



Introduction to petroleum reserves

May 2026

Each year, MBIE produces annual data on New Zealand's petroleum reserves based on data provided to it by petroleum permit holders. This data provides a public view on the amount of oil, gas, and LPG remaining in New Zealand's petroleum fields¹.

This document outlines the core concepts behind MBIE's petroleum reserves data and explains some of the key phrases used in our release.

MBIE collects reserves data from field operators

Every company that holds a permit to extract oil, gas, or other petroleum products (collectively referred to as 'petroleum') in New Zealand must submit an annual summary report (ASR) each year under the Crown Minerals Act 1991. The ASR provides a summary of the company's permit activity, which includes both the amount of material extracted and the estimated amount remaining in their field. These reports are collected, checked, and compiled by New Zealand Petroleum and Minerals², a part of MBIE. Data provided through ASRs is reported as at 1 January for a given year, and is due to MBIE in March of that year.

We use the data contained in these ASRs to build and publish a national-level view of petroleum activity and reserves. We report on the following metrics:

- [Permitting activities](#)
- [Reserves and contingent resources](#)
- [Deliverability](#)
- [Production profiles](#)

These measures are constructed in accordance with the Society of Petroleum Engineers' *Petroleum Reserves and Resources Definitions*³.

Permitting activities show aggregate exploration activity within New Zealand

Aggregated data is published on total exploration activity rather than per-field as field-level information is commercially sensitive. This aggregated reporting demonstrates the level of petroleum exploration and development occurring in New Zealand. Activities reported are summarised in Table 1.

ISBN: 978-1-997308-40-9 (Online)

¹ Data can be accessed at: <https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-statistics-and-modelling/energy-statistics/petroleum-reserves-data>

² <https://www.nzpam.govt.nz>

³ <https://www.spe.org/en/industry/reserves/>

Table 1. Summary of activities reported in the Petroleum Reserves data.

Activity	Description
Wells drilled	<p>The total number of wells drilled over the course of the year. We also report on the total length of wells drilled (Metres made) as well as the total cost of all wells (Well expenditure). Wells are categorised as follows:</p> <ul style="list-style-type: none"> • Exploration wells are drilled in a new area to determine if it's suitable for a petroleum field. • Appraisal wells are drilled where an exploration well has made a discovery, with the purpose of gathering more information on its suitability for production. • Development wells are drilled to extract petroleum.
Seismic acquisition	<p>The amount of seismic exploration undertaken over the year. This includes 2D seismic acquisition (carried out along single lines, measured in kilometres) and 3D seismic acquisition (carried out over an area, measured in square kilometres).</p>
Seismic reprocessing	<p>The amount of raw seismic data reprocessed using updated mathematical methods to produce a more accurate picture of the subsurface. As above, this is reported separately for 2D and 3D acquisition using the appropriate units.</p>
Seismic expenditure	<p>The total cost of all seismic acquisition and reprocessing.</p>
Expenditure for all Petroleum Permits	<p>The total cost incurred under all permits. This data is categorised as follows⁴:</p> <ul style="list-style-type: none"> • Petroleum prospecting permits (PPP) allow the holder to carry out general investigation of a given area, but do not allow the holder to drill. • Petroleum exploration permits (PEP) allow the holder to carry out more focussed investigation of a given area, including well drilling. • Petroleum Mining Permits (PMP) (historically 'Petroleum Mining Licences' or 'PML') allow the holder to extract and produce petroleum.
Permits granted and permits ended	<p>The number of permits which have been granted, and which have lapsed (either through being surrendered, having expired, or having been revoked through the year). These are categorised into prospecting, exploration, and mining permits, as above.</p>
Total number of permits	<p>The total number of permits of the given category in force during the year.</p>

⁴ See New Zealand Petroleum and Minerals' website for more information on the different types of permit: <https://www.nzpam.govt.nz/permits/petroleum/types>.

Reserves and contingent resources measure the petroleum we have left

Reserves measure the quantity of a given material that can be commercially recovered. This means the amount of material which the permit holder expects they can extract and supply to the market. In contrast, **contingent resources** measure the quantity of a given material that exists, but which *cannot* be commercially recovered at that point in time. Together, reserves and contingent resources give an idea of the total amount of material which remains in each field, regardless of whether it can be recovered.

There are many reasons why a given quantity of material may be considered a contingent resource: for example it may be too deep or too difficult to get to, tightly bound up within a rock formation, or contaminated with other substances. Over time, contingent resources may be 'promoted' to reserves as circumstances change. Conversely, reserves may be 'demoted' to contingent resources if further development shows them to be more difficult to recover than previously thought.

Reserves are expressed in two forms:

- **Estimated Ultimate Recoverable:** the total amount of material which is expected to be recovered over the whole lifetime of the field. This includes material which has already been recovered.
- **Remaining Reserves:** the total amount of material which is expected to be recovered over the remaining life of the field.

By subtracting Remaining Reserves from Estimated Ultimate Recoverable reserves we get a measure of the total amount of material extracted from the field to date.

Reserves and contingent resources are probabilistic measures

The above values are calculated through comprehensive processes but are at their core estimates of the remaining material at each field, which means that they carry a level of uncertainty. Permit holders record these values as *probability distributions*, which indicate an expected range of values as well as the median value (see Figure 1 for an example). Over time, a permit holder's understanding of a given field's reserves may change, altering the probability distribution for that field.

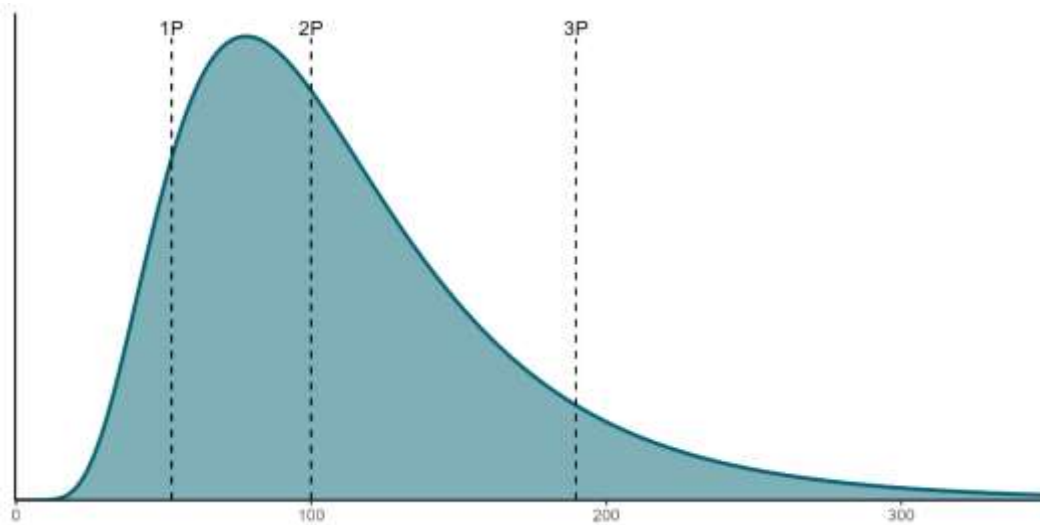
Permit holders report reserves as three measures in their ASRs:

- **1P** reserves ('Proved': 90% chance of recovery)
- **2P** reserves ('Proved + Probable': 50% chance of recovery)
- **3P** reserves ('Proved + Probable + Possible': 10% chance of recovery).

In other words, permit holders believe there's a:

- 90% chance that their reserves are equal to or greater than their supplied 1P figure,
- a 50% chance that their reserves are equal to or greater than their supplied 2P figure, and
- a 10% chance that their reserves are equal to or greater than their supplied 3P figure.

Figure 1. A sample probability distribution for petroleum reserves. The greater the area under a given point on the curve, the higher probability that this point represents the actual value. The dashed lines show sample 1P, 2P, and 3P values based on this distribution.



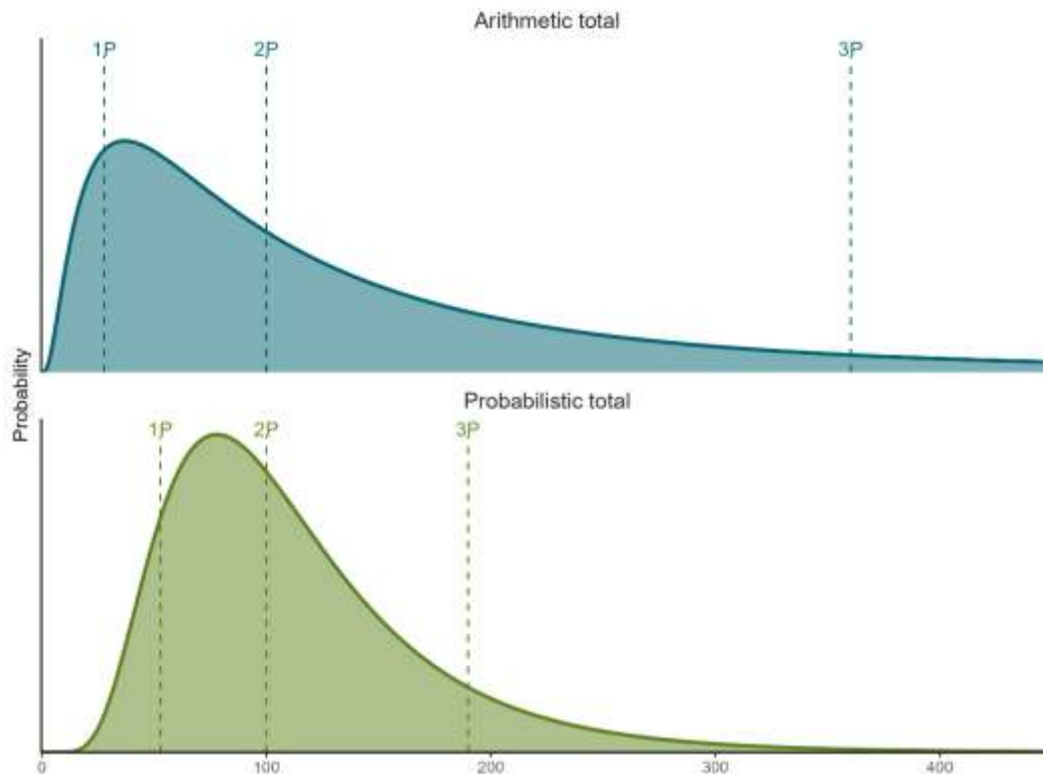
Permit holders only report their 2C (50% probability of exceeding) figure for contingent resources.

When creating a national total from probability distributions, it's important to note that we cannot simply add each field's 1P, 2P and 3P reserves figures together. Instead, we perform a Monte Carlo analysis on the provided data, using the following technique. (See the [Appendix](#) for a more detailed description of this technique.)

1. For each field, we construct a probability distribution based on the provided 1P, 2P, and 3P figures.
2. We then run 100,000 scenarios, calculating random reserves quantities for each field based the field's calculated distribution and summing them to find a national total.
3. Finally, we derive a national set of 1P, 2P and 3P reserves figures based on the distribution of 100,000 national totals.

As a result, we produce *probabilistic total* 1P, 2P, and 3P reserves figures for the whole of New Zealand. For completeness, we also provide an arithmetic total (ie a total calculated by simply adding the figures as reported by permit holders). While the arithmetic total is useful for calculating proportions (such as contributions of specific fields), it should not be used as a national-level figure. Because oil and gas distributions are typically skewed to the high side, we expect the probabilistic 1P figure to be somewhat larger than the arithmetic 1P figure, the probabilistic 3P figure to be somewhat smaller than the arithmetic 3P figure, and the probabilistic and arithmetic 2P figures to be closer to equal (see Figure 2).

Figure 2. Comparing arithmetic and probabilistic totals calculated from probability distributions for a series of fields. The probabilistic total distribution is ‘narrower’ than the arithmetic total distribution, resulting in a higher 1P and lower 3P value, although the 2P values are approximately equal.



Petroleum initially in place measures the total material in each field

A field’s petroleum initially in place (PIIP) is a measure of the quantity of material, recoverable or not, which existed in the field at the start of its life. This includes ultimate recoverable reserves and contingent resources, as well as petroleum which can be identified but is unrecoverable even under the best technical, economic and regulatory conditions.

Production profiles give a measure of expected future supply

Each permit holder provides MBIE with a year-by-year series of expected production based on existing trends and planned development. This shows the quantity of material the permit holder expects to recover each year for the remaining lifetime of the field. It is worth noting that some fields may provide an extensive production profile with very low expected production in the field’s last years: fields may cease production before this point, as extraction may prove to be uneconomical. The sum of production profile quantities for a given field should be equal to the field’s 2P remaining reserves. It should be noted that production profiles are a measure of *expected production* and are not a forecast of expected demand.

Deliverability measures our historic ability to meet demand

Each field provides MBIE with a measure of its deliverability over the previous calendar year. This is a measure of the field’s ability to meet day-to-day demand and is affected both by the rate at which material can be extracted from the field and the processing capacity of the field.

Each field’s minimum and maximum deliverability are mainly governed by the field’s processing facilities. In contrast, the field’s average deliverability measures the rate at which the field supplied gas to the market over the past year.

Appendix: Monte Carlo methodology

Probabilistic totals published as part of the reserves data are derived using a Monte Carlo simulation of the possible distribution of each field's reserves.

The process used is as follows:

1. Each field submits Annual Summary Reports to MBIE. Data is provided in various units of measure alongside conversion factors, so values are converted to petajoules (PJ) for ease of calculation and comparison.
2. The reported 2P and 1P figures are then used to calculate a standard deviation for each field. For this calculation, we assume the 2P to be the mean, and 1P to be the 0.1 quantile. The calculation used is:

$$SD = \left(\frac{1P - 2P}{qnorm(0.1)} \right)$$

We use a lognormal distribution⁵ to model potential volumes for each field. The lognormal requires calculation of the location and shape parameters. These are calculated as follows where s is the standard deviation, and m is the mean.

$$\text{location} = \log \left(\frac{m^2}{\sqrt{s^2 + m^2}} \right)$$

$$\text{shape} = \sqrt{\log \left(1 + \frac{s^2}{m^2} \right)}$$

3. We then filter the data by commodity (gas, oil, condensate, LPG) and perform calculations on each fuel type subset.
4. We now calculate 100,000 samples for each field based on the lognormal distribution of possible values.
5. Each set of samples is summed, leaving us with 100,000 possible national totals.
6. This simulated set of national totals effectively forms a distribution of possible values. We take the 0.1, 0.5, and 0.9 quantiles of this range as the 1P, 2P, and 3P values respectively.

⁵ This is a distribution whose logarithm is normally distributed. In practice this provides for a distribution with a 'long tail' of low-probability values which mimics the actual probability distribution of reserves measurements.