Updates to the New Zealand Emissions Trading Scheme market model

Ngā Whakahōu ki te tauira mākete o te Kaupapa Hokohoko Tukunga o Aotearoa

Ministry for the Environment
Manatū Mō Te Taiao

Te Kāwanatanga o Aotearoa
New Zealand Government

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Introduction

The New Zealand Emissions Trading Scheme (NZ ETS) market model was developed in 2022/23. The model plays a key role in analysing the potential market dynamics of the NZ ETS to support policy advice. Combined with other information, the outputs of the NZ ETS market model help inform assessments of whether a given combination of unit and price controls is in accordance with emissions budgets. The model also includes functionality to help test the sensitivity of outputs to changes in key assumptions, such as the:

- size and liquidity of the stockpile

- responsiveness of emissions reductions and removals to NZ ETS prices

- split between NZ ETS and non-ETS sectors.

The market model is part of a suite of climate models used by the Government to assess climate mitigation policy. It has been used to support annual NZ ETS unit and price control settings updates[1] and was an input into modelling of the second emissions reduction plan (ERP2).[2] It is also used to develop insights on the potential impacts of other policies on the NZ ETS (for example the restrictions on converting productive farmland to forestry) and market-related developments (such as auction outcomes).

As with all models, the market model is an imperfect approximation of reality and subject to uncertainty. The results of the model should be understood and interpreted alongside wider information and evidence. Wherever possible, a variety of sensitivity analysis and robustness checks should be undertaken alongside central scenarios. This document highlights some of the particularly important modelling assumptions and parameters that should be tested as part of sensitivity analysis.

February 2025 version of the market model

The model is continuing to be developed and refined. This document outlines the technical updates and improvements made to the model since the previous release in May 2024 and its original publication in August 2023. It should be read with the original documentation of the modelling available in the *Review of the New Zealand Emissions Trading Scheme Summary of modelling*.

The February 2025 version of the NZ ETS market model is substantively the same as the version used to support ERP2 modelling. To make it more useful and up to date for users, a small number of changes have been made following ERP2 including:

- updating the demand baseline and industrial allocation projections to align with ERP2 projections

- incorporating updated forestry unit flow data from the 2024 October Baseline Update

- reflecting 2024 auction outcomes.

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[1] See Regulatory Impact Statement: 2024 update to New Zealand Emissions Trading Scheme limits and price control settings for units.

[2] See New Zealand's second emissions reduction plan 2026-30: Technical annex.

The NZ ETS market model is available on request from the Ministry for the Environment – please contact etsconsultations@mfe.govt.nz. Because the model is a macro-enabled Excel spreadsheet, we cannot make it available directly on our website.

Further updates between consultation and final settings

The NZ ETS market model is continually being reviewed and updated for new information as it becomes available. Expected updates that will occur over the course of 2025 include:

- adjustments for 2025 greenhouse gas inventory data, including understanding implications for base NZU demand projections

- factoring in information and insights received as part of the ETS settings consultation process and other ETS stakeholder engagement. This may be most relevant to assessments of the stockpile and its behaviour, and responsiveness of participants to prices.

We welcome any feedback from users on how the model could be further developed and improved. Please contact etsconsultations@mfe.govt.nz with your feedback.

Updates to the New Zealand Emissions Trading Scheme market model

Government supply

On the 'Model' tab, the 'old' unit settings option refers to status quo settings (ie, as set in regulations in 2024) and 'new' refers to the settings proposed by He Pou a Rangi | Climate Change Commission (the Commission). This toggles both the unit settings (auction volumes and cost containment reserve volumes) and the price controls[3] (auction floor price and cost containment reserve trigger prices). The model has also been updated to reflect the two-tier cost containment reserve.

Industrial allocation volumes reflect the latest forecasts from the Commission (from 2024 NZ ETS settings advice), updated to reflect known or expected policy and other impacts. This includes:

* the New Zealand Steel electric arc furnace coming online in 2026

* the New Zealand Aluminium Smelter electricity contracts

* aligning Methanex output assumptions with ERP2 assumptions.[4]

Forestry data

The model uses the Ministry for Primary Industries' (MPI) 2024 October budget update projections of forestry NZ ETS unit flow data, which are consistent with ERP2 afforestation and removals projections.

When undertaking analysis using the endogenous forestry response functionality (Manley model) the low specification is generally preferred. The 'low' specification has performed reasonably well at explaining recent afforestation rates and produces similar results to MPI afforestation projections. Using a conservative function also partly mitigates some of the concerns over how well the Manley model performs for ETS prices above historical ranges. For 2024 and 2025 we have made an additional assumption of lower afforestation than would otherwise be implied by prices alone. This judgement is to reflect the impact of recent policy uncertainty on foresters' decisions, as well as the impact of natural events such as Cyclone Gabrielle.

A new parameter has been included in the model to assist with modelling the impacts of the restrictions on highly productive farmland conversions to exotic forestry from registering in the NZ ETS.[5] Cell B18 in the 'Model' tab sets an overall limit on afforestation when using the endogenous forestry response functionality. If set at a binding level, this caps the annual afforestation projection from the Manley model at the parameter value. Otherwise, afforestation is per the annual change projected by the Manley model. When set at a binding

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[3] Price controls are expressed in 2023 dollars.

[4] See appendix 1 of New Zealand's second emissions reduction plan 2026-30: Technical Annex.

[5] See chapter 11 of New Zealand's second emissions reduction plan 2026-30.

level, the implicit assumption is that the land-use conversion restriction acts to bind all afforestation to this level. To disable this functionality, simply set the parameter value very high (>100,000).

For the purposes of the model, only forestry units deemed 'low risk' are released into the market as a source for offsetting other emissions obligations. The model assumes 'low-risk' units are mostly those units generated by forests under average accounting and by permanent forests, as the units generated from these sources are unlikely to be needed by foresters to meet future harvest liabilities. Other units generated by afforestation are assumed to be held by foresters against their future harvest liabilities (as part of the 'other' stockpile) and therefore are only available to the market under certain circumstances – see Stockpile section.

Stockpile

The total stockpile of New Zealand Units (NZUs) refers to all NZUs held in private accounts, as registered with the Environmental Protection Authority. The 'surplus' stockpile are those NZUs not held for hedging purposes. The 'surplus' is calculated following the methodology used by the Commission and the Government for annual unit settings updates.

The estimates of the 'surplus' and total stockpile of NZUs refer to the 2023 year. Changing the stockpile estimates in cells B11 and B12 therefore affects the 2023 year. The default starting point is to use the surplus estimates from the 2024 NZ ETS settings decisions.

The behaviour of holders of both 'surplus' and 'other' (non-surplus) stockpile units is a key source of uncertainty for NZ ETS market dynamics.

- The model assumes that surplus stockpile NZUs are drawn down first, and therefore the magnitude of the 'surplus' influences the dynamics.

- The 'other' stockpile can also be made available to meet NZU demand. This key modelling choice is determined by the parameter controlling the transfer of stockpiled units to the 'surplus' (liquid) stockpile (cell B13) and can be varied depending on expectations of how liquid or illiquid the stockpile is. We recommend using different values for this parameter as part of sensitivity analysis; values between 5–20 per cent usually generate plausible results. Because the market model is quite sensitive to the liquidity parameter, which is ultimately not empirically testable, the recent practice has been to set it at a value that generates a broadly stable ratio of other stockpile units to compliance demand in the near term (up to 2035).

NZU demand

Baseline NZU demand

NZU baseline demand ('CPR Zero Price' in the 'Model' tab) is based on a 'zero price' run of the Emissions in New Zealand (ENZ) model. The current baseline incorporates ERP2 policies and other adjustments for expected developments such as the New Zealand Steel electric arc furnace and Methanex closing by 2030.

The demand baseline is the 'zero price' projection of NZ ETS sector gross emissions, calculated as total gross emissions less agricultural sector and waste emissions (from the ENZ ERP2 projections) and other non-ETS sector emissions (based on the Commission's updated

demonstration path data). Baseline demand trends downwards even without price effects due to policy effects and underlying trends in efficiency improvements.

Responsiveness of NZU demand to prices

The responsiveness of gross emissions (and therefore NZU demand) to NZ ETS prices is a key source of uncertainty. The NZ ETS market model features an aggregate NZU demand function that incorporates the ETS price impacts on demand using the emissions price responsiveness derived from the ENZ model. The ENZ model is a whole-of-economy, bottom-up model used by both the Ministry for the Environment and the Commission.

The parameters of the NZU demand function are estimated with 95 per cent confidence intervals. To simulate greater and lesser responsiveness to price, a feature has been added to the model to toggle between using the central estimates of the coefficients and the upper and lower estimates of the coefficients (cell B17). Using this functionality is recommended for conducting sensitivity checks of a central scenario, or for constructing alternative scenarios.

New price functionality

The model can endogenously determine the NZ ETS price using the 'Solve for price' macro. As originally designed, this was achieved by determining the constant change in NZ ETS prices that generate sufficient annual supply (including drawing from the stockpile) to meet annual demand while minimising any surplus build-up over the period to 2050. This works best in conjunction with forestry being endogenous. The resulting price path is either a steady upward or downward curve.

More recently, functionality has been introduced to drive a cyclical price path, similar to the rising then falling exogenous price used in the ERP2 discussion document. Under this functionality, the turning point of the cycle must be exogenously imposed – 2030 has been the default for 2024 NZ ETS settings advice and ERP2 analysis. Mechanically, this is set in the 'Prices' tab by altering the multiplier in column A. Set at '1' for the whole period it mimics the original constant price change set up. Set at a negative number until the desired turning point and then a positive number thereafter it generates the cyclical profile.

The model then determines the constant price change as before, but this drives constant price increases up to the turning point and then constant price decreases thereafter. The pace of change before and after the turning point can be different if desired. For 2024 settings and ERP2 it was set at '-1' till 2030 and '0.5' thereafter.

A minimum price constraint can also be imposed if desired (cell B44 in 'Model'). The main rationale for this is an assumption that prices might gravitate to some long-run level eg, the marginal cost of forestry supply of around $50.

Methodology for estimating total net emissions

The NZ ETS market model was not designed to estimate total net emissions; its focus is on net emissions covered by the NZ ETS.

However, the projections from the model can be combined with other information to make a high-level projection of total net emissions. This can help with assessing whether a given

combination of unit and price control settings is in accordance with emissions budgets. Two additional sources of information/assumptions are needed:

- **An estimate of emissions outside of the NZ ETS (mostly agriculture)**
  ENZ ERP2 projections are primarily used to estimate non-NZ-ETS sector emissions, in line with the baseline NZU demand step outlined earlier.

- **A conversion of 'low-risk' forestry NZUs to total 'target' accounting removals**
  Not all emissions removals are within the NZ ETS and the accounting treatment for some forestry units differs between the NZ ETS and 'target' accounting used for emissions budgets. This means the NZ ETS market model projections of 'low-risk' forestry NZUs usually underestimate removals that contribute towards emissions budgets. To adjust for this, an estimate of total removals is made by scaling up projected NZ ETS 'low-risk' forestry units. The scaling factor has been set by comparing MPI's ETS 'low-risk' forestry removals projections with total removals projections (which are calculated with consistent information).

Net emissions are calculated as the total demand for NZUs (ie, gross emissions in NZ ETS sectors) plus non-NZ-ETS sector emissions less total removals.

These point estimates are subject to a high degree of uncertainty. They should be tested in conjunction with sensitivity tests – varying the stockpile liquidity or the price responsiveness parameters are good ways of doing this.

New output functionality

A summary dashboard has been developed for quick scenario analysis. First set up the central assumptions in the 'Model' tab. Then run the 'Populate dashboard' macro (cell AE19) in the 'Dashboard' tab. The macro is a simple loop programme that runs the model using the central price responsiveness coefficients plus +/- 1 standard error and the 95 per cent confidence interval coefficients to generate five scenarios. These five scenarios then populate the various summary tables and charts.