He Pou a Rangi
Climate Change Commission

Advice on
NZ ETS unit limits and price control settings for 2023-2027

Technical Annex 1: Unit limit settings

July 2022

Contents

1. Context

This technical annex provides supplementary information on the analysis underpinning the recommendations on unit limits in the Commission's July 2022 report on New Zealand Emissions Trading Scheme (NZ ETS) unit limits and price control settings for 2023-2027.

The advice report laid out a seven step method for determining unit volumes:

1. Accord with the domestic emissions budgets, the NDC and the 2050 target
2. Allocate the emissions budgets to NZ ETS and non-NZ ETS sectors
3. Make technical adjustments
4. Account for free NZU allocation volumes
5. Set reduction volume to address unit surplus
6. Set approved overseas unit limit
7. Calculate the auction volume and assess sensitivity and risks

This annex provides further methodological detail on steps 2, 3, 4, 5 and 7, to expand on the summary contained in the report. This is also complemented by a spreadsheet with detailed data and calculations for each of these steps.

2. Global warming potentials

All emissions volumes in this advice use Global Warming Potentials (GWPs) with a 100-year timeframe from the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report (AR5). This matches how the emissions budget levels were set and how emissions will be reported in the national Greenhouse Gas Inventory (GHG inventory) from 2023. The Government decided in 2021 that NZ ETS regulations would be revised to reflect these updated GWP_{100} values if they were used in setting the emissions budgets.[1]

The GHG inventory and the Commission's ENZ model currently report CO_2 equivalent emissions using GWP_{100} values from the IPCC's Fourth Assessment Report (AR4). The relevant factors used to convert emissions of the different gases to an AR5 basis are presented in **Table 1**.

Table 1 Global Warming Potentials under AR4 and AR5

Gas	**AR4 GWP_{100}**	**AR5 GWP_{100}**
Carbon dioxide	1	1
Methane	25	28
Nitrous oxide	298	265
F-gases	Conversion factor of 0.94 used to convert from emissions calculated with AR4 to AR5 GWP_{100} values, based on weighted average of individual F-gases across recent years. (AR5 emissions = 0.94 x AR4 emissions)	

[1] (Ministry for the Environment, 2021)

3. Emissions volumes outside of the NZ ETS

Step 2 of calculating unit supply volumes is to allocate the emissions budgets between NZ ETS and non-NZ ETS sectors (page 35 of the main report). This requires identifying emissions sources that are reported in the GHG inventory but are outside of the NZ ETS.

The sectors and sources identified, and assumptions used, are described in Table 2.

Table 2 Sectors and approach taken to emissions volumes outside of the NZ ETS

Sector/source	Information and assumptions
Agriculture	Biological emissions from agriculture are not covered by the NZ ETS.
Waste	Only municipal landfill disposal facilities are covered by the NZ ETS. All other waste emissions are outside of the NZ ETS. This includes emissions from non-municipal landfills, farm fills, and wastewater treatment.
Hydrofluorocarbons (HFCs)	A portion of HFC emissions associated with certain goods and vehicles are priced through the Synthetic Greenhouse Gas (SGG) levy instead of facing NZ ETS unit surrender obligations. We reviewed the historical ratio of emissions covered by the SGG levy compared to surrenders in the NZ ETS. Annual HFC volumes under the NZ ETS and SGG fluctuate significantly, but an annual average of approximately 38% between 2014 and 2020 was found to be covered by the SGG levy, with the remaining 62% falling under the NZ ETS. This ratio was applied to projected HFC emissions to determine the SGG gas levy quantity outside of the NZ ETS.
Biomass combustion (Energy)	Methane and nitrous oxide emissions from biomass combustion are outside of the NZ ETS. Net CO_2 emissions from biomass combustion are assumed to be zero or otherwise accounted for in the forestry (LULUCF) sector of the GHG inventory.
Industrial Processes and Product Use (IPPU)	Several small emissions sources in the Industrial Processes and Product Use (IPPU) inventory category are outside the NZ ETS. These include: - Non-energy products from fuels and solvent use - Sulphur hexafluoride and perfluorocarbons from medical and other product use - Nitrous oxide from medical applications - Other uses of carbonate
Forestry	Owners of post-1989 forests can choose to register these in the NZ ETS to receive NZUs. Around half of the total area of post-1989 forest land estimated in the GHG inventory was registered in the NZ ETS as of September 2021, with older forests less likely to be registered. Deforestation of post-1990 exotic forests face a mandatory surrender obligation under the NZ ETS. However, there is a small amount of ongoing deforestation of indigenous forest land that is not covered.

	To estimate the net forestry emissions outside of the NZ ETS, we have calculated the areas of afforestation and deforestation activities not covered by or not registered in the NZ ETS, and then calculated the emissions and removals from these under the 'target accounting' approach used in the GHG inventory. These calculations use data provided by MPI on NZ ETS-registered forest land as of September 2021.[2]

Table 3 Emissions volumes outside the NZ ETS under the Commission's demonstration path

Sector/source (Mt CO_2-e)	**2023**	**2024**	**2025**	**2026**	**2027**
Agriculture	40.2	39.8	39.3	38.9	38.6
Waste	2.4	2.3	2.2	2.2	2.1
HFCs	0.6	0.6	0.6	0.6	0.5
IPPU	0.2	0.2	0.2	0.2	0.2
Biomass combustion	0.1	0.1	0.1	0.1	0.1
Forestry	-2.2	-2.0	-1.5	-1.7	-1.5
Net emissions outside the NZ ETS†	**41.3**	**41.0**	**41.0**	**40.3**	**40.2**

†These figures are rounded to one decimal place and columns may not sum due to rounding

[2] Significant areas of post-1989 forest have subsequently been the subject of applications to register in the NZ ETS, but this could not be factored in due to the limited data currently available.

4. Technical adjustments

Step 3 is primarily about identifying differences between emissions reported in the NZ ETS and in the national GHG inventory and assessing whether these differences justify technical adjustments to the emissions budget volume available to NZ ETS sectors (page 38 of the main report).

We compared historic emissions reported by the different activities in the NZ ETS to the corresponding emissions in the GHG inventory. Table 4 summarises how we did these comparisons. Results are discussed below.

Table 4 NZ ETS activities and corresponding GHG inventory emissions

Grouping	NZ ETS activities	GHG inventory categories
Liquid fossil fuels	• Owning and purchasing obligation fuels • Combusting used or waste oil • Using crude oil or other liquid hydrocarbons	• Liquid fuel combustion emissions, excluding petroleum refining†
Coal and steel production‡	• Importing coal • Mining coal • Purchasing coal • Producing iron or steel	• Solid fuels combustion emissions • Fugitive emissions, coal mining • Iron and steel production (IPPU)
Gas	• Mining natural gas • Importing natural gas • Purchasing natural gas • Removing emissions for embedded substances	• Gaseous fuels combustion emissions • Fugitive emissions, natural gas venting and flaring • Chemical industry emissions (IPPU), excluding hydrogen production†
Geothermal	• Using geothermal fluid	• Fugitive emissions, geothermal
IPPU	• Producing aluminium • Producing clinker or burnt lime • Producing glass using soda ash • Operating electrical switchgear using sulphur hexafluoride (SF_6)	• Aluminium production • Cement production and lime production • Other uses of soda ash • Electrical equipment (SF_6)
Hydrofluorocarbons (HFCs)	• Importing HFCs • Exporting HFCs	• Product uses as substitutes for ozone depleting substances
Waste	• Operating a disposal facility	• Managed waste disposal sites

† Refining NZ was exempt from the NZ ETS under a Negotiated Greenhouse Agreement.

‡ Emissions from use of coal as a reduction agent in steel production are classified differently between the NZ ETS and the GHG inventory, hence it is necessary to combine total coal and steel emissions in the comparison.

4.1 Liquid fossil fuels

We observe a persistent difference across all years, with GHG inventory emissions higher by between 0.7 – 1.1 Mt CO_2e (**Figure 1**). The difference is steady at approximately 0.8 Mt CO_2e annually over 2018-2020.

Our investigation of the possible underlying causes indicated that different emissions factors and treatment of non-CO_2 gases likely explain some of this difference. However, there may also be other contributing factors.

We propose to apply a fixed quantity adjustment of 0.8 Mt CO_2-e to annual NZ ETS auction volumes.

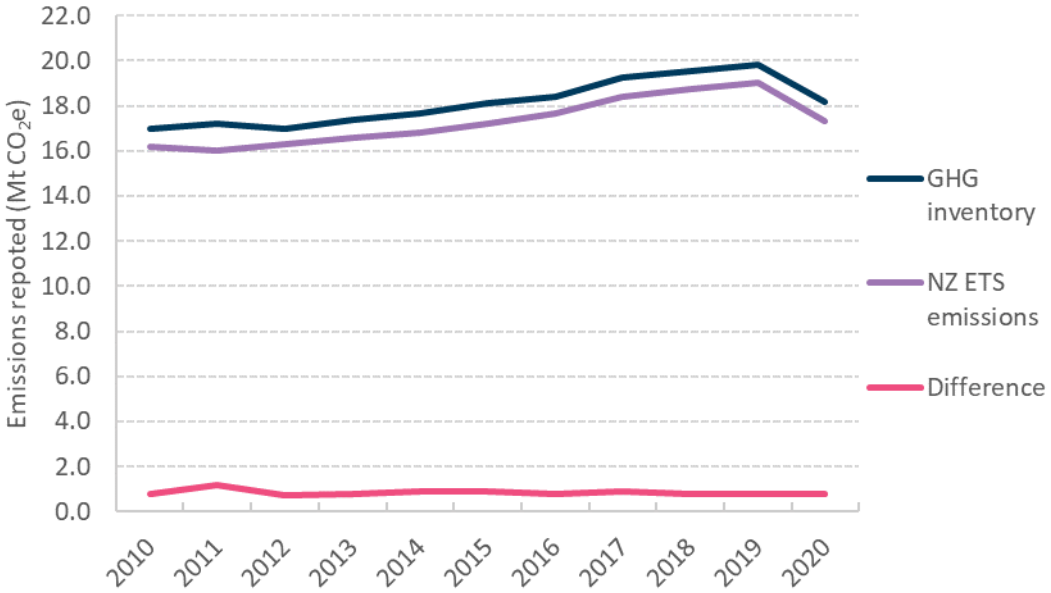

Figure 1 Liquid fossil fuel emissions comparison

4.2 Coal and steel production

We observe close alignment between the period 2012-2017 with substantial differences arising since 2018 (Figure 2).[3] The emissions reported in the NZ ETS were approximately 16% lower than in the GHG inventory for 2019 and 2020.

Our investigation of the possible underlying causes indicated that this recent divergence is likely related to an increase in the gross calorific values for coal reported to MBIE and used in the GHG inventory. There do not appear to have been any significant changes in the gross calorific values under the NZ ETS, as emissions reported track closely in line with total coal consumption (in tonnes) in MBIE's energy statistics.

We propose a fixed percentage adjustment of 16% of projected coal and steel emissions to the annual NZ ETS unit supply.

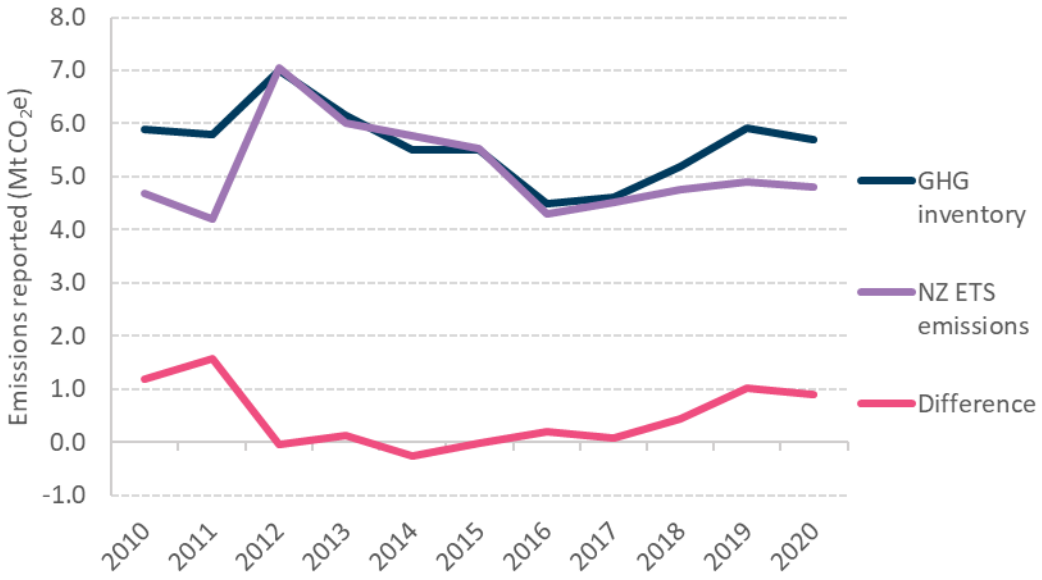

Figure 2 Coal and steel emissions comparison

[3] We would not expect annual volumes to match precisely due to differences between when coal is imported or mined, and when it is used. Total estimated emissions from 2012 – 2017 agree to within 0.3%.

4.3 Gas

Under the NZ ETS, all gas used in methanol production, including as a feedstock, incurs a surrender liability. 'Removal units' are issued for methanol that is exported. This reflects that the carbon embedded in the methanol will only cause domestic emissions if the methanol is combusted in New Zealand.

After subtracting NZ ETS methanol removal units from the comparison, we observe close alignment (Figure 3). Total volumes from 2015-2020 agree to within 1%.

No technical adjustments are proposed.

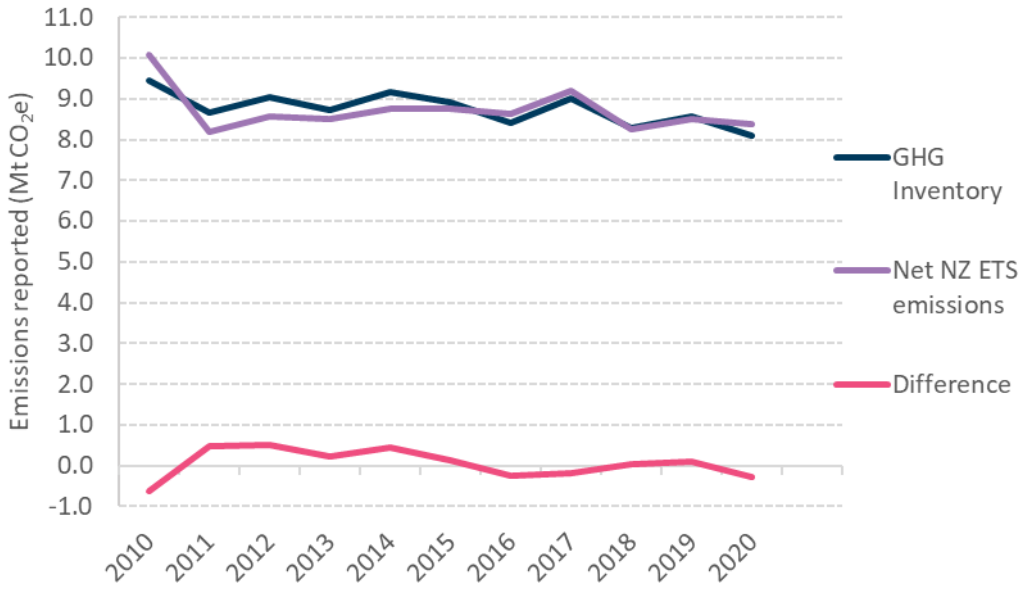

Figure 3 Gas emissions comparison

4.4 Geothermal

Geothermal emissions show close alignment across all years except for 2014 and 2015 (Figure 4). NZ ETS surrenders in these years were consistent with the GHG inventory estimates at the time, but there have been subsequent updates to emissions factors for geothermal fields. Total volumes from 2016-2020 agree to within 0.7%.

No technical adjustments are proposed.

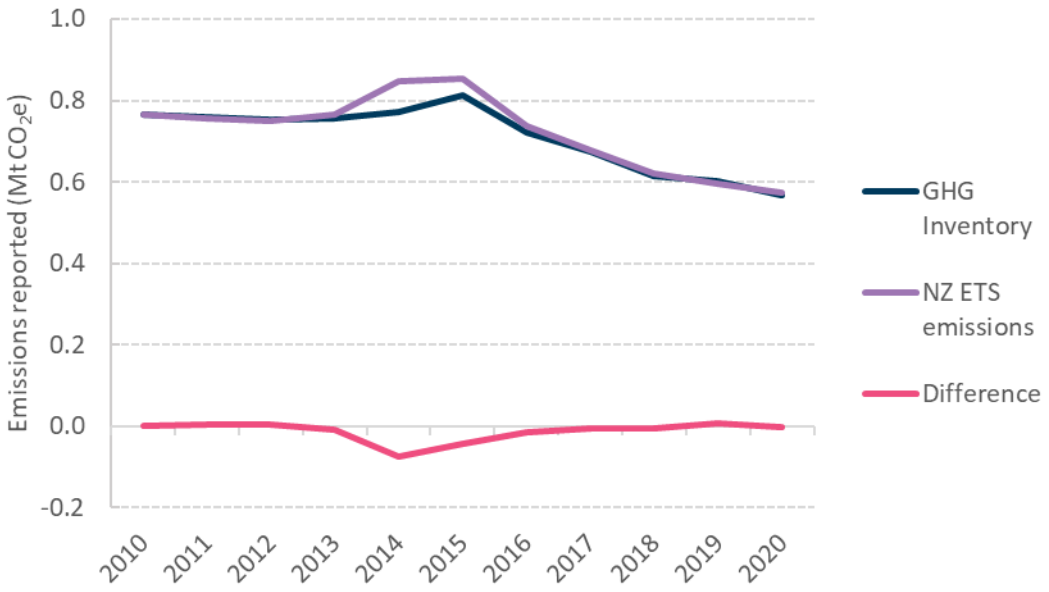

Figure 4 Geothermal emissions comparison

4.5 Industrial Processes and Product Use (IPPU)

IPPU emissions showed very close alignment across all years (Figure 5). Total volumes from 2010-2020 agree to within 0.002%.

No technical adjustments are proposed.

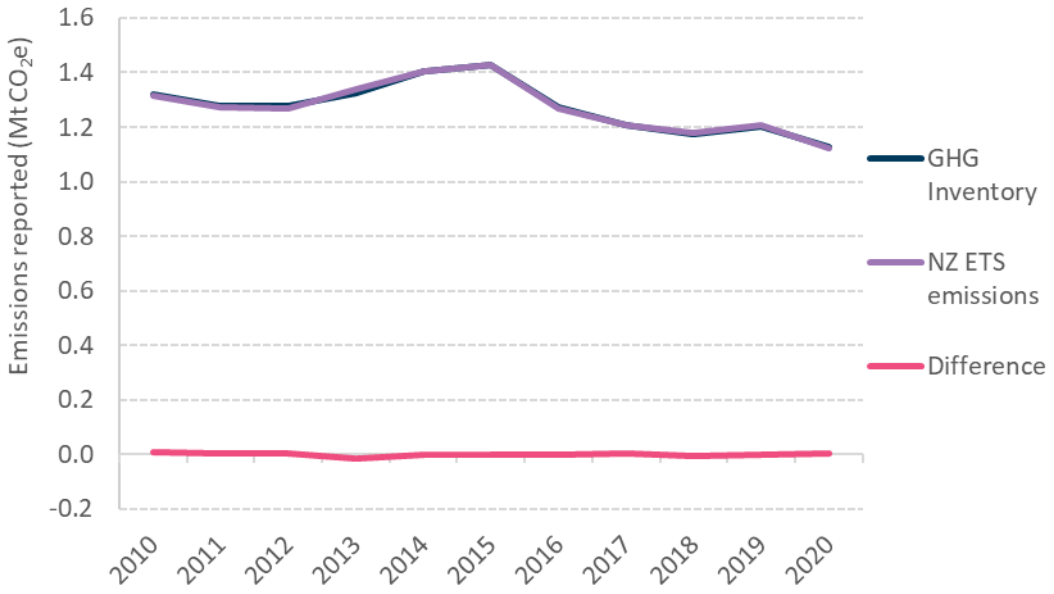

Figure 5 IPPU emissions comparisons

4.6 Waste

The NZ ETS emissions accounting approach for municipal landfills is different to that used in the GHG inventory. The GHG inventory estimates waste emissions as they occur over time due to decay of organic waste, while the NZ ETS accounts based on annual waste deposited assuming instantaneous methane release. Landfill gas capture rates reported in the NZ ETS also differ from assumptions used in the GHG inventory.

Despite these differences, we observe reasonable alignment between annual historical emissions reported in the NZ ETS and emissions reported in the GHG inventory from 2014 onwards (**Figure 6**).[4]

No technical adjustments are proposed.

Figure 6 Waste emissions comparisons

[4] Waste facilities entered the NZ ETS in 2012.

4.7 Hydrofluorocarbons (HFCs)

A portion of HFC emissions in New Zealand are priced through the synthetic greenhouse gas (SGG) levy instead of the NZ ETS. As discussed above in **Table 2**, we have assumed the future percentages covered by the NZ ETS and the SGG levy are in line with historic averages of 62% and 38% respectively.

The NZ ETS and SGG levy emissions accounting approach for HFCs is also different to that used in the GHG inventory. The GHG inventory estimates HFC emissions as they occur over time, while the NZ ETS and SGG levy use a top-down approach where HFCs incur a charge when they are imported to the country in bulk or embedded in certain goods and motor vehicles. Units can also be earnt in the NZ ETS for HFCs that are captured or exported.

We have compared the total HFC emissions reported through the NZ ETS and the SGG levy with the GHG inventory estimates (Figure 7). There is significant variation between years due to the lumpy nature of HFC imports and stockpiling behaviour prior to policy changes. The alignment appears to have improved in recent years, with total volumes from 2017-2020 agreeing to within 3.2%. However, the different accounting approaches make it difficult to make firm conclusions so it will be important to monitor the alignment in future years.

No technical adjustments are proposed.

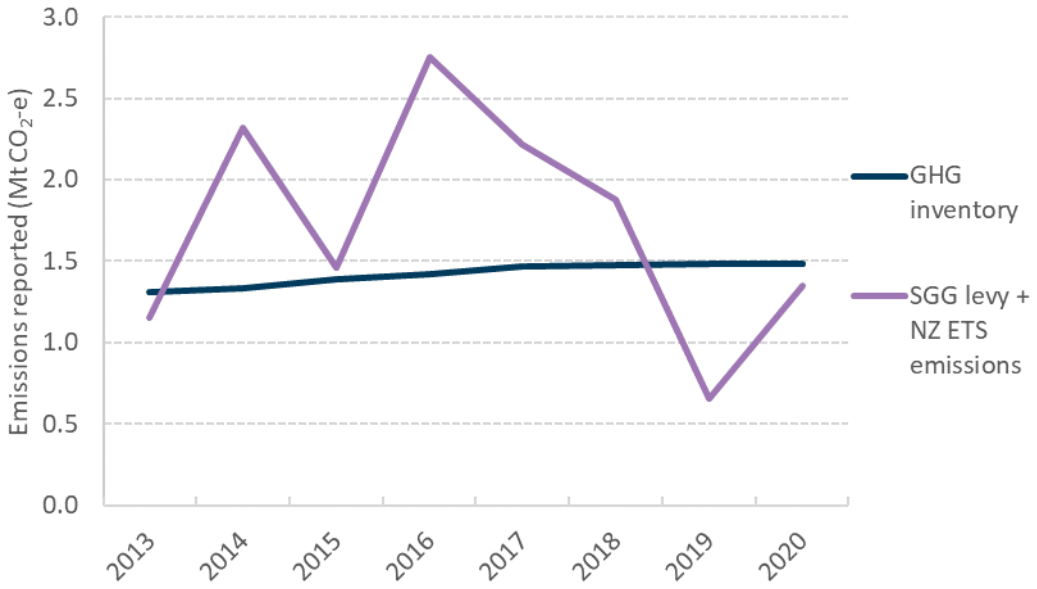

Figure 7 HFC emissions comparisons

4.8 Forestry

Post-1989 forest land can be voluntarily registered in the NZ ETS and receive removal units. Until recently, the NZ ETS has used a default 'stock change' accounting approach and this can continue for those who register by 31 December 2022. Forests registered from 2023 must use the 'averaging' approach, which better aligns with the accounting approach for Aotearoa New Zealand's emissions budgets and NDC.

Further accounting differences between the NZ ETS and national target accounting arise due to use of different carbon yield tables and treatment of soil carbon losses and harvested wood products, which are not included in the NZ ETS. These various accounting differences mean that it is challenging to compare forest emissions and removals reported in the NZ ETS to the emissions and removals used in target accounting and reported in the GHG inventory.

No technical adjustments are proposed at this time. Due to the significant complexities with stock change accounting, further analysis is required to assess implications for NZ ETS unit supply. We intend to undertake further analysis in future to consider whether technical adjustments are warranted in future years' settings.

4.9 Non-compliance

We reviewed historical non-compliance in the NZ ETS from 2013-2022. Units due but not surrendered were found to account for less than 0.1% of total units surrendered over that time. We do not see any reason to expect increases from these low non-compliance rates at this time, particularly given recent increases to non-compliance penalties, although we will continue to monitor this issue.

No technical adjustments are proposed.

4.10 Voluntary unit cancellations

Voluntary cancellation of NZUs up to 2022 has been very small, at less than 100,000 units. Trends in voluntary offsetting, unit cancellation and how these impact the NZ ETS will be monitored in future.

No technical adjustments are proposed.

5. Industrial free allocation projections

Step 4 is to forecast industrial free allocation volumes. Industrial free allocation uses up part of the emissions budget available to the NZ ETS and reduces the amount of NZUs that the Government can auction (see page 39 of the main report).

The high-level method for forecasting industrial allocation developed and used by Ministry for Environment (MfE) for the past two years is sound. We applied this method with some refinements in our analysis, based on more recent information.

The steps we followed to forecast free allocation volumes were:

a. Setting GDP growth projection
b. Grouping eligible industrial activities into categories
c. Determining base industrial allocation growth
d. Applying applicable level of assistance
e. Accounting for other activity assumptions
f. Determining individual sector allocation totals
g. Calculating total free allocation volume.

5.1 Steps a to c

We updated the GDP growth projections using the Treasury's Budget Economic and Fiscal Update (BEFU) May 2022 version of the Fiscal Strategy Model.

We refined and disaggregated MfE's grouping of eligible industrial activities to better align with the sector breakdowns used for emissions budget analysis and modelling in *Ināia Tonu Nei* (Table 5).

Table 5 Disaggregation of industrial allocation categories

MFE allocation categories	**CCC allocation categories**
NZ Steel	Iron and steelmaking
New Zealand Aluminium Smelter (NZAS)	Aluminium smelting (NZAS)
Methanex	Methanol production (Methanex)
Refining NZ	Oil refining (Refining NZ)[5]
"Other" High EITE	Cement and lime manufacturing
	Urea manufacturing (Ballance)
	Pulp and paper products
	"Other" - High EITE [6]

[5] We have included oil refining in our analysis for completeness. The country's sole oil refinery was exempt from the NZ ETS, instead party to a Negotiated Greenhouse Agreement set to end at the end of 2022. It converted to an import-only terminal in April 2022 so no allocation for oil refining has been factored into our projections.
[6] "Other" High EITE activities includes caustic soda, hydrogen peroxide production, and cut roses.

“Other” Moderate EITE	Dairy products
	Meat products
	Horticulture
	"Other" - Moderate EITE[7]

Base industrial allocation growth is largely dependent on assumptions around an eligible industrial activity’s production capacity and growth.

Our core assumption is that all eligible industrial activities do not grow in line with GDP projections due to most industrial activity sectors being currently at maximum production capacity. This differs from MFE’s assumption that “Other” High and Moderate EITE activities grow in line with GDP.

5.2 Step e

We refined the assumptions that MfE made in accounting for other industrial activity considerations. These are summarised in Table 6. Our assumptions were informed by emissions budget analysis and sector engagement undertaken for *Ināia Tonu Nei* and are broadly consistent with assumptions made under the demonstration path.

We adjusted for announcements since the release of *Ināia Tonu Nei* such as the potential for aluminium smelting to continue beyond 2024 and changes to NZAS’ electricity allocation factor (EAF). These have also been included through the annual ENZ model update.

In March 2022, the EAF for New Zealand’s Aluminium Smelter (NZAS) for its emissions unit allocation for their main electricity contract was reset to accurately reflect the emissions costs NZAS incurs from their renegotiated contract with Meridian. The renegotiated contract runs from 1 January 2021 through 31 December 2024.

NZAS’ EAF for electricity consumption under the main contract was reduced from 0.206 tCO_2e/MWh to 0 tCO_2e/MWh. NZAS will continue to receive the standard EAF set at 0.537 tCO_2e/MWh for spot electricity market purchases, outside its contracts with Meridian. NZAS is the second largest recipient of industrial free allocation in the NZ ETS.

Table 6 Key assumptions around industrial activities for the Commission’s approach

Allocation category	**Key assumptions in core scenario**
Iron and steelmaking	Production held constant at 100% of 2019 levels
Aluminium smelting (NZAS)	Production held constant at 90% from 2020 as potline 4 is idled due to COVID-19. Aluminium smelting is assumed to continue beyond 2024.
Methanol production (Methanex)	Production reduced to 80% from 2022 then 40% from 2027. Production ceases from 2040. These assumptions are in line with MBIE’s assumptions around the staged closure of methanol production and our modelled scenarios for ITN.

[7] “Other” Moderate EITE activities include ethanol, clay, glass manufacturing, tissue paper and reconstituted wood panels manufacturing

Oil refining (Refining NZ)	Production under a simplified refining structure from 2021, and conversion to an import-only terminal from 2022.
Cement and lime manufacturing	Production held constant at 100% of 2019 levels
Urea manufacturing (Ballance)	Production held constant at 100% of 2019 levels
Pulp and paper products	Production reduced to 82% in 2021 and to 74% from 2022 to account for closure of Norske Skog's Tasman Mill. Remaining activities in this category are held constant at 100% of 2019 levels.
"Other" - High EITE	Production held constant at 100% of 2019 levels
Dairy products	Production held constant at 100% of 2019 levels
Meat products	Production held constant at 100% of 2019 levels
Horticulture	Production held constant at 100% of 2019 levels
"Other" - Moderate EITE	Production held constant at 100% of 2019 levels

In making assumptions around future industrial activities, we have chosen not to include potential effects from MfE's ongoing review of industrial allocation as no formal policy decisions have been made at the time of writing. We have also not made any assumptions around potential effects of a broader review of the EAF.

5.3 Sensitivity testing of industrial free allocation projections

We tested our core industrial free allocation projections against changes to key assumptions, namely timing of plant closures and the effect of a single facility closure on the industrial activity category (Table 7).

Table 8 and Figure 8 show the resulting industrial free allocation volume projections based on different scenarios.

Table 7 Sensitivity testing of industrial free allocation to changes in key assumptions

Allocation category	**Key assumptions in high scenario**	**Key assumptions in low scenario**
Iron and steelmaking	Same as core scenario	Production ceases at the end of the third emissions budget period
Aluminium smelting (NZAS)	Same as core scenario	Production ceases at the end of 2024
Methanol production (Methanex)	Production resumes at full capacity from 2026 before undergoing a staggered closure towards 2040.	Same as core scenario
Oil refining (Refining NZ)	Same as core scenario	Same as core scenario
Cement and lime manufacturing	Same as core scenario	Same as core scenario
Urea manufacturing (Ballance)	Same as core scenario	Same as core scenario
Pulp and paper products	Production impact from the closure of Norske Skog's Tasman Mill is more	Same as core scenario

	conservative, reducing to 80% from 2022	
"Other" - High EITE	Same as core scenario	Same as core scenario
Dairy products	Growth in line with GDP	Same as core scenario
Meat products	Growth in line with GDP	Same as core scenario
Horticulture	Growth in line with GDP	Same as core scenario
"Other" - Moderate EITE	Same as core scenario	Same as core scenario

Table 8 Projected industrial free allocation volumes across different scenarios

Million NZUs	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Core scenario	6.4	6.3	6.3	6.2	6.1	6.0	6.0	5.4
Low scenario	6.4	6.3	5.6	5.5	5.5	5.4	5.3	4.8
High scenario	6.5	6.4	6.4	6.5	6.5	6.4	6.3	6.0

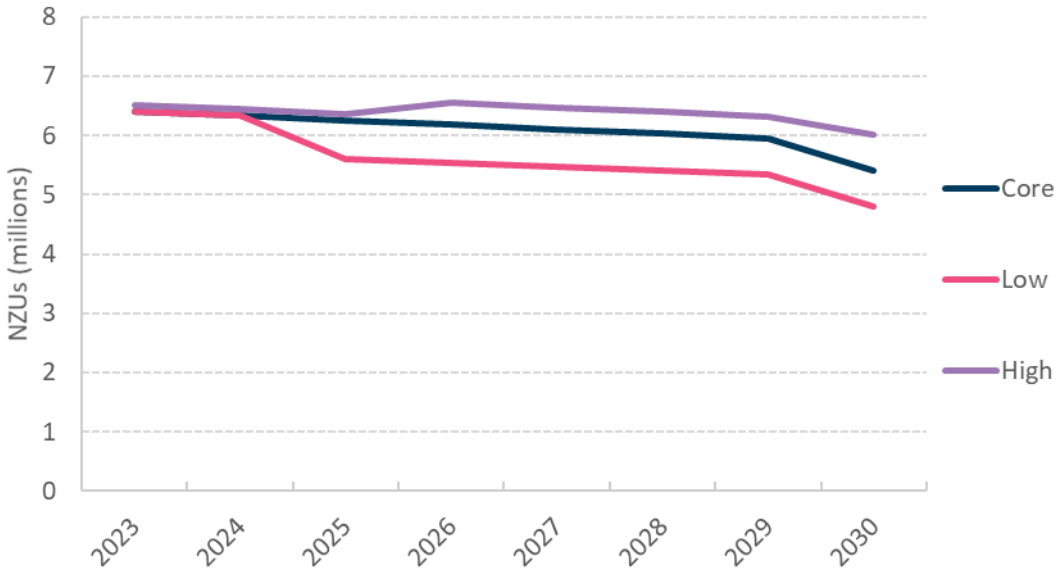

Figure 8 Industrial free allocation volume projections to 2030 across different scenarios

We used the Commission's core scenario projection for industrial allocation volumes in determining our proposed unit limits. The key differences between the scenarios are assumptions on the timing of cessation of aluminium smelting, the change in NZAS' EAF, methanol production levels, and growth in line with GDP for smaller allocation recipients.

Assessing over- or under-allocation for eligible industrial activities is not within the scope of this advice.

In the event of actual plant closures, the industrial allocation volume could be reassessed when determining unit limits.

6. Unit surplus reduction volume

Step 5 is to estimate the volume of surplus units in the scheme and evaluate how to address the risk that these surplus units will allow emissions exceeding emissions budgets, by reducing auction volumes (see page 40 of the main report).

We first identified three major categories of units that may not be available to the market:

- units held for hedging purposes by emitters (non-forestry participants)
- units held for post-1989 forest harvest liabilities
- pre-1990 forest allocation units held long-term.

For each category we made a core scenario estimate of unit volumes, as well as low and high scenario estimate to represent what we consider are the reasonable boundaries of uncertainty based on available data and information.

6.1 Units held for hedging by emitters

It is common practice for compliance participants in the NZ ETS to hold NZUs to cover a proportion of their compliance obligation over a certain period in advance ("hedging"). Hedging involves emitters pre-purchasing NZUs when they fix prices with customers, to manage their exposure to NZU price risk.

The extent to which NZ ETS participants hedge varies both by sector and by company and can vary over time. In general, participants that can change their prices quickly have lower hedging needs. There is limited publicly available information about companies' individual hedge programmes, so it is not possible to calculate the volume needed precisely.

We assessed the hedging needs of different types of emitters based on our knowledge of different industries and engagement feedback, with our core scenario estimate of hedging volumes based on the following assumptions:

- liquid fossil fuel participants on average have a hedge profile that drops from 100% to 0% over 1 year forward, given their ability to rapidly pass on NZ ETS price changes
- stationary energy and IPPU on average have a hedge profile that drops from 100% to 0% over three years forward, as they set prices in advance to a greater degree than other sectors
- waste participants on average hedge a full year in advance, as landfills generally set their prices on an annual basis.

These assumptions are outlined in Table 9. We also included alternative assumptions representing what we judge to be high or low scenario estimates of the hedging needs of these sectors, given that there is significant uncertainty about NZ ETS participants' hedging behaviour.

Table 9 Hedging profile assumptions by sector, scenario, and year

Sector	Scenario	2023	2024	2025	2026	2027
Liquid fossil fuels	Core	50%	0%	0%	0%	0%
	Low	25%	0%	0%	0%	0%
	High	75%	0%	0%	0%	0%

Stationary energy & IPPU	Core	100%	67%	33%	0%	0%
	Low	100%	50%	0%	0%	0%
	High	100%	75%	50%	25%	0%
Waste	Core	100%	0%	0%	0%	0%
	Low	100%	0%	0%	0%	0%
	High	100%	0%	0%	0%	0%

We then forecast the sector breakdown of future emissions volumes, taking into account the technical adjustments determined in the earlier step. This is shown in **Table 10**.

Table 10 Forecast emissions by sector

Sector (Million NZUs)	**2023**	**2024**	**2025**	**2026**	**2027**
Liquid fossil fuels	19.7	19.5	19.4	19.1	18.8
Stationary energy & IPPU	13.9	13.1	12.2	12.0	11.6
Waste	1.1	1.1	1.0	1.0	1.0

We combined the forecast emissions with the hedge profile assumptions to estimate the total units held for hedging purposes, shown in **Table 11**. Note that several large emitters in the stationary energy and IPPU sector (which might be expected to have extensive hedging practices) are in practice hedged to a large extent by the industrial free allocation they receive. We have factored this into the calculation of the hedging estimates.

Table 11 Estimated range of units currently held for hedging purposes

Sector (million NZUs)	**Core**	**Low**	**High**
Liquid fossil fuels	9.8	4.9	14.7
Stationary energy & IPPU	19.3	14.9	23.6
Waste	1.1	1.1	1.1
Total	**30.2**	**20.9**	**39.4**

6.2 Units held for post-1989 forest harvest liabilities

Forests registered in the NZ ETS and planted after 1989 receive NZUs for removing carbon as they grow. All of the post-1989 forestry units in the scheme now have been provided under the stock change accounting approach. Under stock change accounting, landowners receive units as a forest grows, and must repay a large portion of those units when the forest is harvested. [8] This means that forestry participants need to hold a large number of units in advance of harvesting their forests, and this is one explanation for the large volume of units currently banked in private accounts.

[8] The percentage of units received that need to be surrendered at harvest depends on species, harvest age, and the age from which the forest was registered in the NZ ETS. Owners of multiple forests can reduce their harvest liabilities by managing unit flows across their portfolio.

Recent changes to the NZ ETS have introduced the averaging accounting approach for post-1989 forests. Averaging reflects the long-term average carbon stock of forests over multiple cycles of growth and harvest but means that foresters do not have to surrender NZUs at harvest as long as they replant. With time, averaging is likely to change forestry participants' behaviour in respect of holding and selling units, as under averaging there is no need to hold units for future harvest liabilities. However, at this time averaging is not relevant for the forestry units that are currently held in the NZ ETS.

We estimate a range of between 46 to 58 million NZUs are currently held for forest harvest liabilities, reflecting the large area of post-1989 forests due for harvest out to 2030. This estimate is informed by data on current unit holdings obtained from the EPA, survey data from MPI, discussions with forestry stakeholders, and our modelling of the likely quantity of units needed by forestry participants over the coming years. There is a significant uncertainty range due to limitations in what can be deduced from current unit holdings and uncertainty around forestry participants' behaviour and intentions.

A key uncertainty in our estimate is the proportion of post-1989 forest area that will go unharvested in response to high NZU prices, which would enable a greater share of units to be sold to emitters. A 2018 study for MPI found that 10.5% of the NZ ETS-registered post-1989 forest area was already not intended to be harvested.[9]

A second key uncertainty is the proportion of NZUs received by forest owners that do not need to be held in reserve to meet potential future harvest liabilities (sometimes called 'safe' or 'low risk' units). This will vary for individual forest owners depending on the mix of age classes and species in their portfolio.

Our core scenario estimate is that approximately 52 million units are being held for post-1989 harvest liabilities. This is close to the number of units currently held in accounts the EPA has categorised as forestry participants (52.6 million on 1 June 2022). Based on our modelling, this is consistent with foresters overall having sold close to their theoretical maximum 'low risk' units and around 20% of the exotic forest area currently registered in the NZ ETS going unharvested. The upper and lower ends of our range above would be consistent with around 10% and 30% of the area going unharvested, respectively, assuming the same level of 'low risk' units sold.

Table 12 shows estimates of the quantity of NZUs expected to be held for harvest liabilities under a range of assumptions on the non-harvest percentage and the average level of 'low risk' units. These estimates are from our modelling of unit allocations and surrenders using NZ ETS forestry data provided by MPI.

Table 12: Modelled net quantity of post-1989 forestry NZUs issued up to 2021 subject to a harvest liability, under different assumptions

Estimated units with harvest liability (Million NZUs)		**Average 'low risk' carbon level**		
		Minimum†	***85% of maximum***	***Maximum‡***
Non-harvest percentage	***10%***	81.1	58.6	50.8
	20%	72.1	52.1	45.1
	30%	63.1	45.6	39.5

† The minimum is the low-risk carbon level for an individual production forest.

‡ The maximum is the forests' long-term average carbon stock. This is the theoretical maximum level assuming a forest portfolio with equal areas in all age classes.

[9] (Ministry for Primary Industries, 2022)

6.3 Pre-1990 forest allocation units held long-term

Pre-1990 units were originally allocated to owners of forests planted before 1990 as partial compensation for the restriction the NZ ETS put on their ability to change land use. Owners of pre-1990 forest do not need to surrender NZUs upon harvest so long as the land is replanted.

Based on past trends, and what we heard through our engagement, a proportion of the remaining pre-1990 units are likely to be held for the long-term and not come to market in the coming years. This may be for several reasons, for example:

- the units are being held as a hedge in case of future deforestation decisions to enable use of land for another purpose (e.g. developed for pasture or for housing)
- units may be held as an insurance in case requirements to replant or regenerate the land with species that meet certain criteria within a set timeframe are not met
- some Iwi landowners may wish to retain the units as an asset for future generations
- slow and deliberate decision-making about the sale of units, for example due to collective decision-making within Māori entities.

To determine the volume of pre-1990 NZUs considered surplus, we estimated how many units were likely to be held long-term in the accounts to which they were originally allocated.

We developed a range of potential unsold unit volumes by considering recent trends in sales of pre-1990 units from original recipients' accounts (**Figure 9**). The rate of unit sales has slowed significantly in recent years, so we extrapolated two paths for how the units may be sold in future, based on recent trends in pre-1990 unit sales from the start of 2020 (fast) and 2021 (slow).

Our core scenario estimate is based on the volume of pre-1990 units remaining unsold on the slow sales path in 2030, as this reflects the most recent trend. This is 86% of the pre-1990 units remaining in the original recipients' accounts as of 2022.

We also provided a low and high scenario to better reflect the inherent uncertainty of this estimate. Our low scenario estimate is approximately 15% lower than the core scenario and based on the fast sales path. Our

high scenario estimate is approximately 5% above the core scenario based on the limited scope for the rate of unit sales to slow further compared to the slow sales path. (**Table 13**).

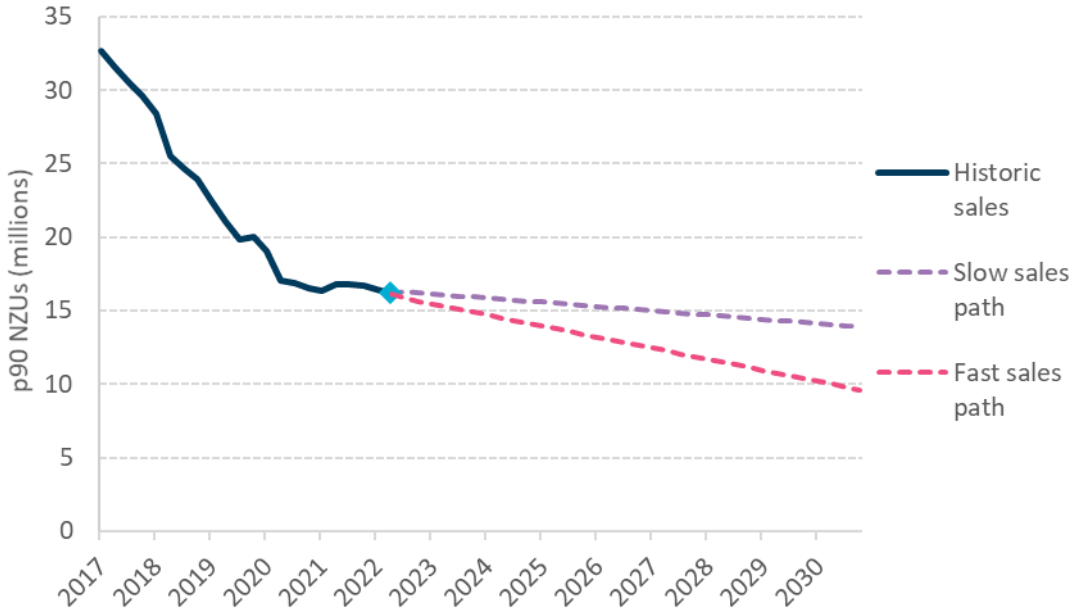

Figure 9 Historic and projected number of pre-1990 units remaining in original recipient accounts

Table 13 Pre-1990 NZUs remaining unsold in original recipients' accounts

Scenario	Total volume remaining in original recipients' accounts (million NZUs)
Total pre-1990 units held in original recipient accounts (June 2022)	16.2
Core	13.8
Low	11.7
High	14.7

6.4 Total surplus units

To reach our estimate of the total surplus volume, we took the total volume of privately held units from 1 June 2022 (144m) and subtracted our estimates of unit volumes held for hedging by emitters, post-1989 harvest liabilities and pre-1990 units remaining in original recipients' accounts. We then added the 1.3 million for cost containment reserve units released at the 15 June 2022 NZ ETS unit auction.

Our final recommendation is based on the core surplus volume estimate of 49 million units, with a potential surplus range of between 33 and 66 million units (**Table 14**).

Table 14: Components of the stockpile of units held and total estimate of surplus units

Million NZUs	**Core surplus scenario**	**Low surplus scenario**	**High surplus scenario**
Units held in private accounts on 1 June 2022, post surrenders for 2021 emissions	144.1	144.1	144.1
Estimated units held for hedging by emitters	-30.2	-39.4	-20.9
Post-1989 units held for harvest liabilities	-52.2	-58.0	-46.4
Pre-1990 allocation units held long-term in original recipient accounts	-13.8	-14.7	-11.7
Estimated surplus before CCR	47.8	32.0	65.1
+ June 2022 auction CCR release	+1.3	+1.3	+1.3
Estimated surplus at end of 2022†	**49.1**	**33.3**	**66.4**

†These figures are rounded to one decimal place and columns may not sum due to rounding

7. Annual surplus reduction volume

We developed four potential methods for how to distribute the total surplus volume into annual amounts used to reduce auction volumes:

1. Constant reduction volume to 2030
2. Constant reduction volume to 2027
3. Reduction volume based on deducting a constant proportion of the NZ ETS cap, which based on our current core surplus estimate equates to 25% per year
4. Reduction volume based on straight-line trajectory to 2030

The resulting surplus reduction volumes based on our core surplus estimate of 49 million units are shown in **Table 15**.

Table 15 Annual surplus reduction volume options

Million NZUs	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
1. Constant volume to 2030	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
2. Constant volume to 2027	9.8	9.8	9.8	9.8	9.8	0.0	0.0	0.0
3. Constant proportion of cap to 2030 (option proposed)	8.0	7.7	7.1	6.5	5.9	5.2	4.7	4.0
4. Straight-line trajectory to 2030	10.9	9.6	8.2	6.8	5.5	4.1	2.7	1.4

Our final proposal is to base the surplus reduction volumes on Option 3, reducing auction volumes by a constant percentage of the annual cap out to 2030.

8. Sensitivity analyses

We tested our proposed auction volumes to the sensitivity of decisions regarding how the emissions budget was allocated, the estimated surplus size and the annual surplus reduction volume methodologies.

8.1 Allocate the emissions budget

In Step 2, two options are presented in the report for allocating the emissions budgets to NZ ETS and non-NZ ETS sectors. The option we propose is to calculate emissions outside of the NZ ETS based on specified shares of effort set by the emissions reduction plan and based on the Commission's demonstration path. The alternative option is to calculate emissions outside of the NZ ETS based on current policy setting forecasts.

Table 16 shows the resulting auction volumes and percentage differences between the different options. Table 16 Auction volume sensitivities to distribution of share of emissions budget

Million NZUs	**2023**	**2024**	**2025**	**2026**	**2027**

Auction volume based on demonstration path (option proposed)	16.3	15.6	14.0	12.2	10.4
Auction volume based on current policy settings	15.6 (-4%)	14.7 (-6%)	12.8 (-8%)	10.1 (-17%)	8.0 (-24%)

8.2 Surplus reduction volume

In Step 5 we estimated the size of the total unit surplus. We propose a core volume, but also developed a potential range with a low and high surplus estimate.

Table 17 shows the resulting auction volumes and percentage difference between the estimates of the core volume and the small and large surplus estimates.

Table 17 Alternative auction volumes based on small or large surplus estimates

Million NZUs	2023	2024	2025	2026	2027
Proposed volume based on core unit surplus (49m)	16.3	15.6	14.0	12.2	10.4
Volumes based on low surplus estimate (33m)	18.9 (+16%)	18.1 (+16%)	16.3 (+17%)	14.3 (+17%)	12.3 (+18%)
Volumes based on high surplus estimate (66m)	13.5 (-17%)	12.9 (-17%)	11.5 (-18%)	9.9 (-19%)	8.4 (-20%)

8.3 Annual surplus reduction volumes

In Step 5, we also developed four potential methods for how to distribute the total surplus volume into annual amounts used to reduce auction volumes. **Table 18** shows the auction volumes resulting from these four options, and percentage difference of the three alternative options from the option we propose.

Table 18 Alternative auction volumes based on different surplus reduction volume options

Million NZUs	2023	2024	2025	2026	2027
1. Constant volume to 2030	18.2 (+12%)	17.2 (+10%)	15.0 (+7%)	12.5 (+3%)	10.2 (+2%)
2. Constant volume to 2027	14.5 (-20%)	13.5 (-21%)	11.3 (-25%)	8.9 (-29%)	6.5 (-36%)
3. Constant proportion of cap to 2030 (option proposed)	16.3	15.6	14.0	12.2	10.4
4. Straight-line trajectory to 2030	13.4 (-18%)	13.8 (-12%)	12.9 (-8%)	11.9 (-3%)	10.8 (+4%)

9. Comparison to current settings

To aid understanding of how differences have arisen, we present below tables comparing the results of key steps in the method for developing unit limits for current and proposed settings.

Table 19 Emissions budget allocation to NZ ETS sectors (NZ ETS cap)

Mt CO_2-e	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Current NZ ETS cap	32.9	32.9	31.3	28.2	26.6	
Proposed NZ ETS cap		32.3	31.1	28.7	26.2	23.7

Table 20 Technical adjustments

Mt CO_2-e	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Current technical adjustments	0.0	0.0	0.0	0.0	0.0	
Proposed technical adjustments		-1.6	-1.4	-1.3	-1.3	-1.3

Table 21 Industrial free allocation

Million NZUs	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Current free allocation projections	8.2	8.9	7.9	6.3	6.2	
Updated free allocation projections		6.4	6.3	6.3	6.2	6.1

Table 22 Surplus reduction volume

Million NZUs	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Current surplus reduction	5.4	5.4	5.4	5.4	5.4	
Proposed surplus reduction		8.0	7.7	7.1	6.5	5.9

Table 23 International unit limits

Million NZUs	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Current international unit limit	0.0	0.0	0.0	0.0	0.0	
Recommended international unit limit		0.0	0.0	0.0	0.0	0.0

Table 24 Final auction volume (not including CCR)

Million NZUs	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Current auction volumes	19.3	18.6	18.0	16.5	15.0	
Proposed auction volumes		16.3	15.6	14.0	12.2	10.4

References

Ministry for Primary Industries. (2022). *Intentions of forest owners following harvest of post-1989 forests*.

Ministry for the Environment. (2021). *Proposed changes to NZ ETS and SGG levy regulations 2021: Consultation document*. https://environment.govt.nz/assets/Publications/Files/proposed-changes-to-NZETS-and-SGG-levy-regulations-2021.pdf.

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