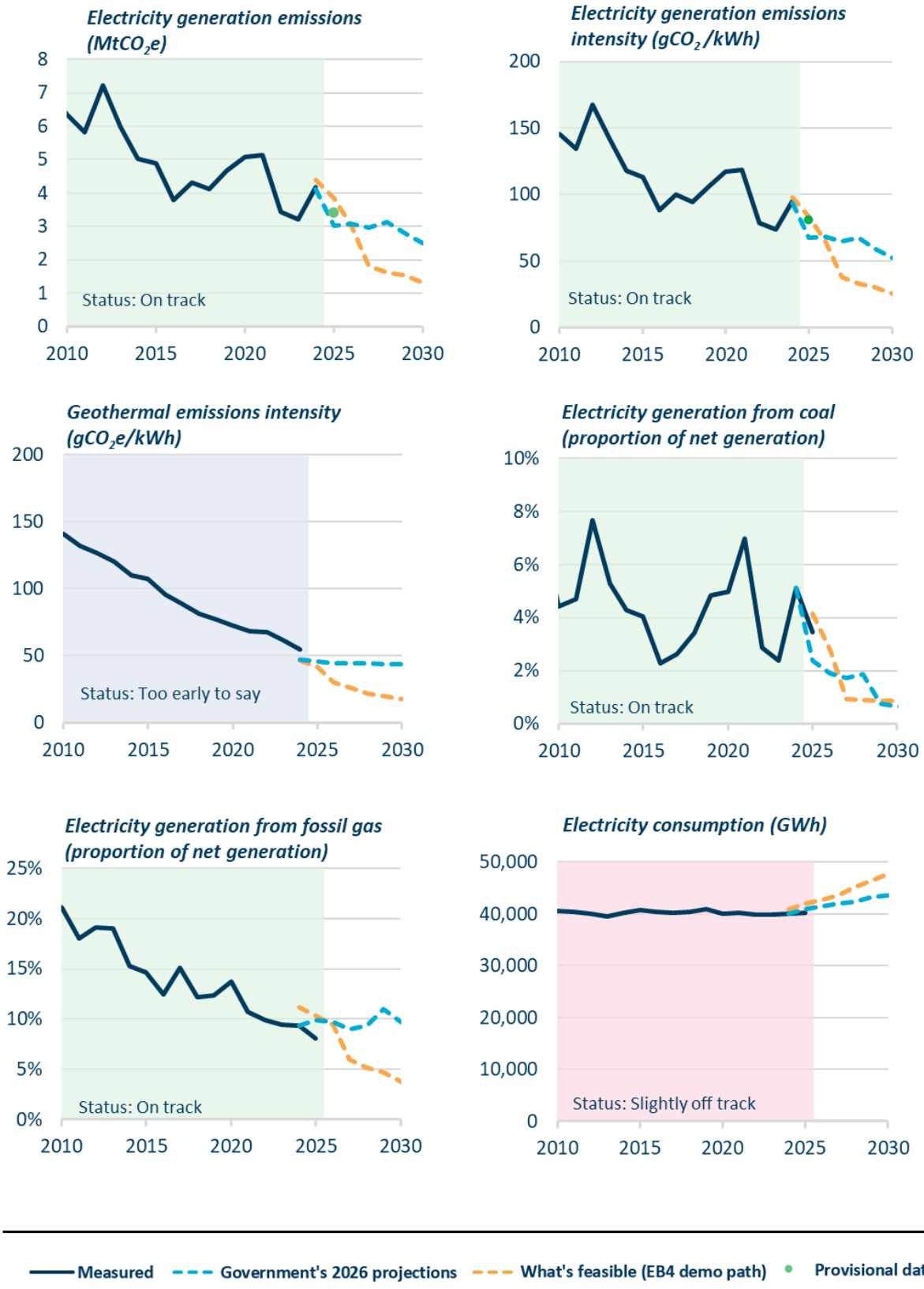
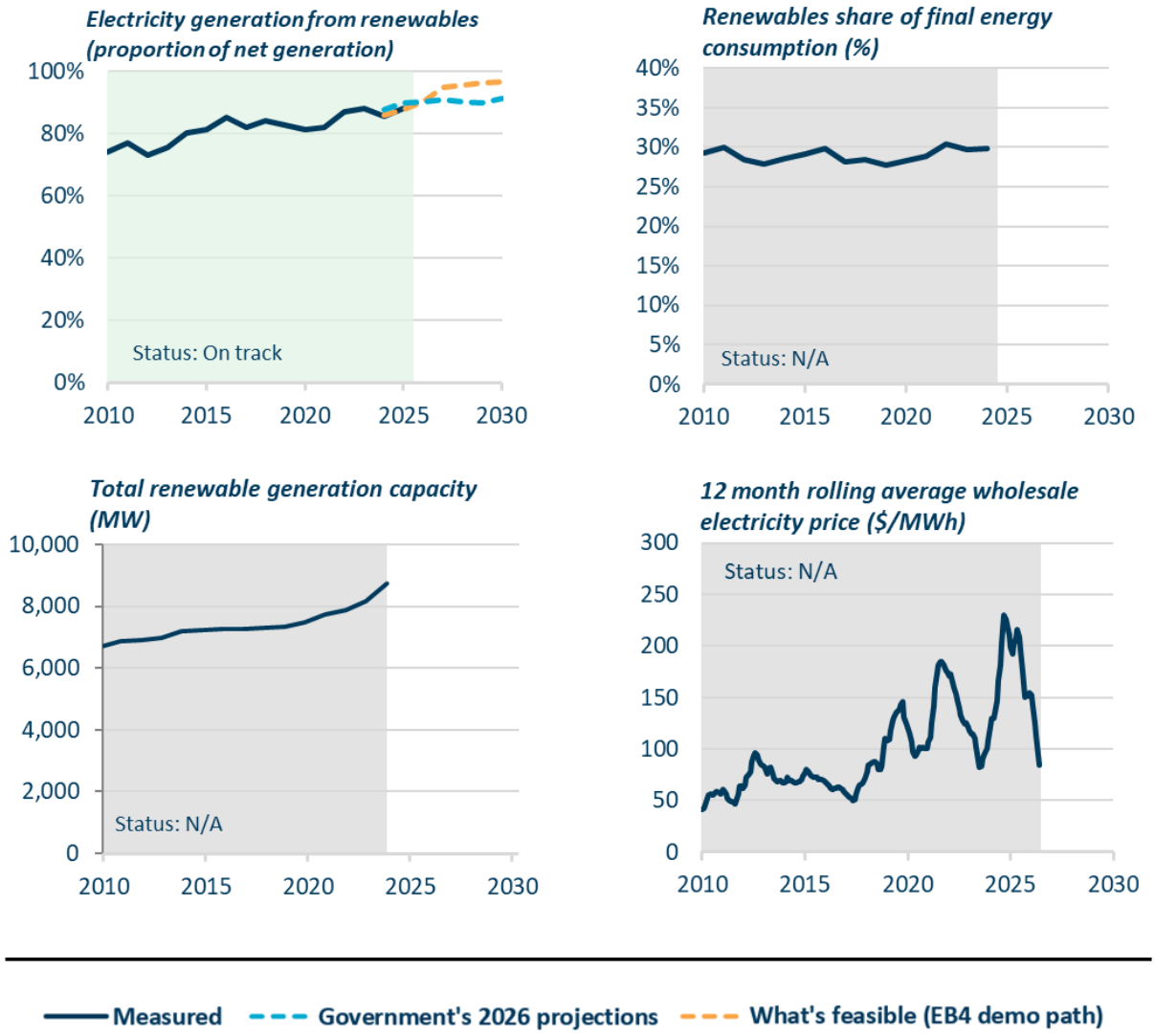


Figure 18: Progress indicators dashboard for electricity supply *continued*



Source: Commission analysis, MfE ERP2[19], Stats NZ[20], GHG Inventory[4], MBIE energy statistics [18], Electricity Authority [21]

Figure 19: Progress indicators dashboard for buildings

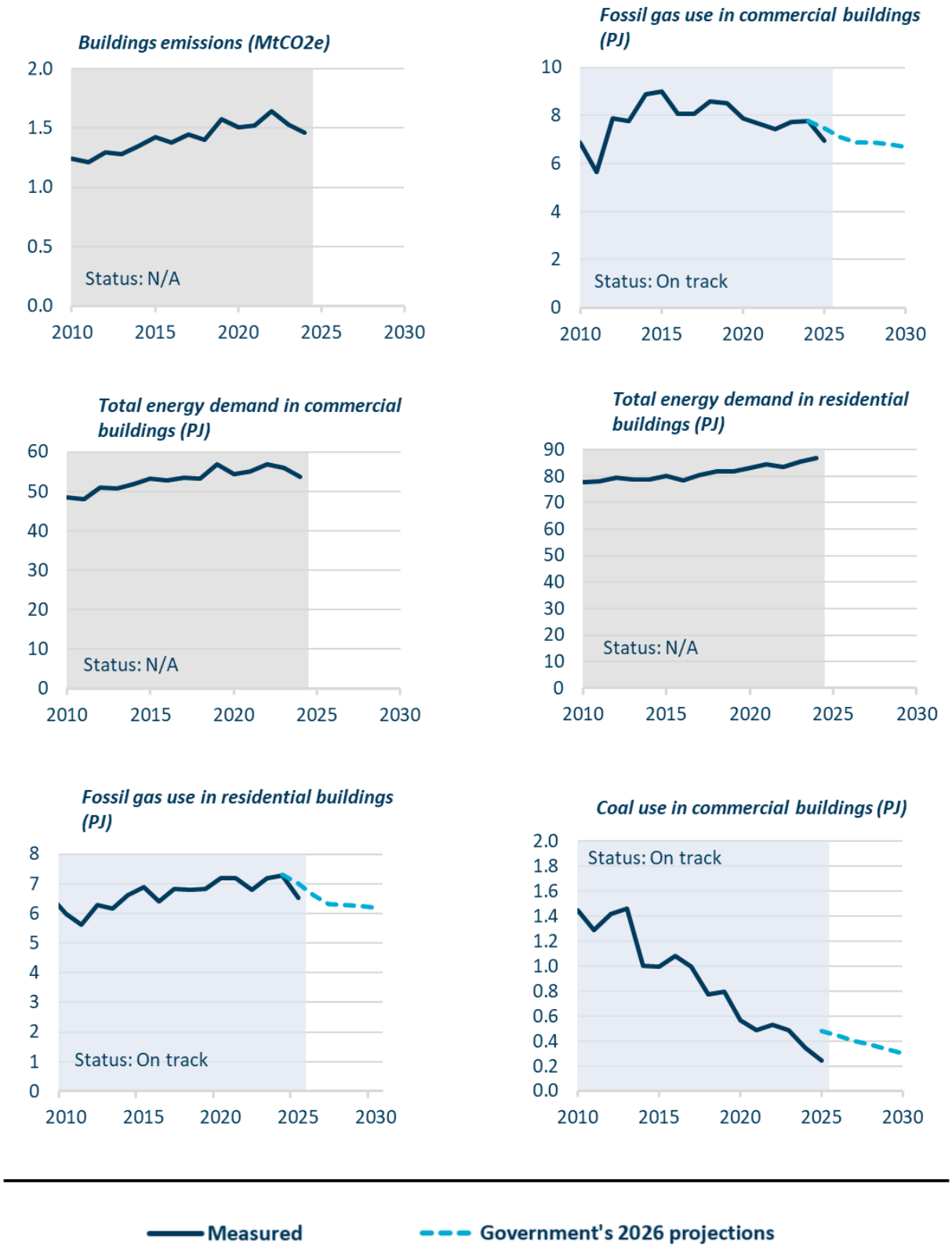
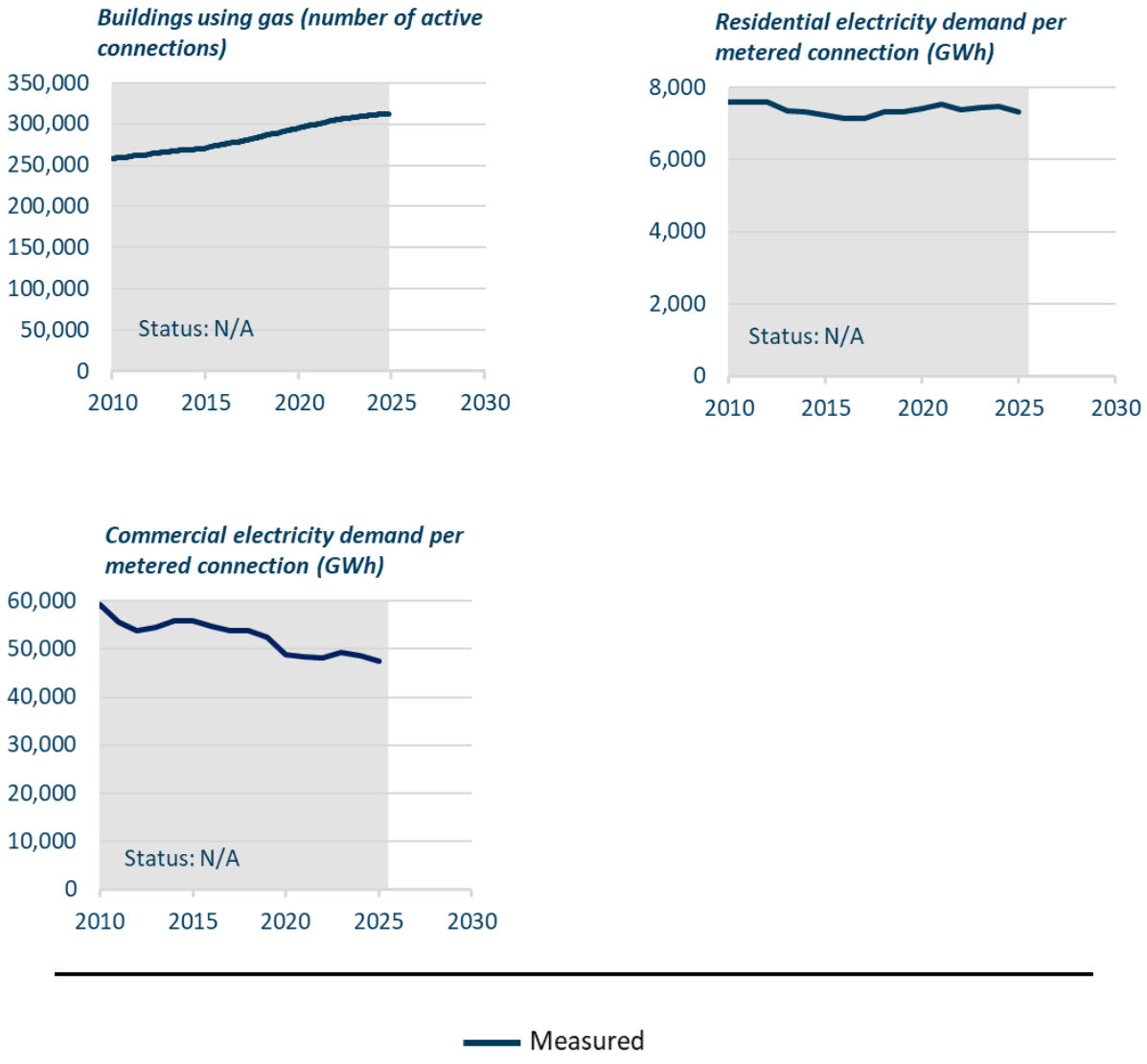
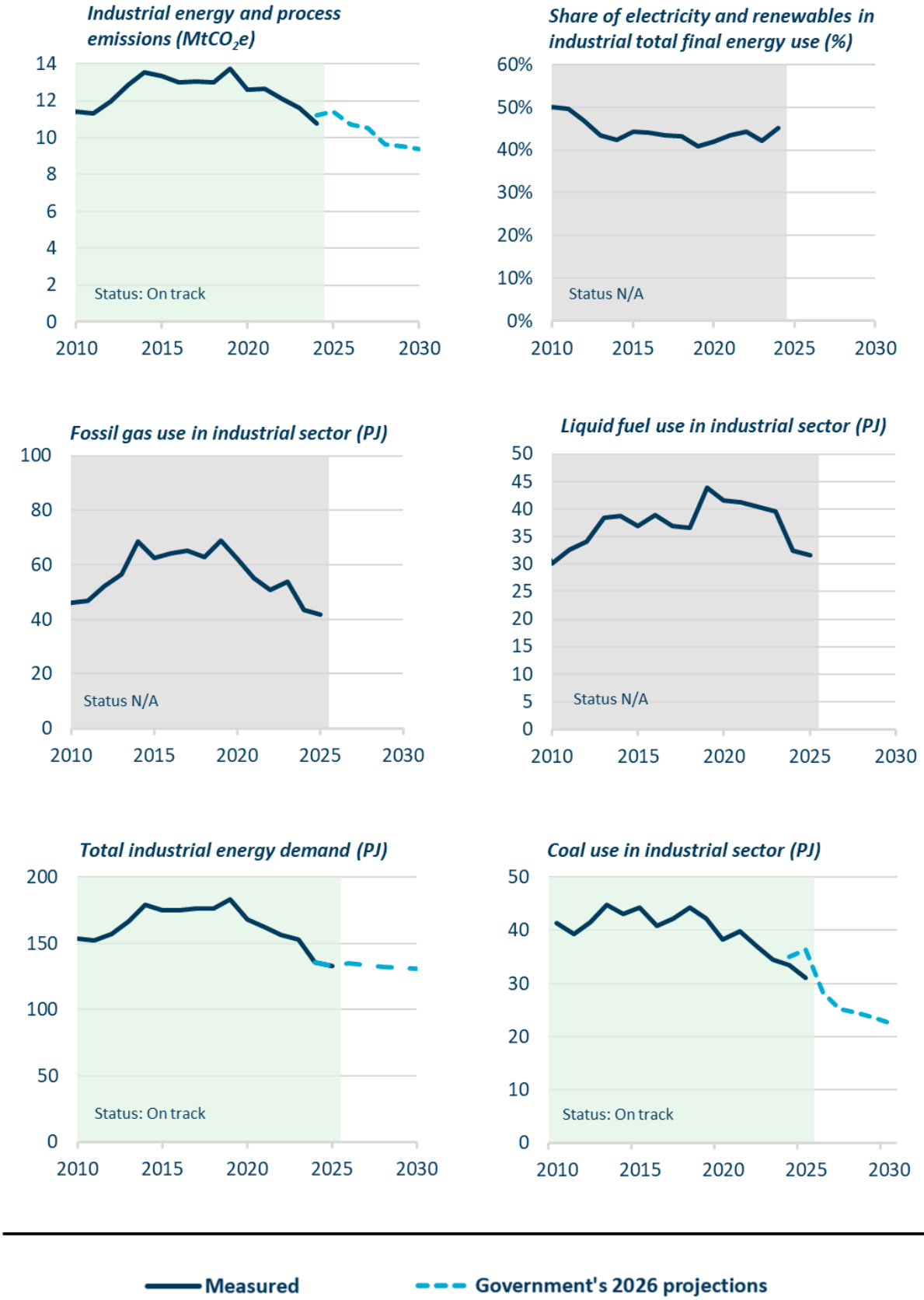


Figure 19: Progress indicators dashboard for buildings *continued*



Source: Commission analysis, MfE ERP2[19], GHG Inventory[4], MBIE energy statistics

Figure 20: Progress indicators dashboard for industry

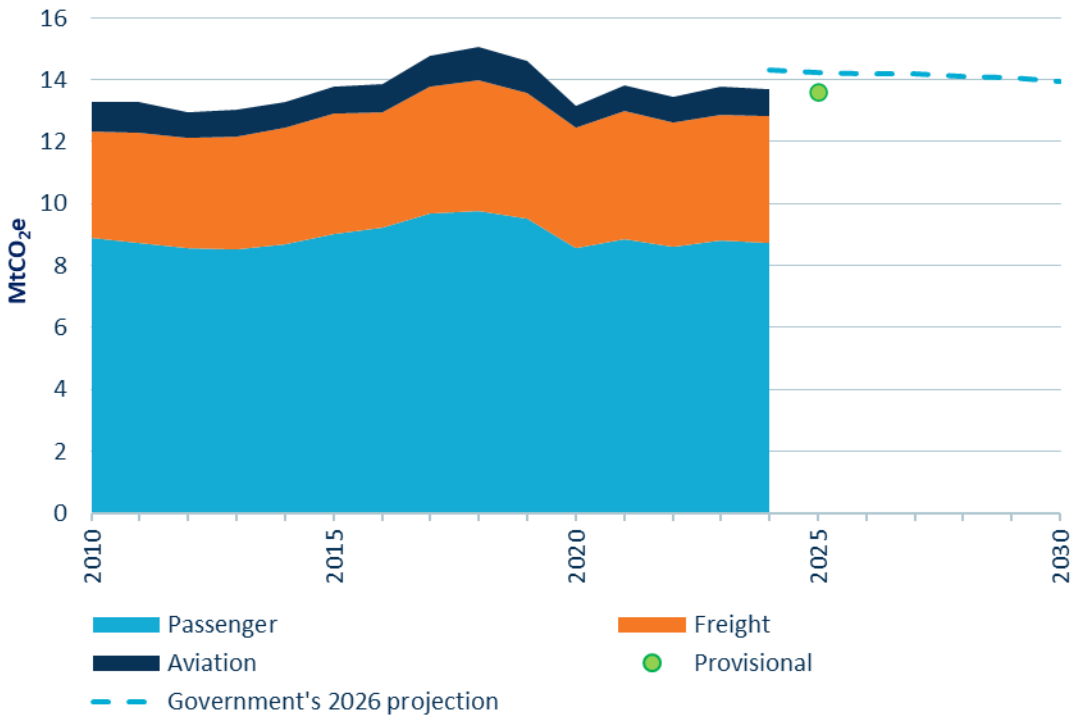


Source: Commission analysis, MfE ERP2[19], GHG Inventory[4], MBIE energy statistics[6]

3.4. Transport

This section summarises the progress to reduce greenhouse gas emissions in the transport sector. Transport emissions in 2024 were 13.7 $MtCO_2e$ (**Figure 21**), which is 18% of gross emissions and 35% of long-lived greenhouse gases (other than biogenic methane). These emissions are created by the burning of fossil fuels for road and rail transport, domestic aviation, and domestic shipping.

Figure 21: Transport emissions by subcategory

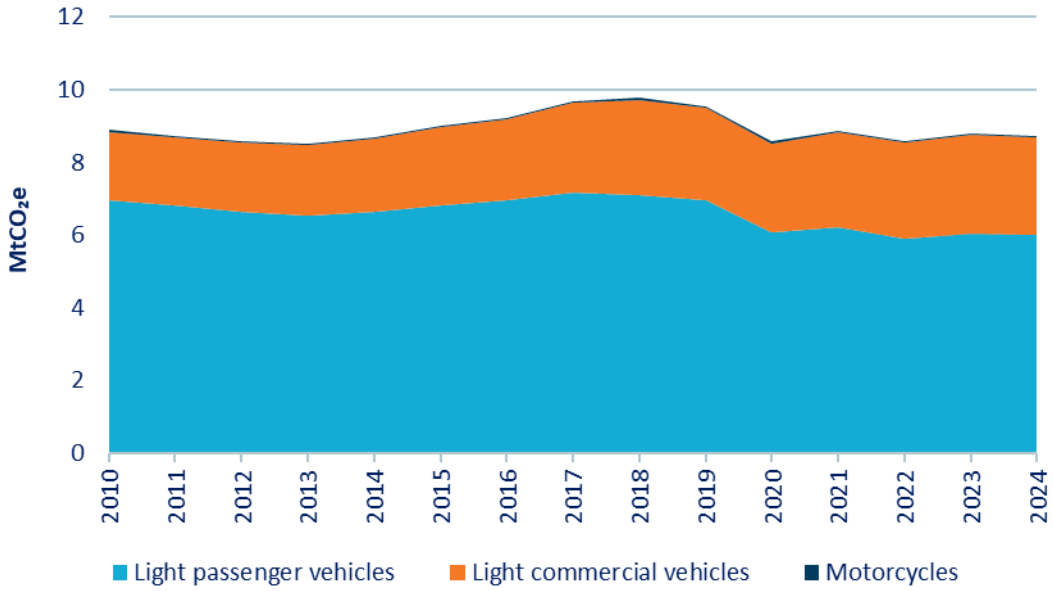


Source: Commission analysis of GHG Inventory 1990–2024, Stats NZ provisional data for 2025, Government's second emissions reduction plan

Passenger transport gross emissions decreased by 0.6% (0.05 $MtCO_2e$) from 8.8 $MtCO_2e$ in 2023 to 8.7 $MtCO_2e$ in 2024. Passenger emissions in 2024 are composed of light passenger vehicles (LPVs) (68% or 6.0 $MtCO_2e$), light commercial vehicles (LCVs) (31% or 2.7 $MtCO_2e$) and motorcycles (0.5% or 0.04 $MtCO_2e$) (**Figure 22**).

Total travel by light vehicles increased in 2024 to 46.2 billion, which is a 0.9% increase from 2023 and 4% higher than the previous peak in 2018. Despite the increase in travel in 2024, passenger transport emissions have declined 11% since their peak in 2018 (9.8 $MtCO_2e$). This highlights improvements in the emissions intensity of vehicle entering the fleet, including electric vehicle uptake.

Figure 22: Passenger transport emissions by vehicle type

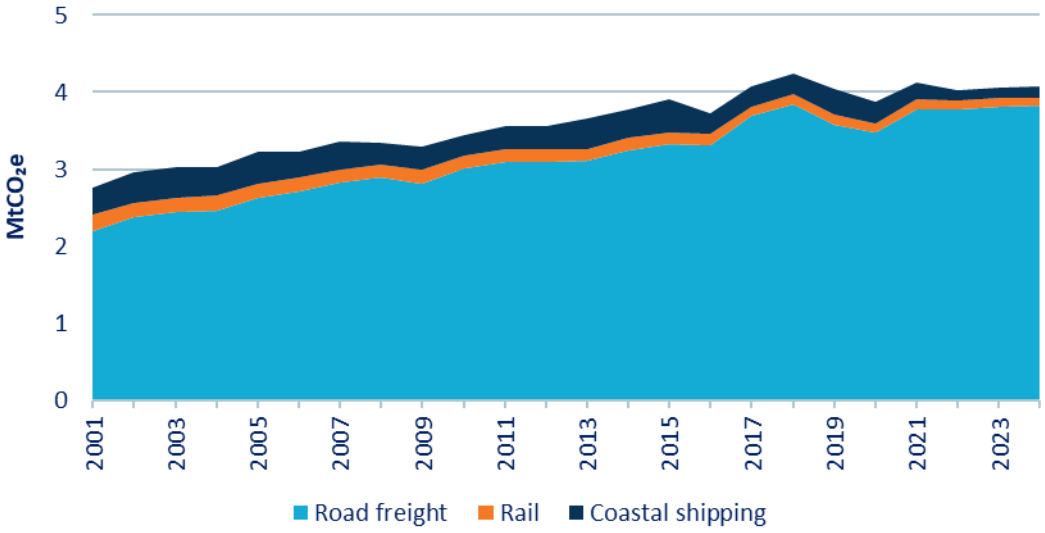


Source: Commission analysis of GHG Inventory 1990–2024[4]

Gross freight emissions have increased by 0.2% (0.01 $MtCO_2e$) in 2024. Freight emissions in 2024 are composed of heavy vehicles (medium and heavy trucks and buses make up 94%), rail (3%) and coastal shipping (3%) (**Figure 23**).

Coastal shipping emissions have increased slightly but remain close to historically low levels. Rail freight decreased by 7% (0.01 $MtCO_2e$) whilst road freight increased by 0.2% (0.01 $MtCO_2e$) between 2023 and 2024.

Figure 23: Freight transport emissions



Source: Commission analysis of GHG Inventory 1990–2024[4]

Aviation

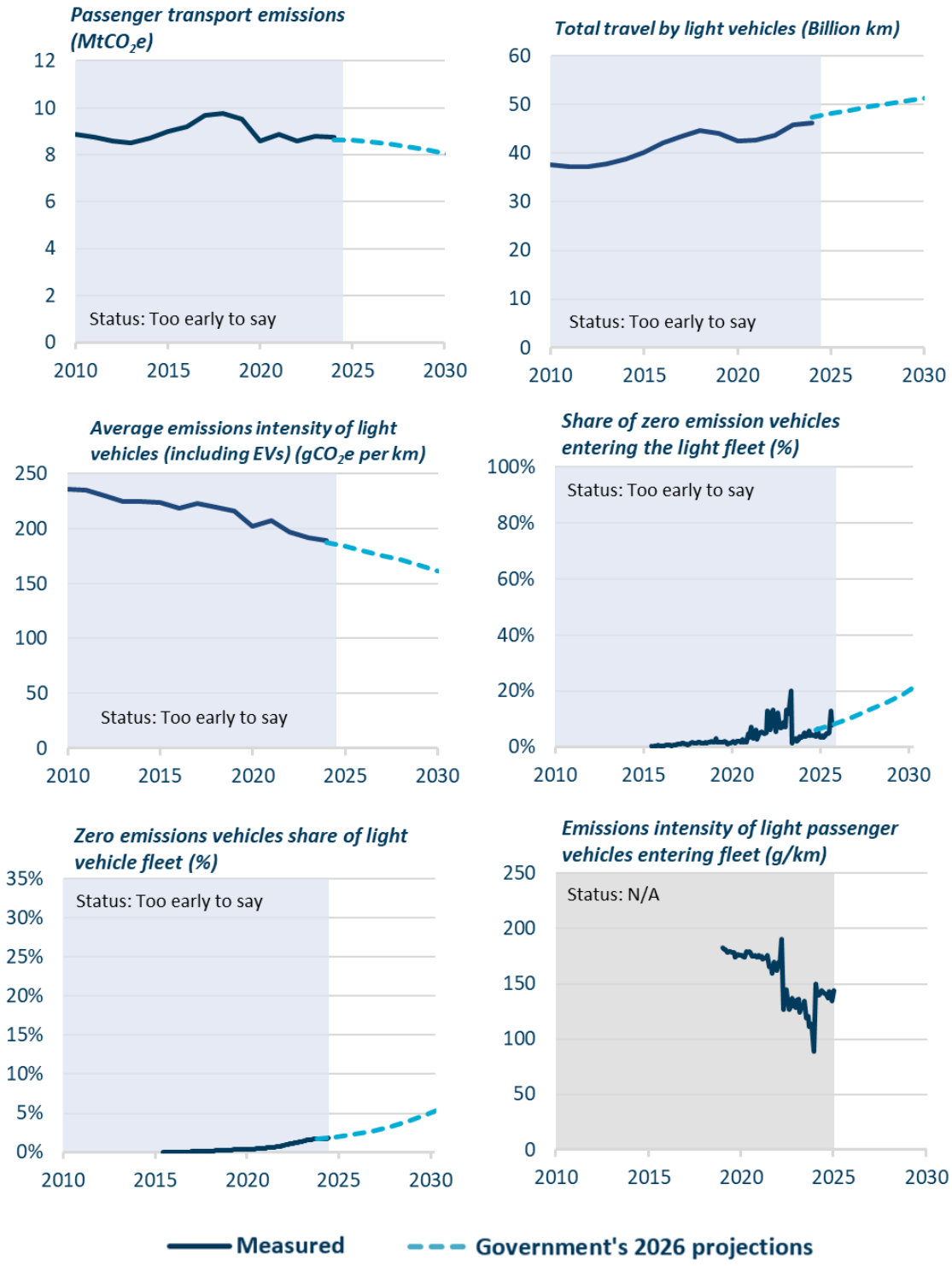
Gross emissions from domestic aviation in 2024 were 0.9 $MtCO_2e$. This was 1% of gross emissions and 2% of gross long-lived greenhouse gas emissions (other than biogenic methane). Emissions from domestic aviation in 2024 reduced by 2% from 2023 (0.91 $MtCO_2e$ vs 0.92 $MtCO_2e$).

Aviation emissions dropped in 2020 because of the COVID-19 epidemic and although there has been a recovery in demand, emissions were still 11% below 2019 levels in 2024. Methodological improvements to the inventory for aviation have lowered emissions in 2022 and 2023, compared to preceding years.

Progress indicators

A set of indicators are shown for passenger transport (**Figure 24**), freight transport (**Figure 25**) and aviation transport (**Figure 26)**; these help us track progress to the goals and pathway outcomes as outlined in the monitoring maps. See *Section 2.6: How we measure progress* for an explanation of the indicators and *Section 2.4: How we monitor emissions by sector* for a description of the monitoring maps.

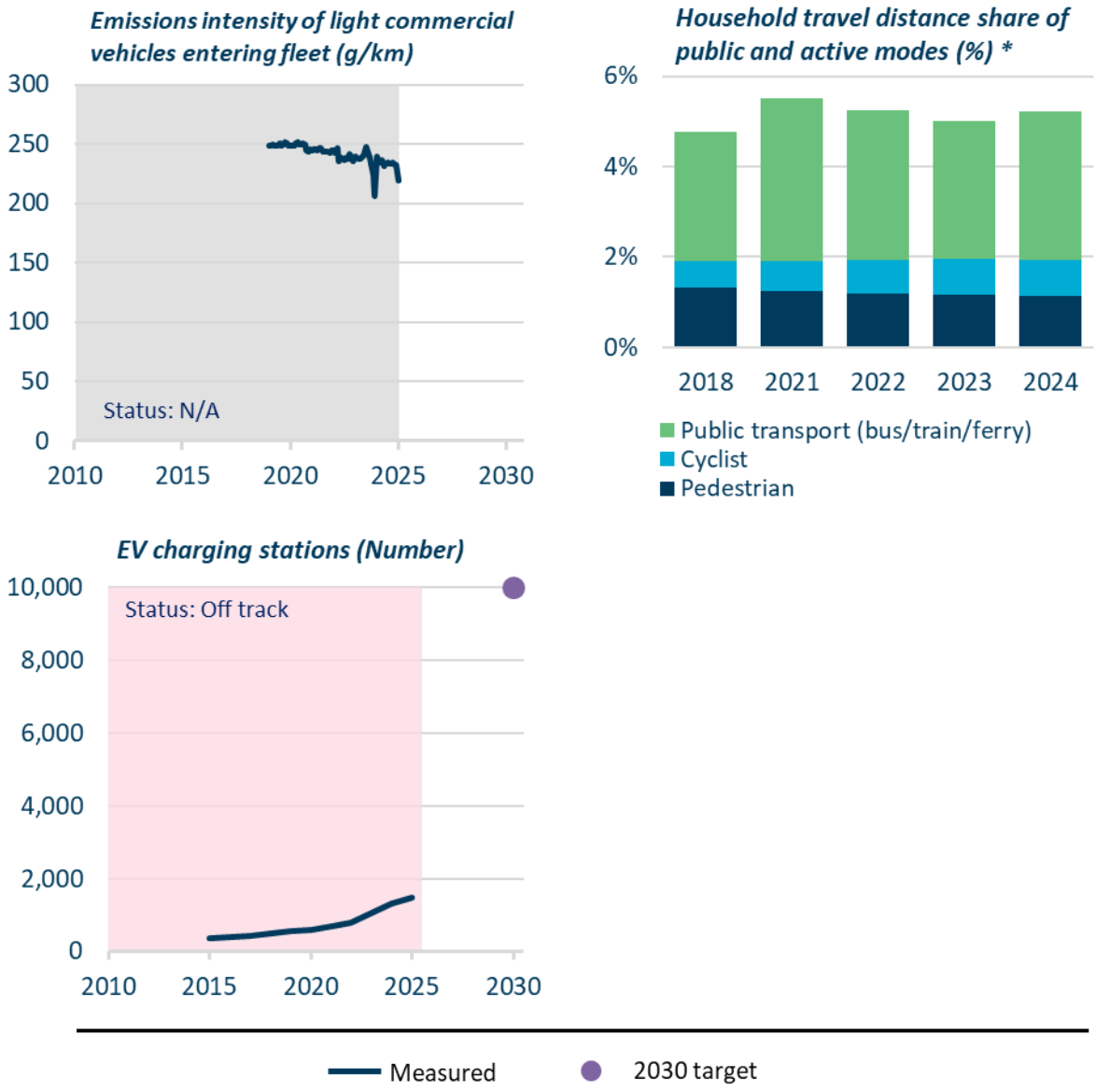
Figure 24: Progress indicators dashboard for passenger transport



EVs include battery electric vehicles, plug in hybrids and fuel cell electric vehicles.

Zero emissions vehicles include battery electric vehicles and fuel cell electric vehicles.

Figure 24: Progress indicators dashboard for passenger transport *continued* [vi]



Source: Commission analysis, GHG Inventory[4], MfE ERP2[6], Ministry of Transport Fleet Statistics [22], New Zealand Household Travel Survey [23], Energy Efficiency & Conservation Authority (EECA) Public EV Charger Dashboard [24]

[vi] Chart shows final year of survey, data corresponds to surveys conducted between 2015-2018, 2018-2021, 2019 - 2022,2021- 2023, 2023-2024.
EVs include battery electric vehicles, plug in hybrids and fuel cell electric vehicles.
Zero emissions vehicles include battery electric vehicles and fuel cell electric vehicles

Figure 25: Progress indicators dashboard for freight transport

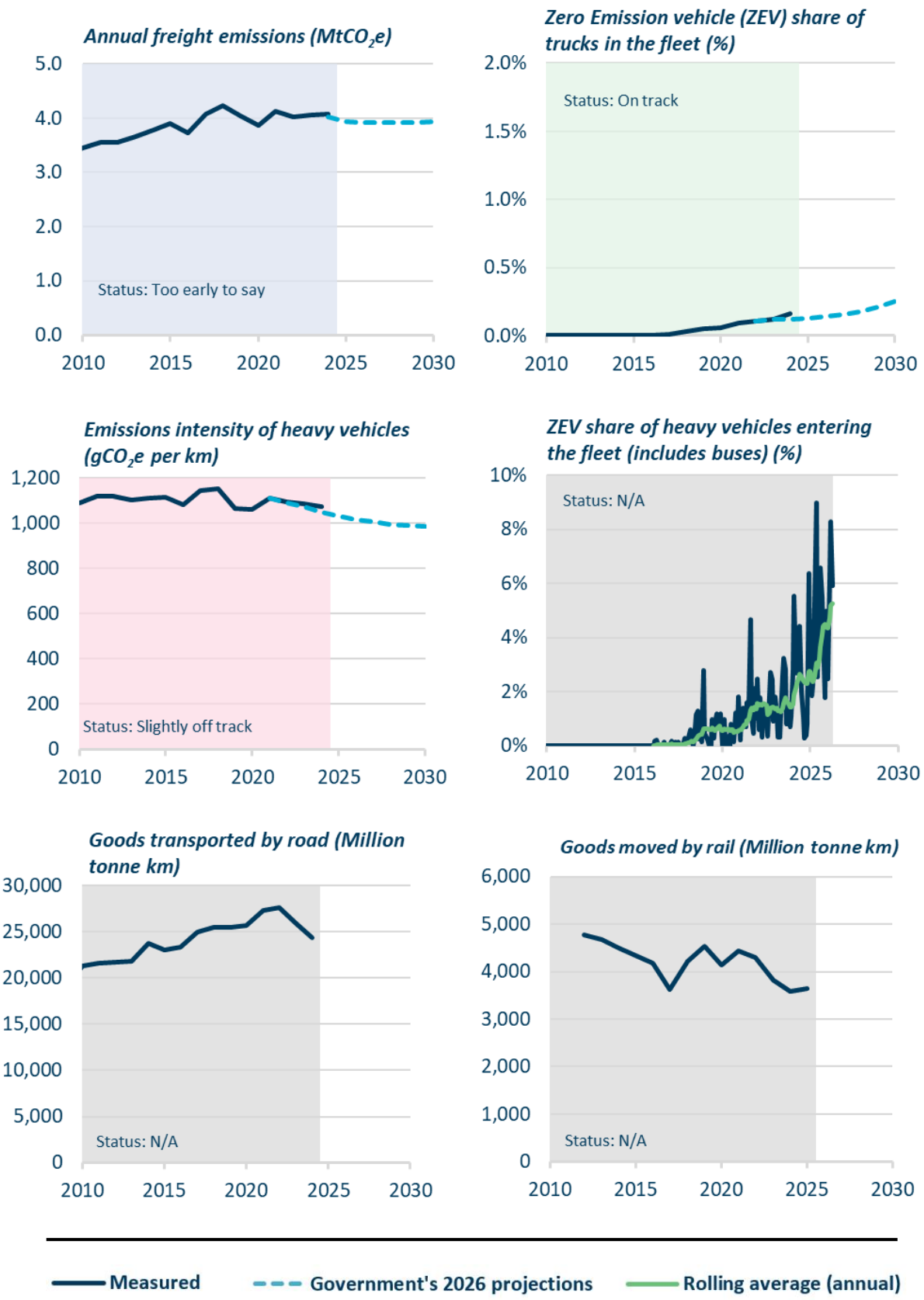
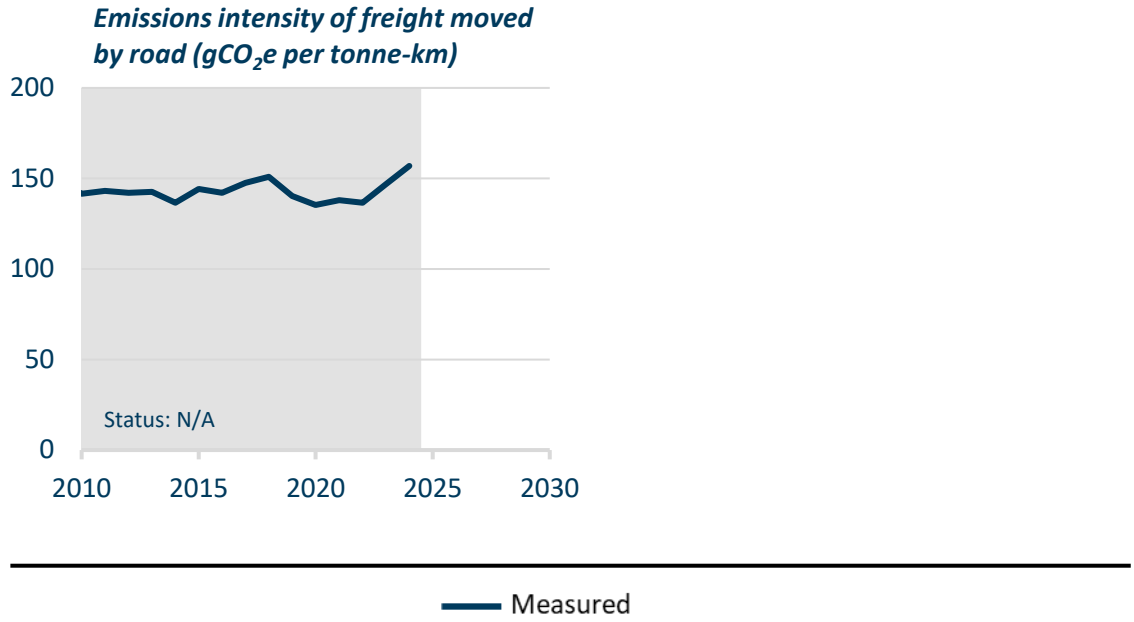


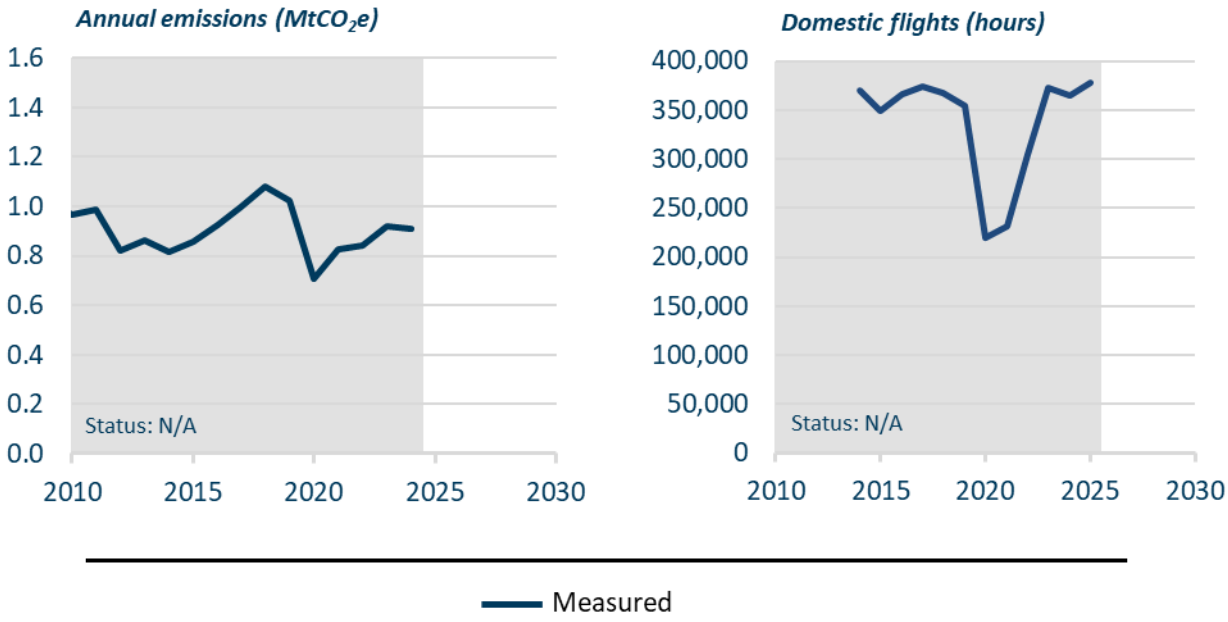
Figure 25: Progress indicators dashboard for freight transport *continued* [vii]



Source: Commission analysis, GHG Inventory[4], MfE ERP2[19], Ministry of Transport Annual Motor Vehicle Fleet Statistics [22], Ministry of Transport Fleet Statistics (monthly)[25], Ministry of Transport Freight Information Gathering System [26]

[vii] Note projections are included only where modelled data of sufficient quality is available for the indicator.

Figure 26: Progress indicators dashboard for aviation [viii]



Source: Commission analysis, GHG Inventory[4], MfE ERP2[6], Civil Aviation Authority[27]

3.5. Waste

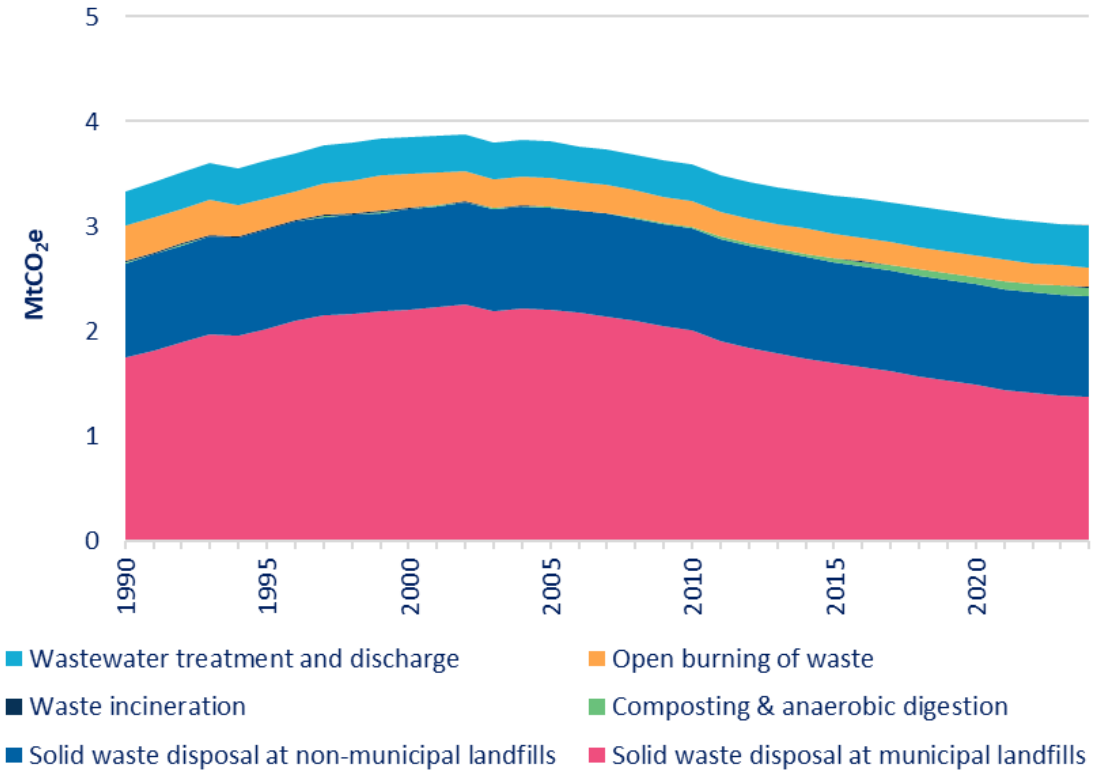
In 2024, gross emissions from the waste sector were 3 $MtCO_2e$, making up 4% of Aotearoa New Zealand's gross emissions. Waste emissions are primarily methane, comprising 92% of the total waste CO_2e emissions, the remainder from the long-lived greenhouse gases carbon dioxide and nitrous oxide. Methane emissions from waste were 0.10 $MtCH_4$ in 2024, making up 8% of biogenic methane emissions.

Aotearoa New Zealand's waste emissions come mostly from disposal of organic waste to landfills (77% of total waste emissions). Smaller quantities of emissions come from wastewater treatment (13%), the incineration and burning of solid waste (6%), and biological treatment such as composting (3%).

Waste emissions were virtually unchanged between 2023 and 2024, reducing by 0.01 $MtCO_2e$ (**Figure 27**).

[viii] The absence of projected emissions data is due to inconsistent emission levels arising from the methodological improvements made between the inventories released in 2025 and 2026.

Figure 27: Emissions from waste



Source: Commission analysis of GHG Inventory 1990–2024 [4]

The annual tonnage of waste sent to municipal landfills reduced by 0.5 Mt (15%) between 2023 and 2024. Emissions from municipal landfills (category 5.A.1 in the Inventory) decreased by 20.7 $ktCO_2e$ across the same period. The national inventory assigns the reduction in emissions to improved landfill gas (LFG) capture and changes in waste composition.

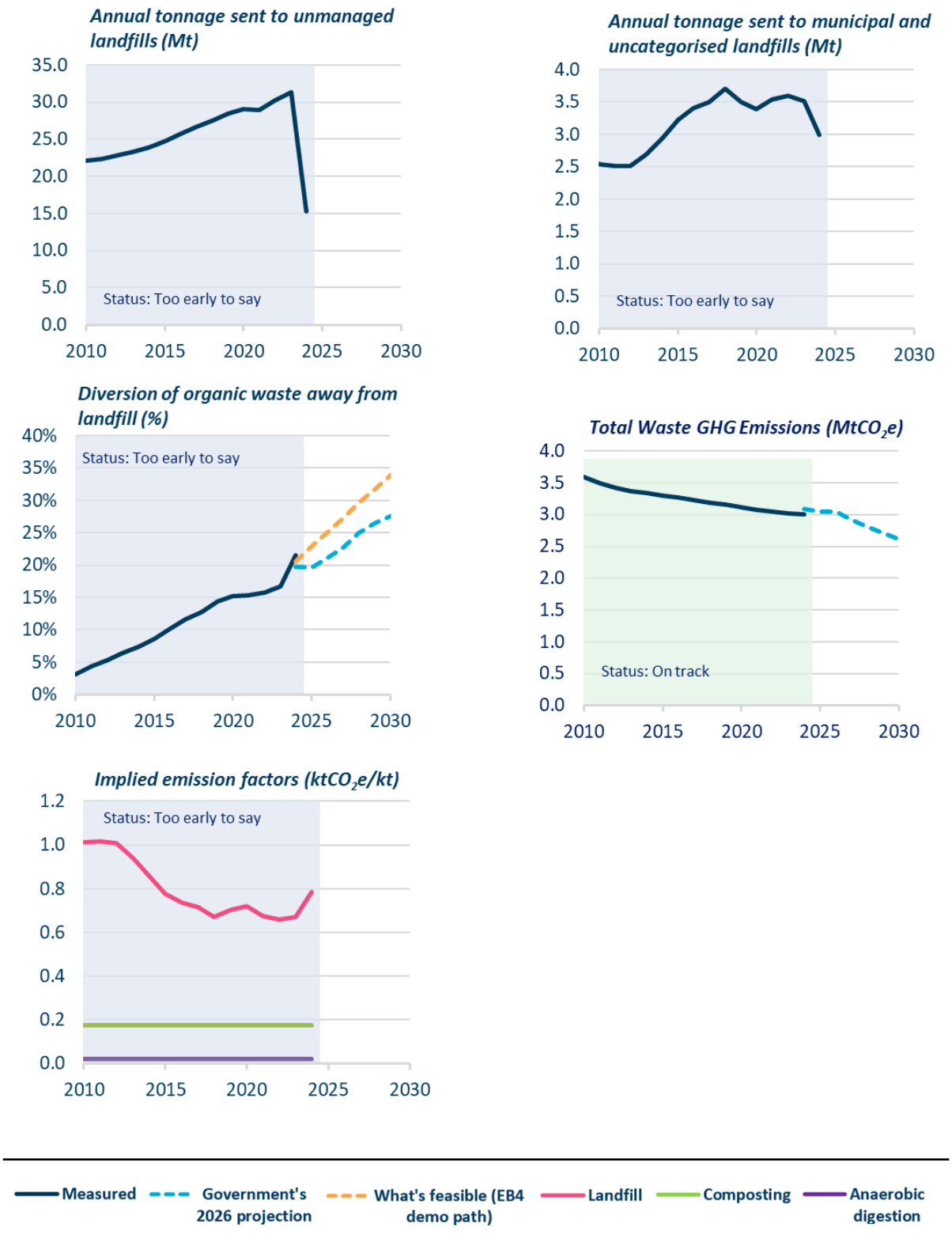
For non-municipal landfills the reduction in the annual tonnage of waste was 16.0 Mt (51%). There was a slight increase in emissions of 0.8 $ktCO_2e$ between 2023 and 2024. The non-municipal landfills (Classes 2-5 and monofills) have much higher proportions of inert materials, hence large changes in tonnage disposed does not necessarily correlate to a change in emissions.

The indicator showing the percentage diversion of organic waste sent to compost and anaerobic digestion increased to 22% in 2024. More waste is diverted to composting currently, but anaerobic digestion is growing rapidly.

Implied emission factors for methane per mass of municipal waste ($ktCO_2e/kt$) in unmanaged landfill showed an increase between 2023 and 2024 (**Figure 28**). This was because although both the emissions decreased and waste tonnage decreased, the tonnage decreased to a lesser extent than emissions. A confounding factor is that emissions are calculated depending upon organic matter deposited in preceding years, whereas tonnage data is for that occurring in a single year. The implied emission factors are sourced from the national inventory and for landfills illustrates the reduction in organic waste occurring over time.

The Waste progress indicators (**Figure 28**) help us track progress to the goals and pathway outcomes as outlined in the monitoring maps. See *Section 2.6: How we measure progress* for an explanation of the indicators and *Section 2.4: How we monitor emissions by sector* for a description of the monitoring maps.

Figure 28: Progress indicators dashboard for waste



Source: Commission analysis, GHG Inventory[4], MfE ERP2[6]

3.6. F-gases

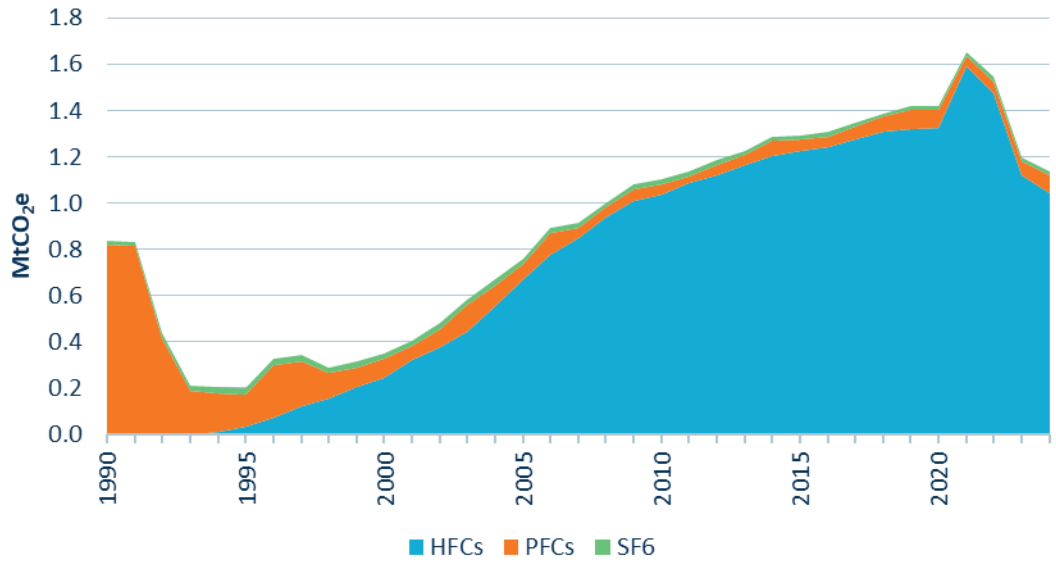
New Zealand's GHG Inventory reporting shows emissions from f-gases, which is the sum of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6), reached a peak in 2021. In 2024, 92% of f-gas emissions were from HFCs, 7% from PFCs and 1% from SF_6 (**Figure 29**).

HFC emissions dropped 7% (0.08 $MtCO_2e$) between 2023 and 2024. There was a reduction in HFCs contained in imported goods and motor vehicles, which are subject to the synthetic greenhouse gas levy. The HFC emissions reduction occurred despite an increase in bulk imports of HFCs in this period. Since the Kigali Amendment to the Montreal Protocol came into force on 1 January 2020, HFC emissions have declined 21% (0.3 $MtCO_2e$).

PFC emissions increased 28% (0.02 $MtCO_2e$) between 2023 and 2024. Almost all of New Zealand's PFC emissions are released during aluminium production. According to the New Zealand Aluminium Smelter environmental monitoring report, higher cell instability was experienced in 2024 due to Demand Response, resulting in more anode effects per cell day and therefore higher PFC emissions.[28]

SF_6 emissions dropped 16% (0.003 $MtCO_2e$) between 2023 and 2024.

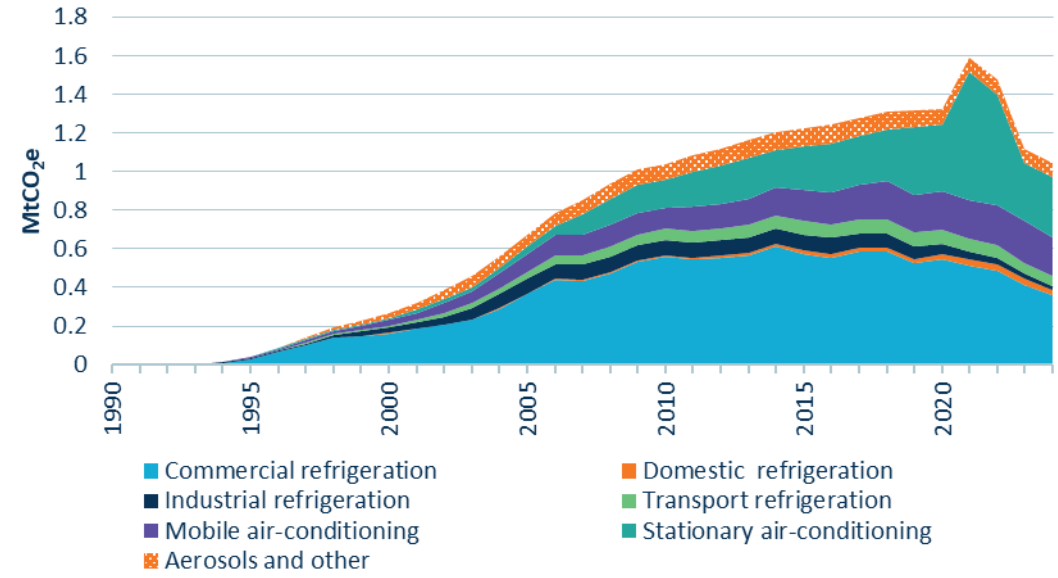
Figure 29: F-gas emissions



Source: Commission analysis of GHG Inventory 1990–2024

Refrigeration and air conditioning categories contributed to 93% of HFC emissions in 2024 (**Figure 30**). Commercial refrigeration had the greatest emissions reduction of 14% (0.06 $MtCO_2e$) between 2023 and 2024.

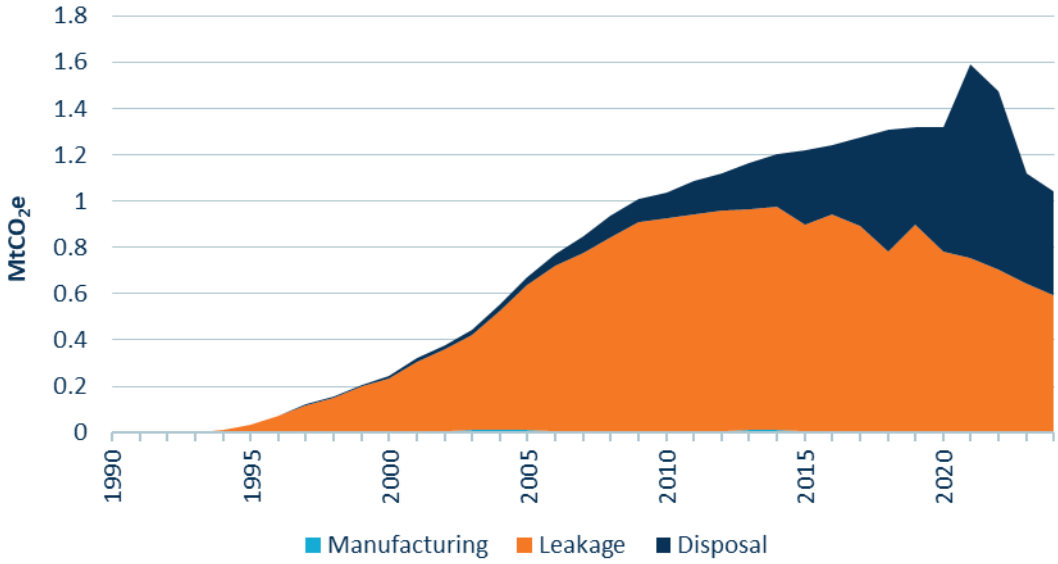
Figure 30: Breakdown of HFC emissions by activity



Source: Commission analysis of GHG Inventory 1990–2024

Figure 31 shows the release of HFCs from product manufacturing, leakage and disposal, which have continued to decline since 2021. Emissions from leakage were responsible for 57% of the release in 2024, whilst disposal contributed 43% and manufacturing only 0.2%.

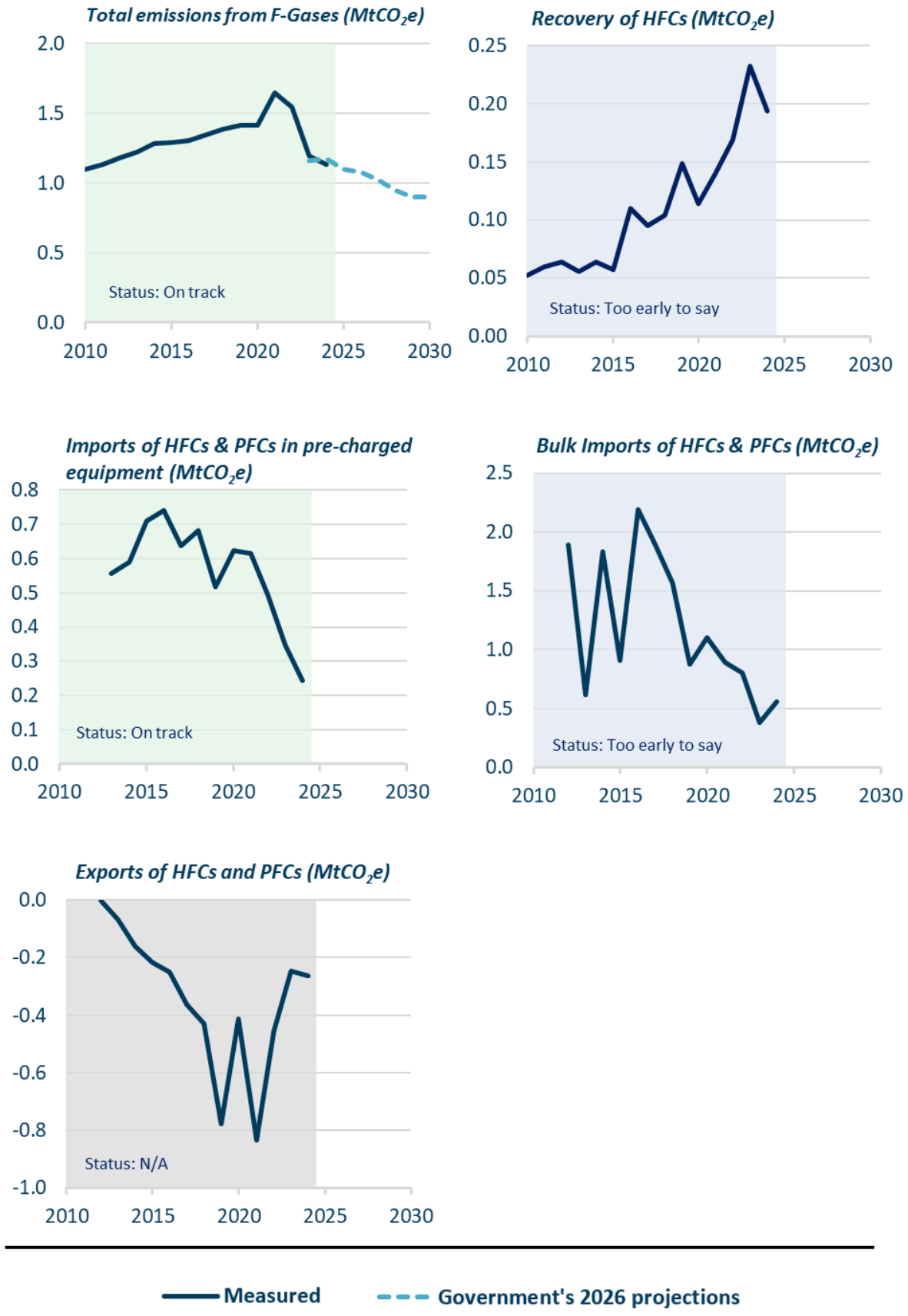
Figure 31: Release of HFCs from product manufacturing, leakage and disposal



Source: Commission analysis of GHG Inventory 1990–2024 [4]

The f-gas progress indicators (**Figure 32**) help us track progress to the goals and pathway outcomes as outlined in the monitoring maps. See *Section 2.6: How we measure progress* for an explanation of the indicators and *Section 2.4: How we monitor emissions by sector* for a description of the monitoring maps.

Figure 32: Progress indicators dashboard for f-gases

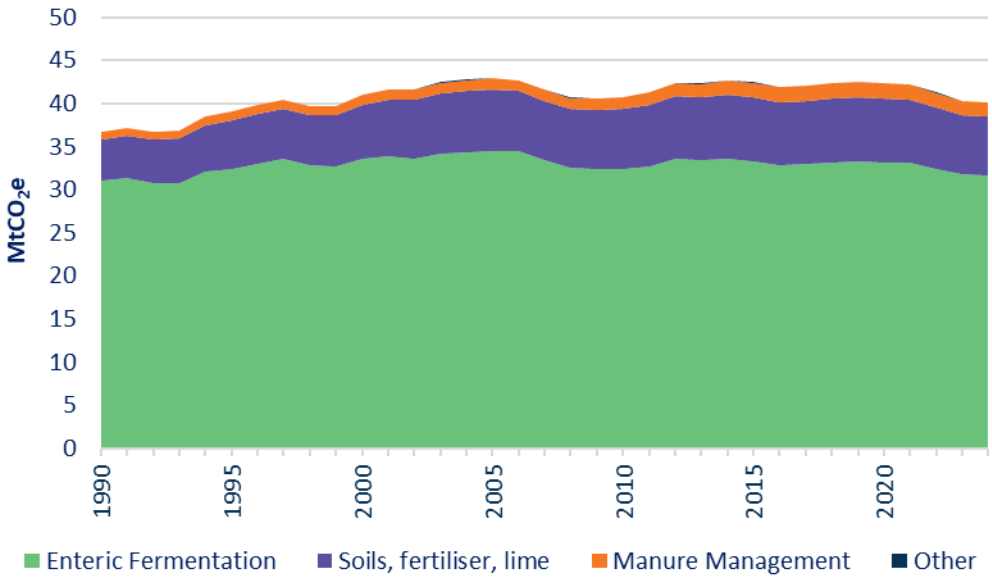


Source: Commission analysis, GHG Inventory[4], MfE ERP2[19], Environmental Protection Authority (EPA) [29]

3.7. Agriculture

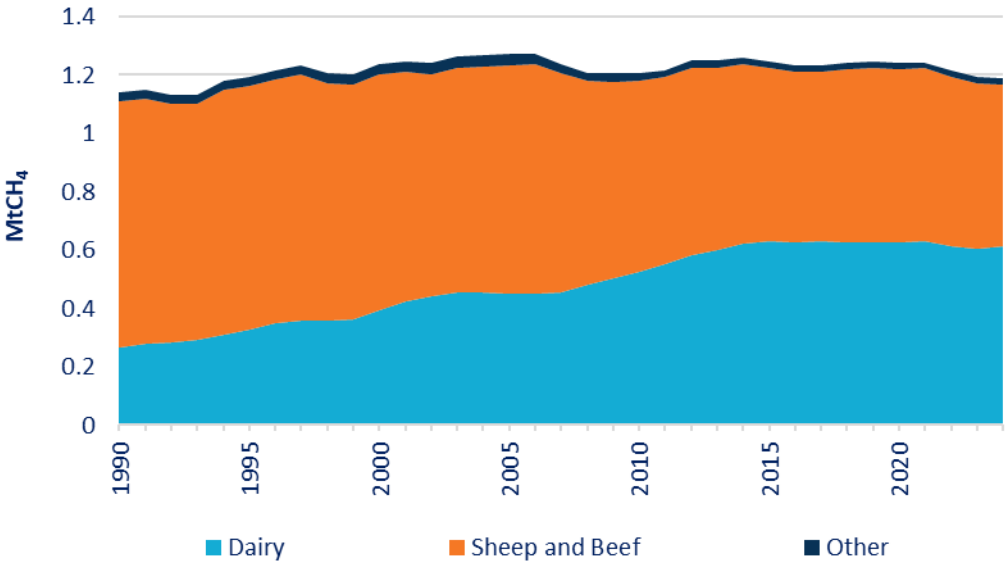
Emissions data for 2024 shows there has been a small, 0.3% (0.1 $MtCO_2e$), decrease in total agricultural emissions from 2023 to 2024, falling from 40.3 $MtCO_2e$ to 40.1 $MtCO_2e$ (**Figure 33**). Reductions in biogenic methane from agriculture have slowed, reducing 0.4% between 2023 and 2024 (**Figure 34**). Methane emissions have increased for dairy cattle (0.01 $MtCH_4$), whilst methane emissions decreased for sheep & beef (0.01 $MtCH_4$).

Figure 33: Agricultural emissions, all gases



Source: Commission analysis of GHG Inventory 1990–2024[4]

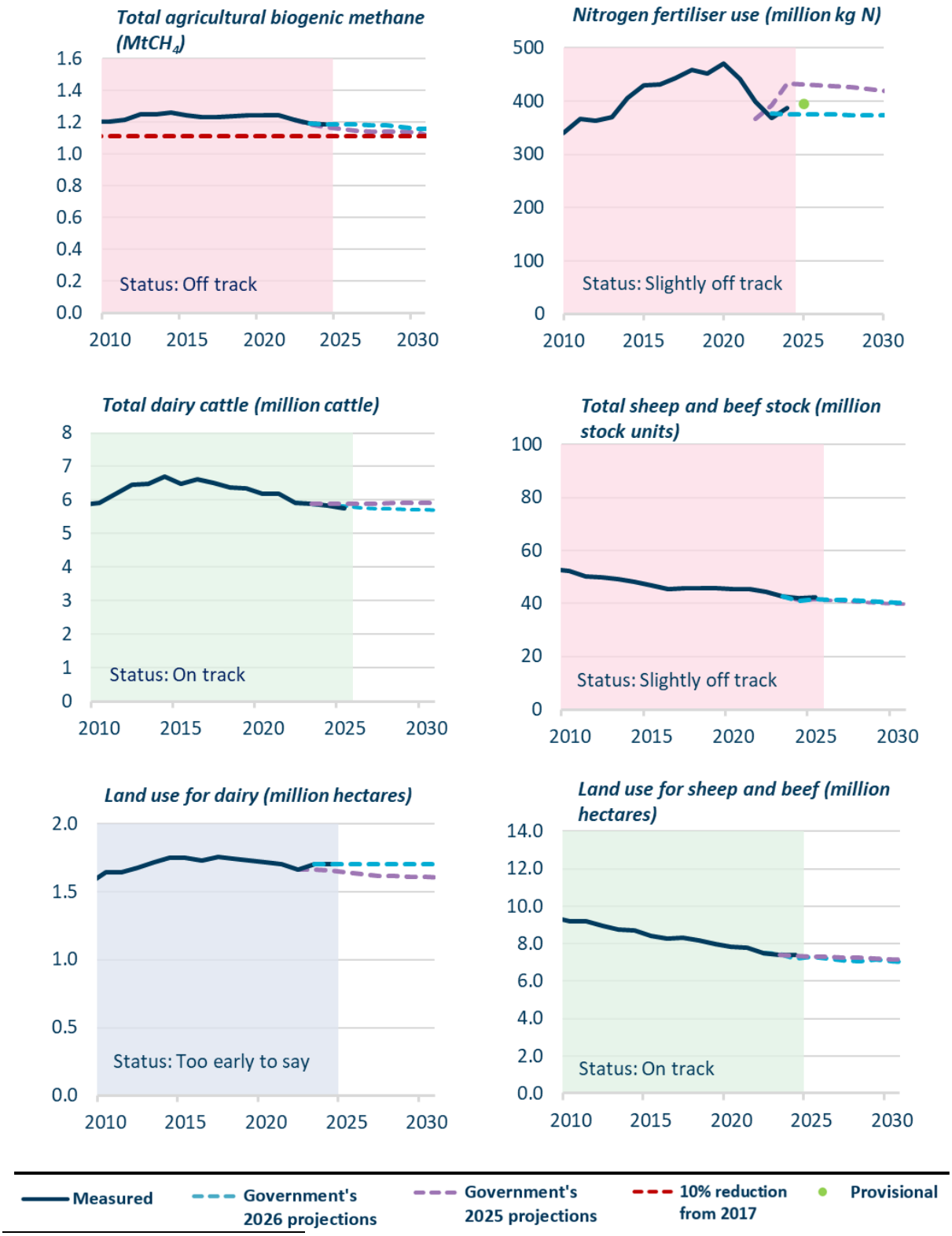
Figure 34: Agricultural biogenic methane emissions



Source: Commission analysis of GHG Inventory 1990–2024[4]

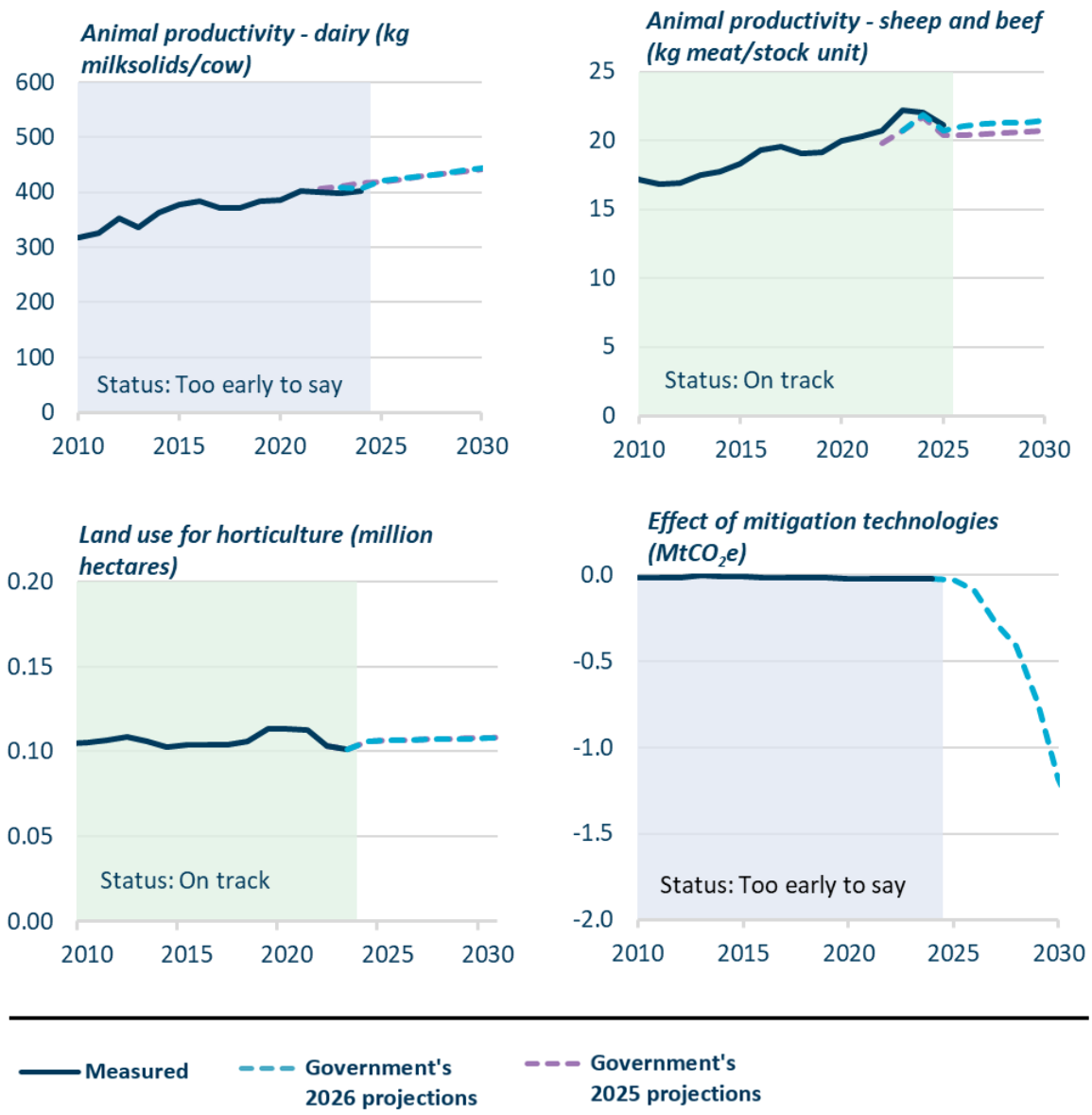
The Agriculture progress indicators (**Figure 35)** help us track progress to the goals and pathway outcomes as outlined in the monitoring maps. See *Section 2.6: How we measure progress* for an explanation of the indicators and *Section 2.4: How we monitor emissions by sector* for a description of the monitoring maps.

Figure 35: Progress indicators dashboard for agriculture[ix]



[ix] The indicator status for total agricultural biogenic methane is assessed as off track based on the biogenic methane target, although it is on track for the Government's 2026 projections

Figure 35: Progress indicators dashboard for agriculture *continued*



Source: Commission analysis, GHG Inventory[4], MfE ERP2[19,30], Dairy Industry Statistics[31], Fertiliser Association[32,33], Stats NZ[20]

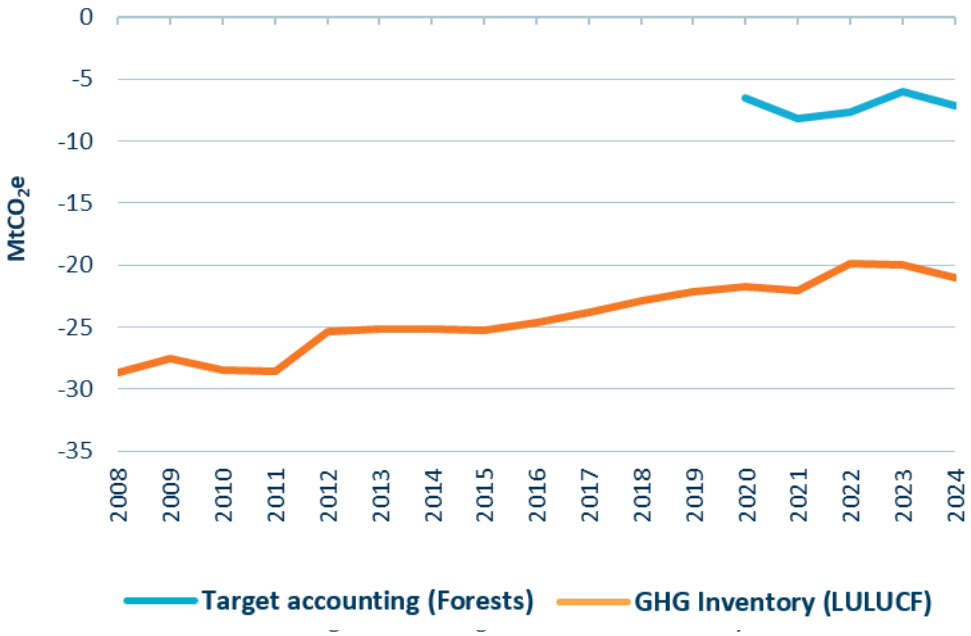
3.8. Land Use, Land-Use Change and Forestry

Figure 36 shows the level of net emissions from forests and other land uses under both the GHG Inventory and target accounting approach.

In the GHG Inventory this year, net removals by forests under target accounting in 2024 were -7.1 $MtCO_2e$. This is equal to 9% of Aotearoa New Zealand's gross emissions in 2024, and 18% of emissions of long-lived gases (gases other than biogenic methane).

Forest removals changed from -6.0 $MtCO_2e$ 2023 to -7.1 $MtCO_2e$ in 2024, an increase of 1.1 $MtCO_2e$ (19%). This is driven by less deforestation in 2024 compared to 2023, as well as an increase in removals from planted forests.

Figure 36: Removals by accounting method



Source: Commission analysis of GHG Inventory 1990–2024[4]

The forest removals progress indicators (**Figure 37**) help track progress to the goals and pathway outcomes as outlined in the monitoring maps. See *Section 2.6: How we measure progress* for an explanation of the indicators and *Section 2.4: How we monitor emissions by sector* for a description of the monitoring maps.

Figure 37: Progress indicators dashboard for forest removals

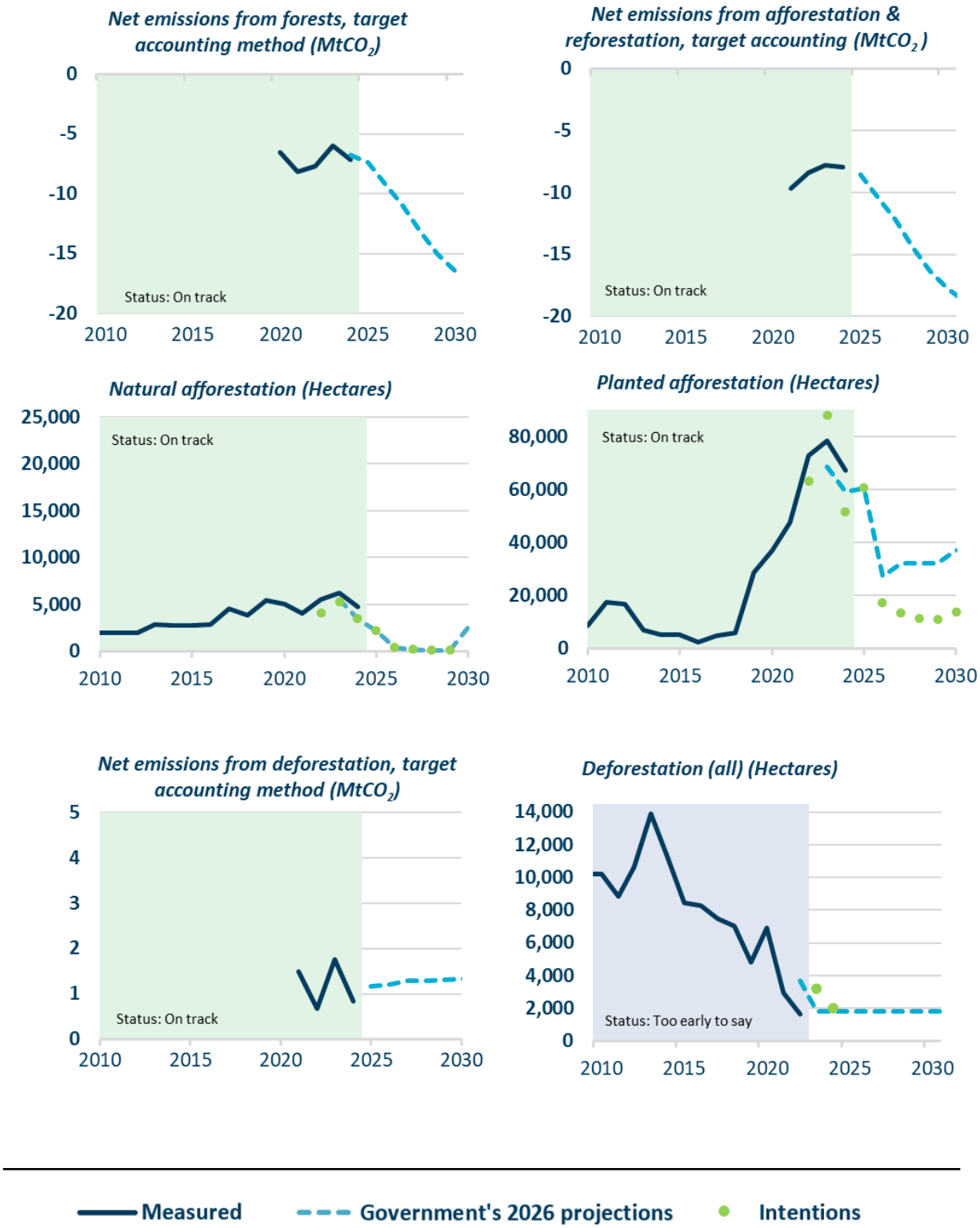
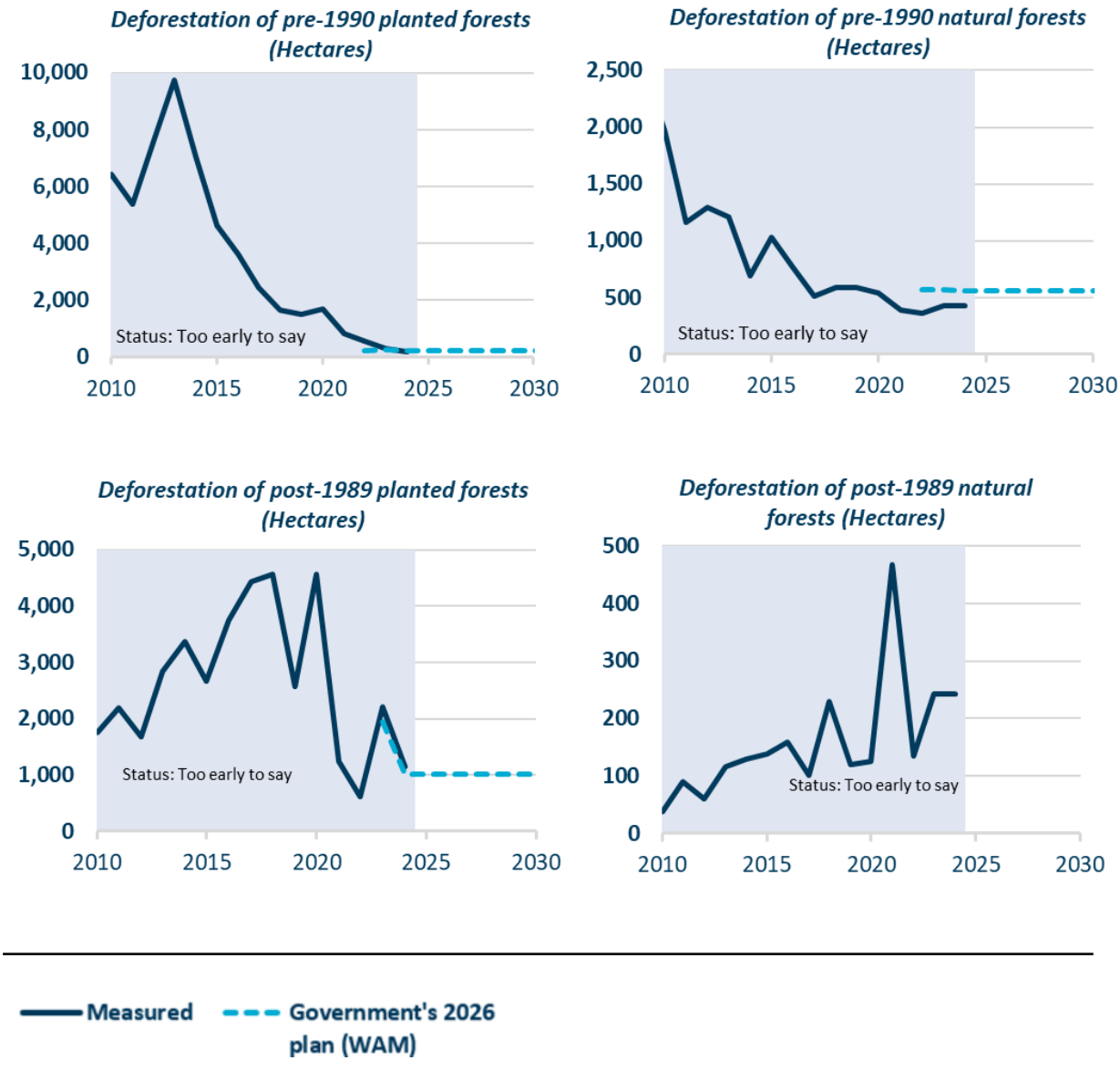


Figure 37: Progress indicators dashboard for forest removals *continued*



Source: 2026 GHG Inventory[4], MfE ERP2[19], Afforestation and Deforestation Intentions Survey[34]

4. Information gaps

Our sectoral assessment of emissions reductions shows some areas lack regular or sufficiently detailed data. Data gaps can limit how well real-world progress is tracked and understood. Analysis of data gaps can also provide opportunities for linking action for adaptation to climate change impacts.

Data collection and reporting could be improved to support monitoring of emissions reduction. Improved data can also strengthen public and private decision making and policy development.

4.1. Cross-cutting areas

Last year's report noted gaps in tracking investment and energy hardship. Energy hardship has been addressed through the Report on Energy Hardship[35], but data to track investment has not.

Indicators to monitor the impacts of climate mitigation policy are under development by the Interdepartmental Executive Board (IEB), with data collection planned to start this year, as discussed in *Chapter 4: Impacts and Benefits*. Whether these will meet monitoring needs cannot be evaluated until they are made public.

4.2. Whakahekenga rehukino

The Commission's previous emissions reduction monitoring reports have highlighted data gaps limiting our ability to track and understand the progress of emissions reductions actions regarding iwi/Māori and the Māori economy. This has not been resolved, and a lack of updated Māori emissions data has limited this assessment.

In previous advice, we stated that iwi/ Māori should also be supported to quantify their emissions profile, to understand their contribution to the national emissions profile. Without a full account of the iwi/Māori contribution to our national emissions profile, it is difficult to design equitable policy.

It is also difficult to assess the adequacy of government action in supporting Māori-led action and integrating mātauranga Māori into the climate response, due to delivery uncertainties surrounding the Māori climate platform, a lack of transparency, and uncertainty of the post-2025 future of the Vision Mātauranga policy and capability fund. Future emissions reduction monitoring reports will be strengthened by the inclusion of mātauranga-informed indicators.

4.3. Energy and industry

Aggregate capacity (MW) of demand flexibility. Some information is publicly available on the total amount of demand that can be shifted or temporarily turned off, particularly thanks to EECA's recent study.[36] However, flexible demand is not consistently tracked and reported. If the Electricity Authority were to conduct regular demand-side flexibility surveys (such as its 2024 one), this could provide data for indicator metrics. For example, the proportion of demand that can be shifted or turned off when needed. Another option could be if the Commerce Commission were to require electricity distribution businesses to report on demand flexibility.

Low-carbon fuels project pipeline. Some information is publicly available but is not consistently tracked and reported. Competitive and secure supply of low-emissions fuels is a key enabler in switching away from fossil fuels for energy or feedstocks. Low-carbon fuels projects may include, for example, the development of green hydrogen and bioenergy production facilities.

Carbon intensity of materials. Environmental Product Declarations (EPDs) are available and used to populate different tools and databases. There is ongoing work to produce tools and databases in a standardised format to facilitate ease of use and increase voluntary uptake of lower-carbon-intensity materials. Such tools could enable monitoring of changes in the carbon intensity of materials over time, although that is not their primary purpose.

Secondary material collection and use. Data on secondary material collection and use could improve monitoring and reporting at the sector and/or product level (for example, volume of scrap metal collection, and construction and demolition waste). Over time, this could include data on recycling and reuse of critical minerals and metals.

Energy efficiency of products. EECA tracks improvements in the energy efficiency of products through sales and product performance information as part of the Equipment Energy Efficiency (E3) Programme. However, data on improvements in product energy efficiency and the range of products offered are not reported in a format that is suitable for tracking progress.

Rate of buildings switching away from fossil gas. Data is not reported in a format that is suitable for tracking progress. Existing data may be accounting for all existing connection points and meters, even if a consumer has ceased using gas and disconnected from their service provider. Data on switching could be aggregated and reported by a central entity, such as the Commerce Commission or the Gas Industry Company.

Building stock retrofit rates. Data is not collected on building retrofits – where the owner undertakes renovations to improve energy efficiency, increase use of renewable energy, improve insulation or similar. Some building projects require a building or resource consent, but others do not. Data from consents is not collected and reported consistently across building consent authorities. A hub for building consent authorities, such as Simpli, could be a centralised way to collect and report such information.[37]

Building efficiency and thermal performance improvements. The NABERSNZ programme collects data from commercial building participants and publishes case studies, but the data is not collated and reported in a format that is suitable for tracking progress. An annual report and database similar to NABERSAUS[38] published by, for example, the New Zealand Green Building Council, which administers NABERSNZ, an annual report and database similar to NABERSAUS[38], could support the development of indicators to monitor progress. There is no centralised collection of data from new or existing residential buildings, but BRANZ has work underway to develop a national housing indicator framework for new builds.

Planned renewable capacity and build rate. The data that is currently collected has improved over the past couple of years, though remains fragmented. The Electricity Authority's Generation Investment Pipeline dashboard and Transpower's Connection Enquiry Dashboard provide short-term data, but a more robust dataset is not currently available, nor is it in a format that can be readily analysed.

Dispatchable low-carbon generation capacity and build rate. Some information about capacity and building of dispatchable generation (that can be turned on as needed) is available for grid-connected resources, but information is not required to be divulged or collected. Data is currently too sparse and inconsistently collected to provide meaningful insights for monitoring purposes.

Utility-scale storage capacity and build rate. There is some information about the capacity and building of grid-connected energy storage collected by Transpower and the Electricity Authority, but this information is not required to be divulged or collected. In particular, there are information gaps regarding projects connected at the distribution level. While EDBs likely keep Transpower informed about such projects, there is currently no aggregated public reporting mechanism that combines this information with data on transmission-connected projects.

Distinguishing emissions reductions from activity effects. Current data limitations make it difficult to determine whether observed emissions reductions reflect genuine decarbonisation (i.e. reductions in emissions intensity) or simply reduced levels of economic activity. While high-level indicators such as emissions per unit of GDP (e.g. tCO_2e/$ GDP, MJ/$ GDP) are available, these are insufficiently granular and can mask shifts in underlying production. This is because GDP is value-based, not physical. It is affected by price changes (e.g., commodity prices) and product mix shifts (e.g., higher-value products).

Physical output indicators would be the most useful missing data. For example, tonnes of methanol, cement, metals, etc. Such information is likely available in places, such as through annual reports from major companies, but there is no single publicly available aggregated dataset.

Another piece of information that would help complete this picture is installed thermal capacity by fuel type, i.e., MW_{th} for coal, gas, biomass, and MW_e for electric boilers or heat pumps. If such data were tracked, showing changes over time (retirements, conversions, new installs, etc), this could provide a detailed insight into fuel switching across the industrial sector. EECA could be best placed to do this, for example, through regular updates to the Regional Heat Demand Database.

4.4. Transport

Public EV charging: Issues have been reported with the Energy Efficiency and Conservation Authority's (EECA) Public EV Charger Dashboard. It is intended to be updated quarterly. We understand EECA is considering how it can best update the dashboard in future.

Vehicle fleet statistics: There are some inconsistencies between Ministry of Transport (MoT) fleet statistics and the New Zealand Transport Agency motor vehicle register dashboard. While vehicle registration numbers are similar, they are not always identical. This may be due to slightly different definitions of vehicle categories.

Public and active transport: A variety of data is published for public transport and active modes across Aotearoa New Zealand. However, data sets are incomplete for public transport usage per passenger kilometre and there is no national level aggregated public transport rideshare data. There is also no data on aggregate active mode or micromobility use in cities. This data would be helpful to track changes in passenger movements.

Public transport passenger movements: Measuring emissions from passenger movements by bus, rail and ferry services would improve emissions reporting through a better division of emissions between freight and passenger transport. Separating buses from other heavy vehicles would allow bus emissions to be captured under passenger transport. This is already done in some MoT projections but not published annually.

Coastal shipping: Coastal shipping tonne-km per vessel data would enable reporting of freight by mode share. Shifting freight to less emissions intensive modes is a key pathway outcome.

Vehicle fuel types: Improved data on vehicle fuel types would enable a more accurate division of heavy vehicle emissions.

Overall aviation travel demand: For the aviation sector, the following data for measuring the reduction of overall travel demand are collected but not freely available at the national level: commercial and passenger kilometres travelled, and freight tonne-kilometres transported at a national level. This data would enable an improved calculation of the efficiency and intensity of domestic aviation in association with national energy and emissions statistics.

Pakihi Māori: There are knowledge gaps around pakihi Māori in transport and the barriers they face to decarbonize (e.g. access to capital, financing).

4.5. Waste and f-gases

Waste emission reduction assumptions may be disconnected from policy. The Government's expected abatement from policies within the second emissions reduction plan for emissions budget two are 1 $MtCO_2e$ through the Waste Minimisation Fund,[x] and 0.8 $MtCO_2e$ through organic waste management and LFG.

Our analysis suggests that, collectively, government waste modelling only assumes a 1 $MtCO_2e$ reduction, creating a shortfall of 0.8 $MtCO_2e$. Compared to 2025, there is an increasing lack of transparency around what, and how, emissions reductions within the waste sector will be achieved.

It is unclear what policy intervention will be undertaken to achieve the Government's proposed LFG capture and efficiency outcomes. Increased policy transparency relating to these assumptions is necessary.

Overall, there appears to be disconnect between waste policy and the level of emissions reductions being sought in the second emissions budget. More broadly, government modelling provided to the Commission does not align with the policy mechanism committed to within the second emissions reduction plan. This inconsistency results in an increased lack of transparency for the public and industry.

[x] Refer to Table 2.2 of the second emissions reduction plan.

We acknowledge the consultation document released in June 2026 requesting feedback on options to reduce organic waste. [39] This document includes details on updated policy measures.

Our previous concern about LFG data uncertainty continues to exist. In 2024 we identified that there was uncertainty about the rate of landfill gas capture occurring at landfills. As part of this initial monitoring work, we referred to the United Nations Framework Convention on Climate Change (UNFCCC) review of New Zealand's GHG Inventory submission, which found that Aotearoa New Zealand's methodology underlying the two assumed recovery rates (68% and 52%) was not in accordance with the 2006 IPCC Guidelines. We understand that the that the Ministry for Cities, Environment, Regions and Transport has attempted to address this issue through a reliance on voluntary data sharing with landfill operators. However, the ongoing lack of open transparency related to landfill emissions data, creates ambiguity for achievement of the second and third emissions budgets.

The consultation document released in June 2026 requesting feedback on options to reduce organic waste, [39] included proposed minimum standards for landfill gas capture systems. The document stated that the "approximate average gas capture efficiency in New Zealand, weighted by methane generation per facility, is 47 percent. Ministry surveys between 2023 and 2025 indicate that estimated landfill gas capture efficiencies currently range from 40 to 80 percent, although the data are self-reported and therefore highly uncertain". Improving the uncertainty in LFG data would help the ongoing monitoring of improvements.

Quality of F-gas emissions data. Ambiguity continues to exist around f-gas emissions data in Aotearoa New Zealand, with data quality being an issue to be addressed. Increasing the robustness of f-gas data would be beneficial for policy development, emissions budgets and emissions reduction plan monitoring.

4.6. Agriculture

Detailed technology adoption modelling. Draft modelling of the potential farmer uptake of the mitigation technology suite and the overall effect on emissions was presented at the 2024 Agriculture and Climate Change conference.[40] It was expected to be repeated and published; however it is not yet available. Access to this information would enhance transparency and be valuable in assessing risks to emissions reductions from farming.

Low emissions practice, feeds, land use and technology activity. There is currently limited quantitative evidence on the uptake of different actions farmers are taking to reduce emissions on farm. In general, this is because technology is just becoming available that activity data can be collected for. Our monitoring could be improved with early activity data of feeds and technology that may be included in the inventory, and data of practice and land use changes affecting emissions.

Farm GHG numbers. We can calculate national averages of emissions per hectare (absolute emissions) and per kilogram of product (emissions intensity) on a production basis but not using the life cycle assessment (LCA) approach used by processors in reporting to their supply chain. Collating of farm emissions numbers on an LCA basis would allow a more detailed understanding of progress towards emissions budgets and the influence of market incentives.

4.7. Land Use, Land-Use Change and Forestry

Long-term monitoring of existing forests to monitor carbon stock maintenance and changes. This is needed to understand long-term forest carbon removals and how to account and report for forest management. The third cycle of measurements of pre-1990 natural forests has been completed, but the carbon stock and change analysis of the complete data set has not yet been finalised or released.

Extent and type of indigenous afforestation and regeneration. The current classification scheme used for forests in the inventory, based on two broad categories of 'planted' and 'natural', mixes type of forest with method of afforestation, and the 'natural' category is not synonymous with indigenous afforestation (for example, it also captures the spread of wilding conifers). In particular, there is a need to disaggregate the 'natural' category mapping and carbon removal estimates into subcategories (for example, indigenous regeneration, wilding pines,

and indigenous tall forest planting). This will improve understanding and reporting of the role of indigenous afforestation and regeneration in carbon removals.

Afforestation/restoration success. Long-term monitoring is needed to understand the success rate of afforestation and regeneration efforts and their resulting carbon removals.

Rules and methods for forest management accounting: At the time emissions budgets were set, the Government indicated that it sought to measure progress towards emissions budgets and the 2050 target by aligning with the accounting approach used for the country's first Nationally Determined Contribution (NDC1).[41] The Government published the baseline, or forest reference level (FRL), of -20.1 $MtCO_2e$ per year, against which to measure forest management activities for the NDC1 period (2021–2030) in its first Biennial Transparency Report in December 2024.[42] As reported, the Government expects the forest management activities to be consistent with the FRL over NDC1 (meaning net emissions would be zero), since it represents the estimated annual average net emissions between 2021 and 2030 under a business-as-usual projection. The final calculation of how forest management activities compare to the FRL will take place at the end of the NDC1 period.[42] To date, the annual emissions against the reference level have been positive, with cumulative emissions against the reference level 5.2 $MtCO_2e$ for 2021 to 2024, inclusive.[43] However, the provisional LULUCF accounting quantity excludes net emissions from forest management (in both the Biennial Transparency Report and annual reporting in the Greenhouse Gas Inventory) since the final forest management emissions will only be reconciled for technical corrections, methodological consistency and actual activity at the end of the NDC1 reporting period.[42,43] The Government is now reconsidering whether the FRL set for NDC1 is applicable to the emissions budget periods.

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