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FUEL SUPPLY DISRUPTION - SCENARIO ANALYSIS

Prepared for MINSTRY OF BUSINESS, INNOVATION & EMPLOYMENT

14 April 2026

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Authorship

This document was written by:

Ian Twomey	e-mail: ian@envisory.co.nz
Steve West	e-mail: steve@envisory.co.nz

Please e-mail for further information.

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1.0 Introduction

This report assesses scenarios that can disrupt diesel supply to New Zealand. Price response is the most immediate impact following disruptions to oil markets like the Strait of Hormuz closure. The price response is to both restrain demand (cause demand destruction so demand falls to available supply) and to cause realignment of supply chains so that crude or product in one region will then flow to where it is needed to cover the shortage.

We initially review how prices have responded over the past 6-7 weeks and how that may be impacting demand, including in New Zealand. We then review possible scenarios that would result in physical disruption to New Zealand's fuel supply and how stocks would be used while replacement cargoes are organised; to date there has been no disruption to New Zealand supply.

2.0 Price response for rationing demand

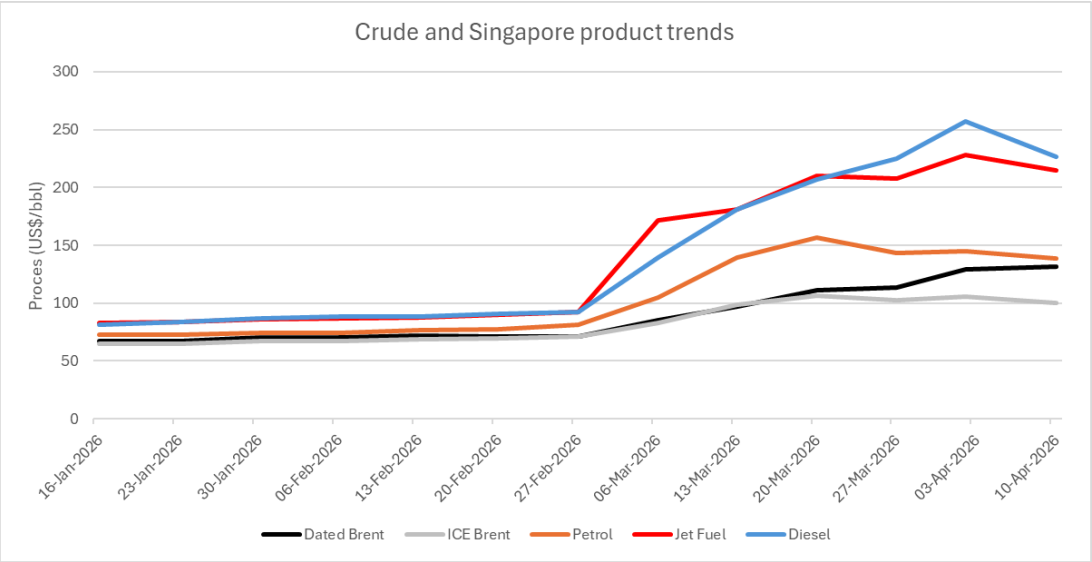
On February 28, United States (US) and Israel launched wide-ranging strikes on Iran, killing much of the country's leadership including the supreme leader. Iran responded by launching missiles at US and Israeli assets in the region as well as targeting other Gulf countries and their energy infrastructure more generally.

Iran, on March 2, announced the closure of the Strait of Hormuz at the mouth of the Arabian Gulf and threatened to attack any vessel transiting. This has halted almost all traffic through the Strait, which normally carries 20 million barrels of crude and products per day. The Strait has now been closed for over six weeks leading to very high petroleum prices.

2.1 Asian price response

Figure 1 provides the price trend for the main international trading crude grade (Brent) along with Singapore product prices (New Zealand product is bought using these market indices). Prices jumped immediately following the attack, and once it was clear after one-two weeks that it was not going to be a quick resolution, prices continued to climb.

Figure 1: Weekly average crude and product price trends



We show both Brent futures (ICE Brent) and physical Brent (Dated Brent). The ICE Brent is the price trading for delivery in one to two months' time rather than physical crude delivery. The physical cost of crude can increase well above the futures when the market is short, and this is happening in the crude market. Despite crude being quoted at around US$100/bbl, the current cost to a refinery is more like US$130-140/bbl plus freight (shown in Dated Brent line in Figure 1). Product prices need to cover the cost of the physical crude, not the futures price.

Singapore product prices all rose substantially immediately following the disruption, although after a few weeks petrol flattened and then dropped from its mid-March peak. This indicated less concern around petrol supply disruption. This is because petrol production is less impacted by the reduced refinery production and change in crude feedstock and is more responsive to increasing prices reducing demand. Petrol prices are now only marginally above the physical cost of crude, indicating the market has no issues with supply.

Diesel and jet fuel prices by contrast have continued to increase until last week's ceasefire announcement. This indicates the market is struggling to meet diesel demand and prices are needing to rise. Diesel and jet fuel are both straight-run products (distilled directly from crude) so are proportionally impacted by run cuts. There is some ability to shift production between the two grades, but the much higher diesel price is indicating diesel supply is the main issue.

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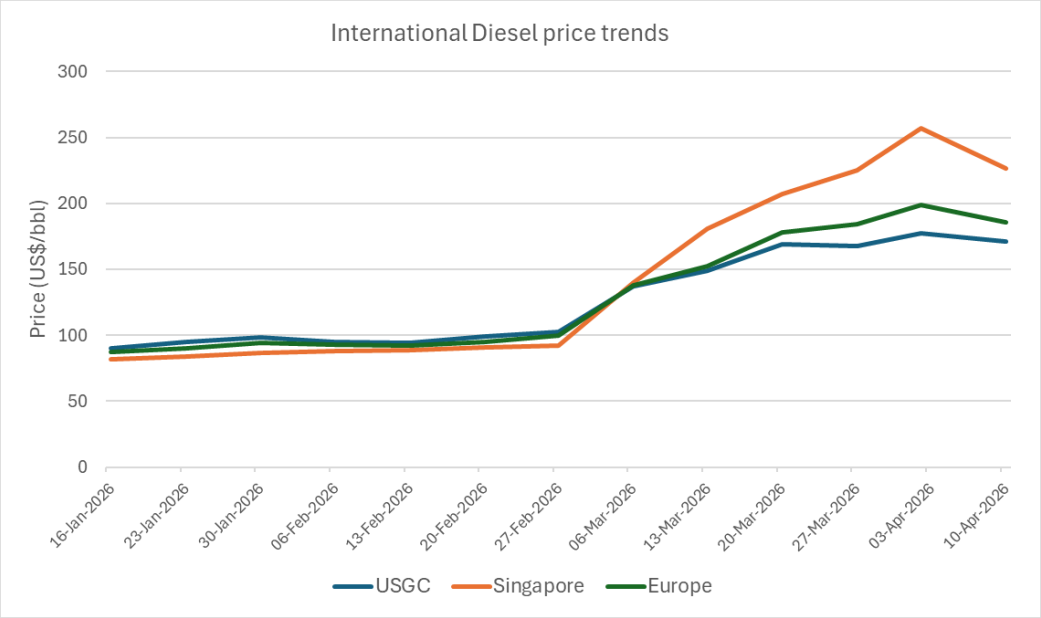
2.2 Supply Chain realignment

Prices rise both to reduce demand and to encourage supply chains to realign. The rise in diesel prices has been more substantial in Asia Pacific than other regions (Figure 3). This is due to the most immediate short of crude being in Asia, so it is Asian refineries that have needed to reduce runs while replacement supply is secured. The Asian diesel price rises so that flows will come from other regions (and their prices rise to reduce demand in those locations).

Asian diesel prices are normally lower that the US or Europe as Asia exports to those locations (primarily India to Europe and South Korea to Europe or the Americas).This was the case until the end of February. Asian prices have now risen substantially above the US and Europe which is

encouraging more direct product supply into the region rather than exports (primarily from the US either via increased refinery throughput or delivering product that may have gone to the Americas or Europe as they reduce demand in response to the high prices).

Figure 3: Diesel price trend in main trading locations



This premium in Asia (relative to other markets) should reduce as supply chains realign; prices peaked around three months after the Ukraine invasion during which supply chains realigned; that impact was less clear immediately as there was uncertainty how the sanctions would work. We expect the current Asian premium to come off a little, although some of the gap closure may come as US and European prices rising in response to the global short (last week's decline was after the ceasefire announcement - those prices are back up somewhat). Asian prices will remain higher while its refineries are mostly impacted by the loss of crude. There is a similar trend for jet fuel with higher Asian prices.

2.3 Demand rationing through price

Ultimately, higher prices reduce demand, even for diesel where demand elasticities are lower than for petrol. Asia could be more than 10% short of product in the near term, given how much crude supply has been lost. Ultimately once supply chains are realigned, the closure of the Strait of Hormuz may result in a 10% reduction globally (the full 20 million barrel /day impact, partially mitigated by spare capacity elsewhere, easing of sanctions and redirection through pipelines). The diesel reduction may be a bit higher with the changing crude diet for key Asian refineries (replacement crudes producing less jet fuel and diesel).

New Zealand is one of the wealthy countries in the Asia-Pacific region so its businesses should be able to keep paying for diesel whereas other less wealthy countries may have to take more severe demand mitigation action. Even in New Zealand demand will respond to price. Based on the elasticities developed for the Fuel Security Study, a doubling of diesel price (this has been the impact on the typical diesel consumer to date) is expected to reduce demand by around 6-7%. This has not been seen in the market data yet as March saw some panic buying initially.

There will be a substantial economic impact from both the price increase and companies and consumers taking action to reduce demand; this is outside the scope of this document.

3.0 Background Information for scenario analysis

This section covers the stock and resupply information that is used in all the scenarios.

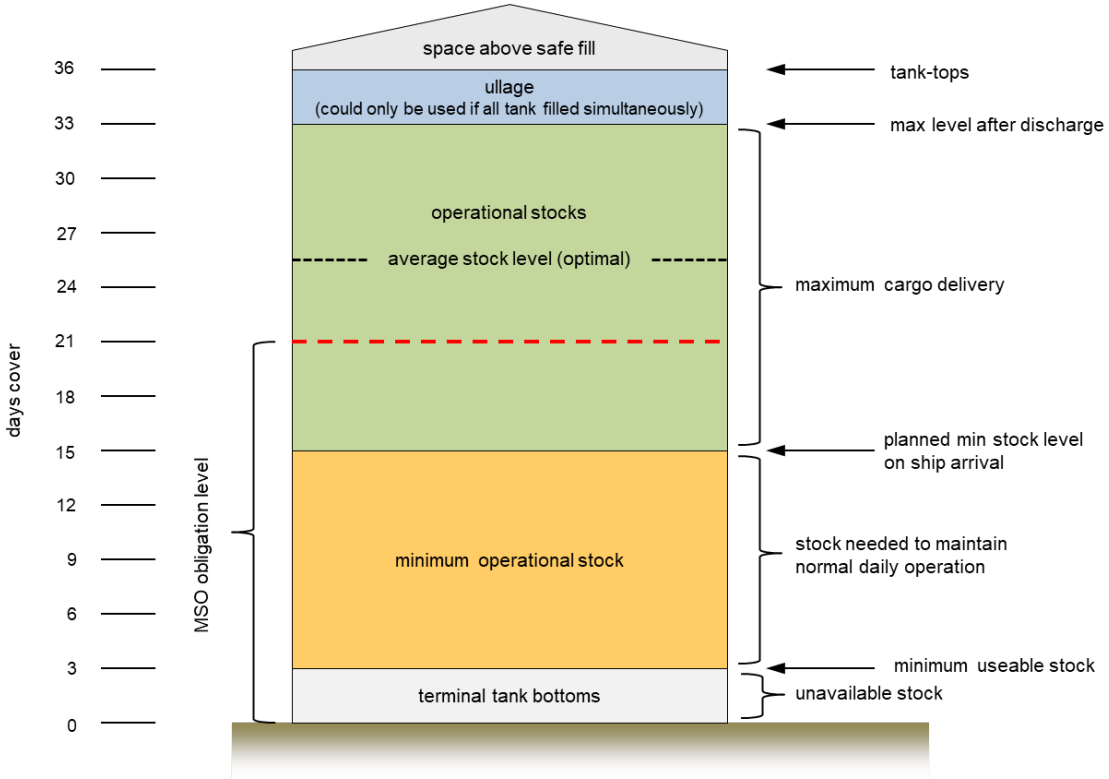
3.1 Stocks

Stocks provides the life stream of a fuel supply system. Stocks are held in New Zealand to allow a continuous flow of product through the supply chain through to the customer. Suppliers need to hold enough stock to manage any demand variation and to cover any variation in ship arrival timing.

Since implementing the minimum stock obligation(MSO) suppliers need to ensure any of the day-to-day variation in the supply system is managed within the stocks held above the MSO. Stock below the MSO level is held for major disruption events to use while companies source alternative product and realign their supply chains. These scenarios investigate when and how those stocks may need to be used. Typically, companies are holding around 4 days demand above the diesel MSO level[1].

The diagram below shows New Zealand's diesel typical stock levels.

Figure 4: New Zealand's diesel stock levels



3.2 Resupply cargoes

Should New Zealand's supply chain be disrupted through the loss on one of more cargoes, then cargoes will need to come from alternative locations. This will take time for alternate cargoes to be purchased (even for a prompt cargo), ships to be secured and possibly longer shipping time to New Zealand. The table below analyses the gap expected between when the originally planned cargo

[1] This is based on national averages not individual company data.

would have arrived and its replacement. This is the gap the stocks need to cover. The planning times are less than would normally be needed which will increase the cargo cost.

We assume a fuel supplier will know (at the latest) that a cargo is going to be cancelled before (at least one day) the ship is about to load. Including loading time (two days) and shipping time, that means the cargo would have been expected to arrive in New Zealand around 20 days after the cancelation date.

Table 1: Replacement cargo timing

Location	Planning time	Loading/ship time	Total	Gap
Similar Asia locations	3-4 weeks	19 days	40-47 days	20-27 days
India	3-4 weeks	27 days	~48 days	28-35 days
United States	2-3 weeks	32 days	~46 days	26-33 days

The current market is stretched so replacement cargoes are more likely to come from India and/or the United States, than similar Asian locations to current supply. We therefore assume the replacement cargoes will take around 25-35 days to arrive to cover the lost cargo. This is the gap the stocks need to cover - i.e. stocks will need to operate at lower levels than normal until the replacement cargos arrive.

There may be options for the impacted company to mitigate the gap (such as sharing some cargoes between New Zealand and Australia) or that company (or others) increasing loading tolerances on other cargoes where possible to mitigate some of the impact. We do not include these mitigation impacts in this analysis.

3.3 Diesel supply and probability of disruption

Diesel is supplied to New Zealand either on:

- Medium Range tankers holding multiple products: Diesel volume likely to be 20-25 million litres (~6 per month)
- Medium Range tankers only holding diesel: Diesel volume 45-50 million litres. (~2 per month)
- Long Range larger product tankers holding two or three products: Diesel volume between 40-50 million litres (~2 per month)

There will be a greater impact on the diesel stocks if a Long Range or full Medium Range (MR) diesel tanker supply is disrupted.

We based the probability of each scenario on the likelihood that there is a 25% chance of a single cargo being cancelled in a month (i.e. expectation of one cargo cancelled every four months). This relates to the current stressed market environment - this was assumed around one every two years in the Fuel Security Study for normal market conditions. New Zealand is yet to see a cargo cancelled.

The individual probabilities in each case are calculated based on the typical number of that type of cargo each month (note some cargoes coming to New Zealand do not have any diesel).

4.0 Scenarios

This section looks at three different scenarios through loss of one or more diesel cargoes over a 20-day period[2] that need to be replaced by cargoes that take 25-30 days longer to arrive than the original planned cargo.

We do not state the reason for the loss of cargoes, but possible reasons could be individual refinery upsets (e.g. loss of production resulting in Force Majeure) or a country restricting export volumes (hopefully more notice in this case). Any restriction on exports such as an export refinery cancelling cargoes will have an impact on regional prices. This will mitigate the loss slightly as rising prices will reduce demand further, although that may be marginal on the cases described (the diesel price doubling is expected to reduce NZ's diesel demand 6-7% so even to partially mitigate Scenario 4.1 (7.5% loss) requires another substantial price increase (e.g. international diesel rising to over US$400/bbl). This would be unlikely unless the disruption was substantial (in which case the impact on NZ supply may be more substantial).

In summary - these disruption scenarios are unlikely to be solved by price movement alone although that will contribute.

4.1 Loss of one mixed product medium range tanker (~ 7.5% of normal monthly supply)

This cargo would result in the loss of 20-25 million litres (~ 2 days demand) of diesel. Stocks would be lower from 20 days after the cargo was cancelled to 45-55 days later when the replacement cargo arrives. Stocks would be lower for a 25-35 day period.

Probability: 12% in a month

Outcome

The company with the disrupted cargo should still be able to meet their MSO although it could get tight depending on when in the month the lower stock is (it is easier to meet the MSO obligation if this occurs across two months).

- There will be no issues for New Zealand stocks to meet MSO in total - operational stocks above the MSO will be a little lower than they normally are.

Government Action: None other than continued stock monitoring.

4.2 Loss of a diesel medium range product tanker or Long-range tanker (~15% of normal monthly diesel supply)

The loss of 45-50 million litres of diesel is a little over 4 days demand, so will have a more significant impact as that takes all the stock flexibility above the MSO level out of the system.

[2] We use 20-day period here to ensure there is an impact of two non-delivered cargoes overlapping. If there is a 30-day period, the replacement cargo for the first cargo may arrive before there is any impact from the second event (this becomes two scenarios 4.2 in a row, rather than scenario 4.3 as modelled here).

Probability: 9% in a month

Outcome

- The company with the disrupted cargo will need to apply to go under MSO (or try and 'borrow' stock cover from other companies, but they may not be prepared to do this without their risk of non-compliance being covered).
- Total New Zealand stocks will fall to around the MSO level - this should still be met depending on the exact timing; but it will be tight.

Government Action: Possibly consider a MSO relaxation for one company, although preferably work with all companies to make sure the MSO will be met in total, avoiding the need for announcements about relaxing the MSO. The reduction will likely be observable in public stock level reporting, initially for on the water stocks and then for stocks in country. The replacement cargo timing will be known before this is obvious in the data (early in the shipping time of the original cargo), so it may be best to announce what is going to happen with stocks - they will be lower for an "x" day period from a date until a replacement cargo is arriving on "y" date.

4.3 Loss of two diesel cargoes within a 20-day period (up to 30% loss of normal monthly diesel supply)

We assume the worst case, which is the loss of two larger cargoes (hence the impact on 30% of normal monthly supply).

This could be a loss of 90-100 million litres of normal diesel supply (~ 9 days demand). The total loss may only be seen in country for 10-15 days, as the replacement cargo for the first lost cargo would offset some of the total loss. However, there could be a 20-30 day period around that more severe short where onshore diesel stocks would be 45-50 million litres lower.

Probability: 1% for the worst outcome modelled here

Outcome

- One, or more likely all companies will need an MSO exemption.
- Total New Zealand diesel stocks will fall well below the MSO level, as those stocks are used to cover the gap.
- Total MSO stock levels may fall as low as 16 days stocks. This will be getting tight for companies supplying but as it will only be for a 10-15 day period, so it should be able to be managed without disruption to customers.
- If it impacts one company more than others, they may see some disruption to their customers or require cover from others.

Government Action: The following government actions may be needed.

- MSO: A MSO relaxation would most probably be needed for all companies (as those who are not disrupted will be supplying more to cover others demand so they would also fall below MSO). The government will want to allow that as if unaffected companies choose not to increase supply to other customers to ensure compliance with their MSO target, then the disruption impact on customers will be worse than it needs to be.
- Communication: The reduction will be obvious in stock releases, initially for on the water stocks and then for stocks in country. The communication could describe what is going to happen with

stock levels in advance (as replacement cargo timing will be known) to demonstrate the system is working as it is designed to do (drawing on MSO stocks to cover realignment).

- Government stocks: If the government held stocks this would be a sensible trigger for release (loss of more than one diesel cargo within a 30-day period). Release of Government stocks to cover one of the lost cargoes would mean stock below MSO stock should not need to be called on (this scenario then looks like scenario 4.2).

5.0 Government diesel stocks

This paper does not consider the decision on the purchase of additional diesel stock, rather the decisions around using it should the government have control of around 90 million litres of diesel stocks at the Marsden Point Terminal.

Our view is that this stock should only be considered for use if the supply disruption is significant enough that it is clear than industry will not be able to maintain national stocks at or above the MSO. That means it does not cover an individual company's loss of one cargo (scenario 4.1 and 4.2 above) but rather when event compounds and there is the loss of two cargoes in a 20-30 day period. Even if not as severe as scenario 4.3, it is clear if New Zealand suppliers lose more than one diesel cargo national stocks will fall below the MSO.

The aim for rules around release is to ensure the Crown's decision to hold diesel does not impact suppliers' supply decisions, including how much stock they need to hold above the MSO level to manage normal supply disruption impacts. If they consider they can operate lower levels with government-controlled diesel there as a backup, then it is self-defeating.

The stock trajectory will be known around 3 weeks before the low point hits the in-country stocks. In such as event, the government should offer the company that has lost the cargo (or possibly half each to the two companies who have lost cargoes), the same volume of diesel that it was planning to deliver on the date it was expected to arrive. When that company's replacement cargo arrives in 25 to 35 days' time, that should be discharged into the Crown's storage to replace stock taken.

This does not need to be a buy/sell transaction, however there is a time value when the market structure is steeply backwardated with prompt prices much higher than further out. This should be agreed as part of the transaction with the value for the prompt versus the stock delivered later, locked in with the market structure (in effect a company is getting stock much earlier than they are paying for it). This could be either paid to the government or at minimum shared in some way between the company and the government.