IMPROVING AUSTRALIA'S FUEL SECURITY

PREPARED FOR AUSTRALASIAN REFINERIES OPERATIVES COMMITTEE (AROC)

BY BIS OXFORD ECONOMICS

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BIS Oxford Economics

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Australia has a Fuel Security Problem

COVID-19 has shown the material risks to sovereign nations of a reliance on overseas production and just in time supply chains. A shortage of personal protective equipment such as facemasks and surgical gloves and other medical supplies made what was once an abstract concept stark reality.

And yet on a more fundamental question – that of fuel security, Australia is far more exposed.

On any reasonable measure, Australia has inadequate reserves of liquid fuel (i.e. crude oil and refined petroleum products) that it can immediately draw upon in a situation of an unforeseen national crisis. Our heavy reliance on imports of both crude oil feedstock and refined products and lack of domestic storage means Australia is exposed to the danger of serious fuel shortages in a crisis, particularly if imports were disrupted, say by a shipping crisis or an armed conflict which impacts on major shipping routes.

The liquid fuel security has worsened over recent years with the closure of 3 domestic refineries since 2012. Despite a number of enquiries and reports to government over the past decade, the government has been slow to act to the obvious threats to Australia's fuel security. The Australian (Commonwealth) Government's implicit policy was to rely on the 'market' (i.e. commercial operators) to provide reliable storage and supply. This policy has led to a situation where Australia only has just over 50 days of stocks relative to net imports – well below the International Energy Agency's minimum 90-day rule (making Australia the only non-compliant member) – while the stocks-to-consumption ratios have averaged 25 days of consumption across all fuel types over recent years, although they improved to 29 days in FY19.

Recently, however, the advent of COVID-19, rising tensions between the superpowers of China, USA and India and increasing tensions in the South China Sea has seen the government belatedly recognise the problem, stating that "the COVID-19 pandemic has highlighted limited flexibility in the fuel storage market in Australia where the fuel supply and demand balance changes suddenly."[1]

Key Factors Underlying the Fuel Security Problem

BIS Oxford Economics was commissioned by the Australasian Refineries Operatives Committee (AROC) to investigate fuel security policies in Australia. We have identified several potential risks to fuel security in this report, including:

- **Insufficient storage to withstand large supply shocks:** At the time of writing this report, Australia was the only country that did not meet its IEA obligations for fuel storage (which is a minimum of 90 days' worth of net imports). More importantly, Australia's domestically held stocks are inadequate for even a 'modest' supply crisis, given that the stocks-to-consumption ratios are still below 30 days of consumption (and for the crucial diesel supply, only 20 days). Added to this is poorly designed legislation which in practice would be too slow to enact and prevent panic buying and hoarding by consumers.
- **Concentration of geopolitical risks:** Increasing reliance on refined fuel imports is seeing increased exposure to escalating shipping and geopolitical risks relating to the South China Sea. Around half of Australia's refined imports come from North Asia (mostly South Korea and Japan, but also includes around 11% from China). In contrast, Australia's crude imports have historically been more diverse, being sourced from a range of countries in South-East Asia, the Middle East and Africa.
- **The viability of local refining:** This includes supply and demand imbalance issues that see refineries over-produce products with low demand growth and underproduce products with high demand growth, which could ultimately impact on refinery profitability. If trends in fuel

[1] Department of Industry, Science, Energy & Resources 'Opportunities to Increase Australia's Domestic Fuel Storage Capacity'. Request for Information (RFI), June 2020

consumption continue, demand for diesel and aviation fuel is likely to rise (necessitating more imports) while petrol demand falls, potentially requiring refineries to seek out export markets for their surplus petrol production. This is a serious business concern, given strong potential competition from mega refineries in China, Saudi Arabia, Singapore and, increasingly, India.

- **Transport links and redundancy:** Disruptions to shipping in ports and import terminals can severely hamper import capacity for weeks. This is a significant concern if a region relies on a single import terminal. This impact is exacerbated if local storage is insufficient or land-based transport links are unable to meet local demand.

Australia's fuel security also has significant bearing on Australia's food security, safeguarding the industrial capability required to grow, process and distribute essential foods to its population in a crisis. Specifically, diesel fuel remains a critical input to the agriculture and horticulture industries as a fuel source, petroleum by-products as an input to packaging and food processing materials, and an input to manufactured fertilizers used in the growing process. Without a steady supply of fuel, Australia's food supply chains break down and the ability to feed the nation are called into question.

The ongoing reliability of transportation of health services and food supplies is also an acute factor for Australia's security. Without accessibility to refined fuels, the Australian government's capacity to continue to service the nation's health needs for those sick, isolated, or requiring treatment is restrained.

Australia's entire defense capabilities, including its maritime, ground and air force fleet, depend significantly on refined diesel and petroleum fuels. It must be recognised that all types of crises typically require assistance from our armed forces and capability, not just wars or hostile military action. For instance, throughout the Australian bushfire season maritime ships were deployed to help transport at risk stranded Australians. They were also used to help facilitate the safe procurement of PPE during the COVID-19 pandemic, and the mobilization of government resources to effectively enforce social distancing restrictions.

The Economic Cost of a Shutdown of Australian Refineries

The fuel refining sector makes up a relatively small share of GDP in Australia but has significant linkages to other sectors relative to its size. The refining sector makes up 0.36% of the overall GDP equalling $6.7 billion of direct value added in the economy in FY2018, while recent Australian Industry data for FY2019 from the ABS indicates that the sector directly employs around 5,000 people.

Our analysis shows that 0.12% of value added in the economy is activity related to refining – this includes part of the mining/resource extraction industry and the professional services sector, both of which provide significant inputs to the refining sector. Based on this, if we assume that the productivity of workers in an industry is consistent whichever its associated industry is, we estimate that approximately 13,800 people are employed in businesses that indirectly service final demand for refined products.

A shutdown of the local fuel refining sector would see a direct contraction of $6.7 billion or 0.36% of overall GDP as well as a potential drop in employment of over 5,000 people. This includes a $32 million fall in associated payroll and fringe benefits tax revenues for the Commonwealth and state governments. Critically, this does not include the more significant economic impacts it would bear on the broader economy – such as industry capital investment required to readjust supply chains and infrastructure to depend more on foreign fuel sources.

In addition to this, there may be upstream (refinery input) and downstream (refinery output) effects.

Our analysis shows that $2.2 billion of value added in the economy (0.12% of GDP) with an associated employment of 13,800 is related to businesses providing inputs to service the final demand for refined products. This includes the crude inputs to the refining process, the consultant labour provided, the real estate and transport services among other inputs. In the event of refining shutdowns, this implies that much of this employment and $2.2 billion in value add would be at risk.

Overall, up to a total of 0.48% of GDP – or $8.9 billion – and up to 18,800 jobs are at risk from a total shutdown of the Australian petroleum refining sector.

Added to this are the negative impacts on businesses that use the refinery outputs. This includes the chemicals and pharmaceuticals sectors which often rely on petroleum by-products from the Australian refineries, such as LyondellBasell and Qenos, who are respectively the only domestic manufacturers of polypropylene and polyethylene in Australia. LyondellBasell sources its propylene feedstock solely from local refineries and petrochemical plants. In turn, these companies are key suppliers of these plastics and other feedstocks to a range of companies, such as Indorama and Dow chemicals. Domestic packaging companies are also heavily reliant on this supply chain, such as Amcor, with packaging in turn a key indirect input to the food and beverage sectors. If these companies that rely directly on the domestic petroleum refineries had to import these by-products and other refinery outputs as a result of a shutdown, it is possible they will be exposed to increased transport costs for the (previously locally provided) refinery outputs and higher prices for these refinery outputs, which could have flow on effects to other downstream industries. It should not be underestimated that if the import of these inputs induced a cost increase, it could put significant pressure on the viability of these existing facilities – closures of which could ultimately lead to a further 'hollowing-out' of Australia's manufacturing industries.

A shutdown of the local refining sector would of course also substantially weaken Australia's fuel security. Any serious disruptions to fuel supplies will have the greatest impacts on the transport, agriculture, mining, construction and parts of the manufacturing sectors, as these industries depend on locally-produced refined fuel and related products – leading to substantial economic impacts on the whole economy.

A shutdown of local refining would also necessitate extra storage capacity to be built, in order to have adequate fuel supplies, should a situation arise where imports cease due to a crisis.

Policy End-goals That should be Pursued to Improve Fuel Security

It is clear that to achieve fuel security Australia needs to store more crude oil and refine more petroleum.

To achieve this there are at least 5 key policy objectives (or end-goals) that should be pursued in order to significantly enhance Australia's overall liquid fuel security. It should be noted that there are key interdependencies among the following objectives:

1. **Maintain existing refining capacity** – the ongoing operation of all 4 refineries is absolutely critical to fuel security and will prevent a further increase in what is already an over-reliance on refined imports from north Asia, which has been identified as a region of escalating geo-political risks. However, Australia's refineries are under enormous pressure from low margins and strong import competition, with these pressures only exacerbated by the COVID-19 pandemic. Critically, the capital infrastructure at existing refineries enhance Australia's fuel storage by holding stock through processing units, and if no longer operational, would significantly worsen Australia's fuel security. Shutdowns would also enhance Australia's dependability on overseas fuel sources. In addition, the 4 refineries will need to undertake a collective $1 billion in investment to meet the regulated change in fuel standards to a lower sulphur, which is due in 2027. As part of the policy options, there should be a subsidy to help pay for the investment required for this regulated change, which is largely aimed at improving environmental and health outcomes. An upgrade of capital will give long term confidence to the sector and the Australian economy in general and therefore government policy must be linked to an industry commitment to maintaining refining operations in Australia.

2. **Immediately increase Australia's fuel storage capacity** by a minimum of 4,000 million litres (ML), to both comply with IEA standards and have an adequate storage in the case of an emergency. The fuel stored must be crude oil that is compatible for processing at Australia's refineries to guarantee processing flexibility and adaptability in the event of a crisis. This crude oil must also be purchased by and remain in the sovereign control of the Australian government. Whilst private sector maintenance and servicing will be required, the Australian government must at all times retain

ownership of those fuel reserves. The 4,000 (ML) storage is estimated to involve an annual cost of $440 million per annum, which represents the upper range of the cost estimates of recent years. The initial investment in the storage tanks would have the added benefit of creating jobs and aid the recovery from the current recession. Enhanced storage capacity must be supplemented with the ongoing operation of all four refineries (objective 1). The additional crude oil storage should be located adjacent to those refineries to guarantee dependable response times in the event of a crisis. The enhanced fuel storage capacity will also considerably improve the viability of the local refining. This stems from the government's purchasing power advantages over market prices and the operational efficiencies associated with procuring large loads of fuel. These benefits are critical to help local refineries achieve similar cost advantages to overseas mega refineries and steer the course through challenging market conditions brought on by COVID-19. Importantly the government's commitment to the sector provides confidence for long term capital investments from operators. Any shutdowns would require extra capacity to be built – and create a further dependence on imports and not provide any true fuel security for an island nation and is therefore not recommended. A nation that needs to store fuel produced overseas will eventually run out under severe disruption or blockade.

3. **Increase the production of diesel,** possibly at the expense of petrol (automotive gasoline) at the existing refineries, assuming no increase in overall capacity. Diesel has been identified as crucial to the defence, transport, agricultural, mining, construction and manufacturing sectors – as such it can be argued it is the key fuel for Australia's food and economic security. It is also the key fuel for the defence sector. As identified in section 3, the demand for diesel is set to experience sustained increases over the next two decades. There already is a significant reliance on imports of diesel. On the other hand, demand for petrol is expected to decline over the next two decades and by 2040 the local refineries will need to find export markets for this product. As this objective is indirectly linked to objective 1, once again a subsidy may need to be considered for this policy which will greatly improve fuel security.

4. **Increase the volume of processing of local crude production** by the existing (or even new) refineries. In FY19, the local refineries only used 19% of indigenous crude as feedstock for their refineries – or 5,695ML (equivalent to an average monthly rate of 474ML/mth), which equated to around 31% of total Australian crude oil production. Over the 9 months to March 2020, the average monthly indigenous usage had increased to 615ML/mth – which equated to over 25% of feedstock, a higher rate than FY17, FY18 and FY19. Processing of more local crude rather than importing enhances Australia's overall fuel security. However, lifting the proportion of indigenous crude in refinery production has technical and logistics challenges. The logistics challenge may require dedicated tankers (which should be Australian 'controlled' and domestically crewed to enhance fuel security) to bring the condensate from the north-west of Australia to the refineries in the south and east of the continent.

5. **Improve interstate transport of fuel.** Poor interstate transport and shipping links have been identified in section 6.1 as a risk to fuel security. Objective 4 may need to include an Australian owned and operated oil tanker to bring local crude from the north-west to the south-east of Australia. Within this objective and the increased storage objective (#1), there is also the imperative that fuel security for Australia's defence sector needs to be addressed. A number of the domestic defence installations are spread across northern Australia, where there is not only inadequate storage for defence-related emergencies but transport linkages are inadequate and prone to risk.

Policy Options

Ultimately, any taxes on the fuel supply chain would get passed on to end-users. Thus, broadly speaking, financing a fuel security policy is a question of a 'user pays' tax against a more general tax that is not aimed explicitly at fuel users. This tax-type distinction has bearing on how much that overall cost will be shared upon the community, or whether certain parts of that community pay more. Fuel security is inherently a national problem, servicing health services, food supply, and defence capabilities in the event of a crisis. These essential goods and services would be resourced to protect the welfare of the whole community, and there must remain a preference to fund fuel security through general taxation. However, practical constraints such as the efficiency of taxation collections and political obstacles mean that general taxation may not be achievable (albeit not impossible).

Australia's fuel prices are some of the lowest in the OECD, to a large degree because taxes on fuels are very low. For 'premium' unleaded petrol and automotive diesel, Australian prices are around 50 cents below the average as of December quarter 2019. Many countries around the world implicitly (or explicitly) include an indirect tax related to storage in their overall fuel taxes. As such, Australia should consider some form of fuel tax to fund the extra storage infrastructure required. Indeed, given our relatively low fuel taxes, there is arguably plenty of scope to enact such a policy.

Based on fuel storage cost estimates from the IEA and Hale & Twomey, we show that a 0.7 to 1 cent per litre tax on refined fuel sales over 30 years is likely able to pay for the gap in storage capacity and allow Australia to meet its IEA fuel storage obligations. As a broad rule of thumb, a 1 cent tax is able to generate $600 million in annual revenue, based on consumption levels in FY 2019. Taking the 90-day reserve as a presumptive model, we expect meeting these requirements is possible using a 0.7 cent per litre tax on all petroleum product consumption. This will fund the solution described in key policy objective number 2 above.

Note that the 0.7 cents represents the upper range of the cost estimates of the IEA and Hale &Twomey. The 4,000 (ML) storage is estimated to involve an annual cost of $440 million per annum, which represents the upper range of the cost estimates of recent years. However, given the decline in interest rates and oil prices, the cost and ultimate fuel tax could be lower – but we have been deliberately conservative because of the considerable variation in cost estimates, which also depend on the location of storage. Storage near existing facilities (such as operating refineries) is less expensive. Using information from current industry sources, we estimate the upfront capital cost to build and stock (fill) 4,000ML of storage (with crude feedstock comprising 2/3 of the new storage and refined product the other 1/3) is around $4.7 billion. This assumes that all storage is at existing refineries and sites (which would be the cheapest option) and thus does not include the extra costs of locating refined products in green-field locations. It also does not include discounted cost of capital (7% over 30 years - see footnote 2 below). Adding these in, we believe, would bring the total overall cost close to the lower range of the IEA and Hale & Twomey estimates. As we have noted, this is one estimate – there is likely to be a range of cost estimates, which will depend on a range of factors.

It must be noted that the level of fuel excise tax in other taxes does little to capture the fact that general taxation of the community helps every other country in the OECD fulfil the public costs associated with their fuel security compliance. This means that whether it is instituted through a fuel excise tax or not, Australia is the only country in the OECD that does not meet their fuel security obligations.

Broadly speaking, we would expect many initiatives to support fuel security can be easily financed through such a mechanism. For instance, the estimated $1 billion investment required by the fuel refining industry to meet new petrol standards can be achieved by the imposition of a 1.66 cent per litre tax over only a 1 year period.[2] Given the $1billion investment is required by 2026, a 5 year period may represent a better policy. This would require a 0.42 cent tax per litre of fuel over the 5 years. This fuel tax will fund the solution to key policy objective number 1.

In terms of the key policy objectives numbers 3 and 4 (i.e. increasing the production of diesel and the proportion of indigenous crude processed by the refineries), we do not have an estimate of the value of investment required to meet these objectives. Similarly, the estimation of the quantum of infrastructure

[2] If the tax is imposed over a longer time period, this figure would be lower. $1 billion annualised at a standard 7% discount rate over an approximate 30-year lifespan is equivalent to $81 million per year. This is equivalent to a 0.14 cent tax per annum over 30 years – as a 1 cent tax is roughly equivalent to $600 million in annual revenue. Note that this 7% discount rate and 'lifespan' is a standard convention for CBA (cost-benefit analysis) and is used by both the IEA and Hale & Twomey in their analyses. If a lower discount is used the annual $ pay-off is lower, while a shorter lifespan will increase the annual $ cost.

and transport equipment spending required to improve interstate transport links is not available (and in any case is outside the scope of this paper). This includes any additional expenditure that may be specifically required to bolster storage and transport of fuels to remote defence facilities. The funding (or part funding) of the solutions to objectives 3, 4 and 5 could also be included in any increases to the taxes on fuel. However, given a mere 0.42 cents/litre over 5 years will raise $1billion, it could be argued that there is ample scope to fund the other objectives, which collectively and in combination with the solution to objectives 1 and 2, will substantially enhance Australia's overall fuel security.

As a minimum policy, the government should enact a revenue-raising policy to achieve funding for the first two objectives: immediately increase domestic fuel storage capacity by 4,000 ML and sustain the operation of all 4 domestic refineries. This involves Government purchasing the crude oil reserves to be stored in the storage units, which must also be placed adjacent to existing refineries to ensure maximum flexibility and adaptability during a crisis.

We note, however, that the direct consumer funding (via taxes) of the $1 billion investment required for the higher quality fuels does not necessarily ensure the ongoing operation of the refineries. As such, the provision of this funding will require guarantees and mutual obligations from the refineries themselves, regarding their ongoing operation. In any case, a government subsidy (either from the broader tax base or via hypothecated taxes) has a number of precedents, including motor vehicle manufacturing and renewable energy infrastructure.

Overall, the cost to consumers to fund objectives 1 and 2, via increased taxes on fuel (including diesel fuel used by the agriculture and mining sectors), is estimated to be around 1.2 cents per litre. This includes 0.73 cents per litre (over 30 years) to fund the immediate construction of 4,000 ML of storage facilities; and 0.42 cents per litre (over 5 years) to fund the approximate $1 billion in funding required to meet the higher fuel standards.

A 1.2 cent per litre tax on petrol and diesel would represent a 0.8% increase in the average fuel price of $1.40 per litre – which is equivalent to the pre-COVID average prices for past 3 years and also the forecast average price expected over the next six years. In terms of the impact on household spending, automotive fuel accounts for 3.6% of household spending, so a 1.2 cent per litre tax would equate to an extra 0.03% addition to annual household budgets and to the Consumer Price Index (CPI). There would also be a minor addition to indirect costs if the extra freight costs from higher diesel prices was passed on to final retail prices, although this is likely to be under 0.1%. The overall impact on households from addressing the first two objectives is under a mere 0.1% on the CPI and average household expenditure. It should also be noted that a 1.2 cents/litre impost is in the range of weekly price movements for many suburban petrol stations.

Given the very low impact on households from addressing the first two objectives, it is apparent that there is scope to raise funding from a higher impost on fuel to address some or all of the other necessary objectives. Indeed, if a 5 year period was chosen for objective 1, the tax could be left unchanged in order to fund other policies which will help maintain the operation of the Australian refineries and further enhance fuel security.

It should be noted however that Australia's overall tax raising to meet fuel security obligations is the lowest across OECD countries. Whether taxes are raised directly through a fuel excise, or through general taxation, consumers inevitably contribute to the enhancement of fuel security and community welfare in Australia.

Critically, the immaterial increase on petroleum price costs – 1.2 cents per lite – remains well within the weekly fluctuations of the petroleum price driven by global fuel prices, ironically also driven by geopolitical tensions that bear on oil supply forecasts. The mild revenue capture also insures the consumer against significant price hikes in the event of a crisis, where Australia will remain independent of overseas geopolitical posturing due to sourcing fuel prices from its own fuel stocks.

2. INTRODUCTION & SCOPE

2.1 BACKGROUND

On any reasonable measure, Australia has inadequate reserves of liquid fuel (i.e. crude oil and refined petroleum products) that it can immediately draw upon in a situation of an unforeseen national crisis. Our heavy reliance on imports of both crude oil feedstock and refined products and lack of domestic storage means Australia is exposed to the danger of serious fuel shortages in a crisis, particularly if imports were disrupted, say by a shipping crisis or an armed conflict which impacts on major shipping routes.

The liquid fuel security has worsened over recent years with the closure of 3 domestic refineries since 2012. Despite a number of enquiries and reports to government over the past decade, the government has been slow to act to the obvious threats to Australia's fuel security. The Australian (Commonwealth) Government's implicit policy was to rely on the 'market' (i.e. commercial operators) to provide reliable storage and supply. This policy has led to a situation where Australia only has just over 50 days of stocks relative to net imports – well below the International Energy Agency's minimum 90-day rule (making Australia the only non-compliant member) – while the stocks-to-consumption ratios are down to only around 25 days of consumption.

Recently, however, the advent of COVID-19, rising tensions between the superpowers of China, USA and India and increasing tensions in the South China sea has seen the government belatedly recognise the problem, stating that "the COVID-19 pandemic has highlighted limited flexibility in the fuel storage market in Australia where the fuel supply and demand balance changes suddenly."[3] It has now started a process to raise the security of Australia's fuel supply and storage.

2.2 SCOPE

In light of the above background, BIS Oxford economics was approached by the Australasian Refineries Operatives Committee (AROC) to provide a paper to investigate the benefits of different policies including:

1. Government acts as principal agent in the bulk purchase of fuel
2. Supporting the domestic fuel refining sector

To understand the costs and benefits of both of these policies – and other possible policies – the investigation and analysis involved the following tasks, which are documented in the following chapters of this report:

- A description of the economic context of the fuel refining industry in Australia. This includes employment, the value of production, types of fuel consumed, produced, imported/exported and the local market share. Forecasts of consumption, production and imports are also undertaken, including an analysis of the impacts of the current COVID-19 crisis. An important element will be an input/output analysis to identify the significance of the refining sector in the Australian economy, including upstream and particularly downstream users, such as the local petro-chemical and pharmaceutical industries. The input/output analysis will be used to compare the economic and employment outcomes from supporting the domestic fuel refining sector with the alternative of further shutdowns of Australian refinery capacity, notably for the refineries operated by BP, Caltex, Mobil and Viva Energy. This is covered in section 3.

[3] Department of Industry, Science, Energy & Resources 'Opportunities to Increase Australia's Domestic Fuel Storage Capacity'. Request for Information (RFI), June 2020

- Desk research and reading of reports covering the International Energy Association framework; Australia's lack of compliance with the IEA obligations, reviewing the government's publications in its ongoing liquid fuel security review and researching other publications on the fuel security issue. To supplement the discussion on Australia's position, we will provide a brief discussion of the compliance of other countries with the IEA framework, focusing on New Zealand, Japan, and the United Kingdom. This is covered in sections 4 and 5.

Sections 6 and 7 analyse possible policy end-goals and options aimed at improving Australia's liquid fuel security. This includes a broad overview of the overall costs of supporting the continuation of the current refineries (or even supporting an expansion of the local refining industry) versus the costs of the industry shutting down. Also examined are the potential funding options to ensure the costs of expanding storage capacity are shared equitably, including the pros and cons of two broad tax options: Ultimately, any taxes on the fuel supply chain would get passed on to end-users. Thus, it is a question of the implications of a 'user pays' tax against a more general tax that is not aimed explicitly at fuel users. While the former – so called hypothecated taxes – are often viewed more favourably by consumers, there are equity and competition factors that need to be considered. This section examines a model where the federal government underwrites the initial construction of the storage facilities and recoups the initial investment by way of taxes on consumers and industry. Given the above analysis and policy objectives, we will provide a set of recommendations that best achieve the identified policy goals.

3. INDUSTRY OVERVIEW AND ECONOMIC ASSESSMENT

In this section we detail the size of the fuel refining sector, examine the structure of the industry and import competition, and assess the outlook for the sector.

3.1 DEMAND, SUPPLY & INDUSTRY STRUCTURE

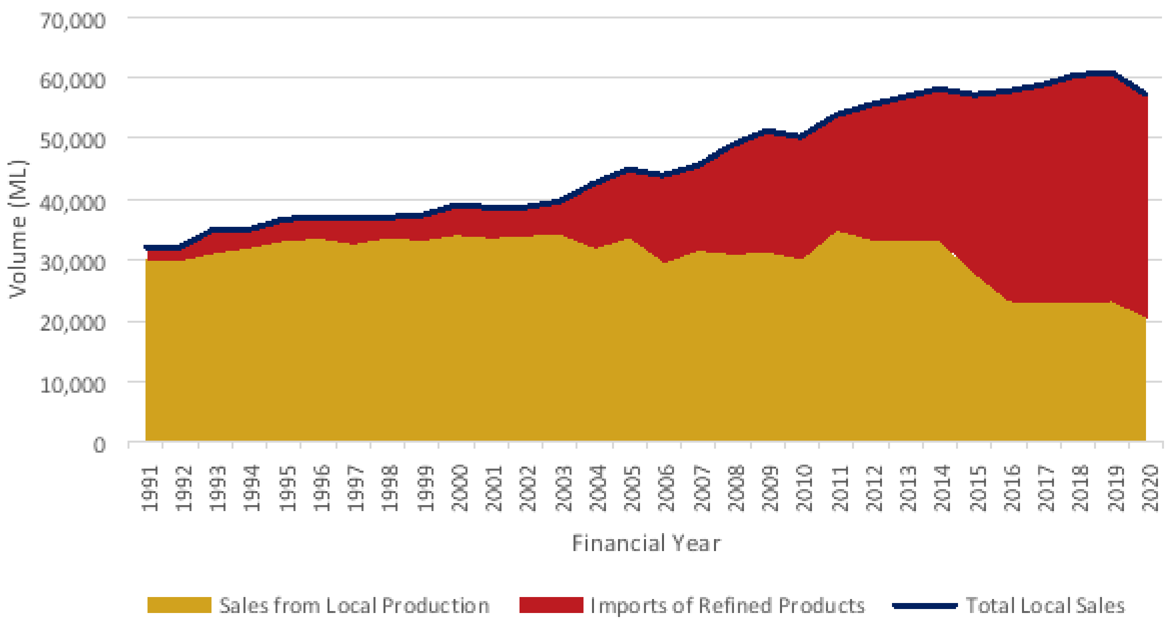
3.1.1 Australian Refineries are under pressure

Australian demand for refined fuels totalled 60,600 ML in FY2019 and has been growing at a moderate average pace of 1.5% per annum since FY2011.

Refinery shutdowns in recent years including Bulwer Island (in 2015), Kurnell (in 2014), and Clyde (in 2012) have seen a collective loss of almost 19,000 ML worth of refining capacity. This has resulted in exceptional growth in refined fuel imports to meet the growing demand. Imports of refined petroleum products grew from 17,400 ML in FY2011 to 36,000 ML in FY2019 – a compound annual growth rate of 9.5%.

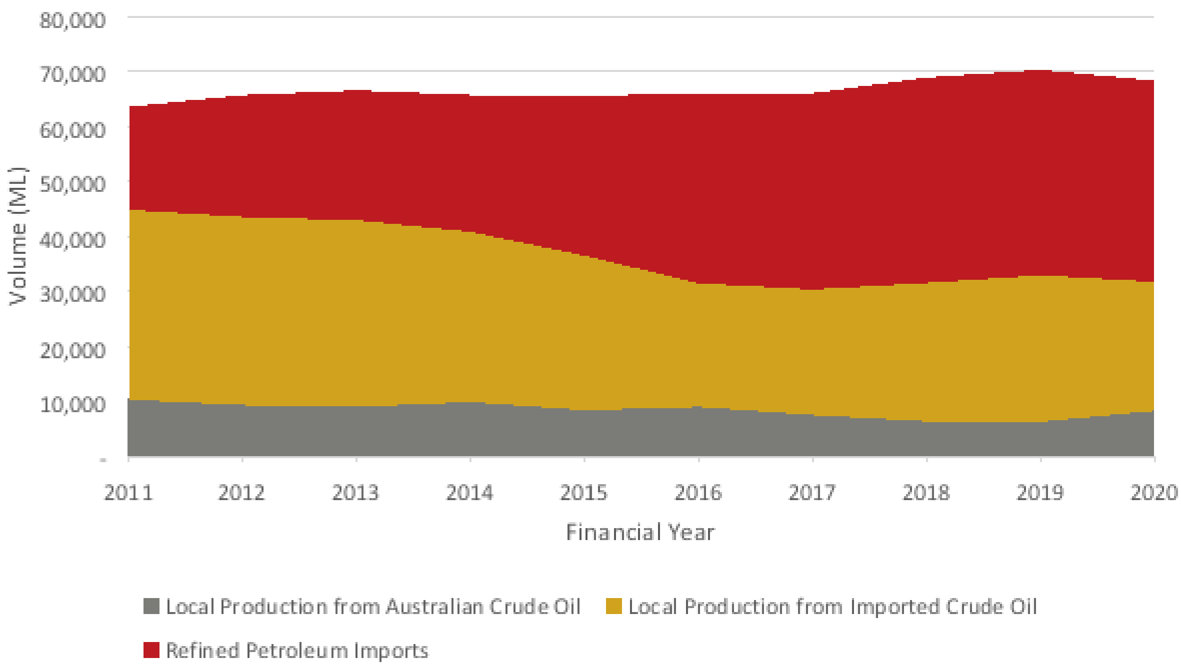
It has been increasingly difficult for domestic refineries to compete with the mega-refineries in China, Saudi Arabia, India and Singapore. This had seen the industry experience soft refining margins over recent years. The slump in global demand over recent months due to COVID-19 has exacerbated the outlook, with widespread financial losses being reported. Caltex and Viva Energy have warned of risks to refineries without government support.

Figure 3.1 Local Sales Vs Imports



Source: BIS Oxford Economics, Australian Petroleum Statistics

Figure 3.2 Local Production: Sources of Crude Oil Feedstock Vs Refined Imports



Source: BIS Oxford Economics, Australian Petroleum Statistics, Office of the Chief Economist

At present, Australia has 4 active refineries, two based in Victoria and one based in each of Queensland and Western Australia.

Based on (pre-COVID-19) data from financial reports and company websites, we have compiled an overview table below. Note that the 'direct' employment numbers supplied by individual refineries understate the overall employment directly related to the refineries, as large sections of the workforce include contractor labour and other specialists not directly employed by the refinery. ABS data shows that the Petroleum Refining sector employs around 5,000 people.

Table 3.1 Australian Refineries

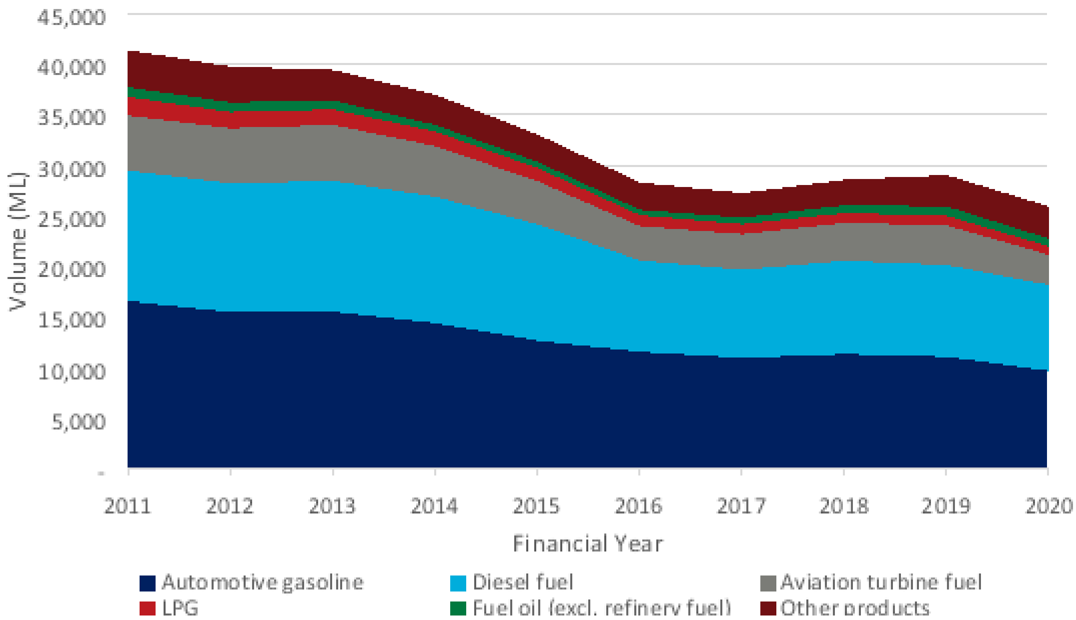
	Altona	Geelong	Lytton	Kwinana
Owner	ExxonMobil	Viva Energy	Caltex	BP
Location	Victoria	Victoria	Queensland	Western Australia
Open Date	1949	1954	1965	1955
Capacity	5,000 ML/y	7,500 ML/y	6,500 ML/y	8,600 ML/y
Employment	~350	~700	~700	~700

Source AIP, ExxonMobil, Viva Energy, Caltex, BP

Refined fuels in Australia tend to be produced in a relatively consistent mix given the class of crude typically used as an input. However, given the requirements of domestic refineries do not match the characteristics of local crude production or due to the distances involved in using crude from the other side of the country, the majority of refinery inputs are imported from overseas. In FY19, local refineries sourced only 19% of their crude oil feedstock from indigenous production, a proportion that had been falling over recent years. Meanwhile, around 80% of local crude production is exported, including the typically sweet crudes (low sulfur content) produced offshore in north west and northern Australia. While there are historical, commercial and logistical reasons for this imbalance, one key reason is that Australian refineries are not geared to process the increasing volumes of condensate that is being produced in the oil and gas fields of northern Australia.

These estimates indicate that without significant storage of compatible crude oil, Australia's refineries will not be able to reliably depend on local crude sources, exacerbating security risk.

Figure 3.3 Australian Refinery Production by Fuel Type



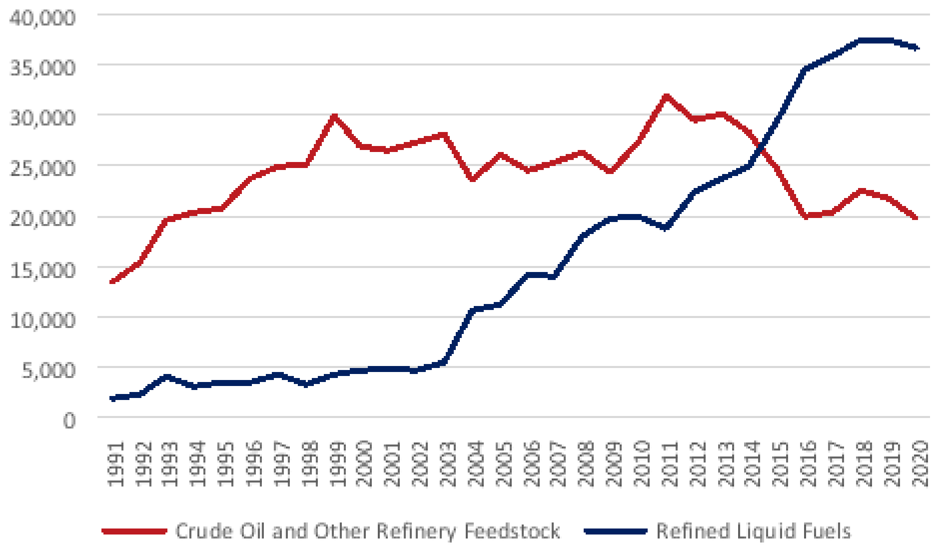
Source: BIS Oxford Economics, Office of the Chief Economist

3.1.2 Imports – Half of Refined Imports being from North Asia is a Risk

The need for local refineries to use imported fuels has meant that crude imports have typically tracked local refinery output. However, as domestic refineries have shut down and refined imports have increased, crude oil imports have become a smaller share of the overall pie.

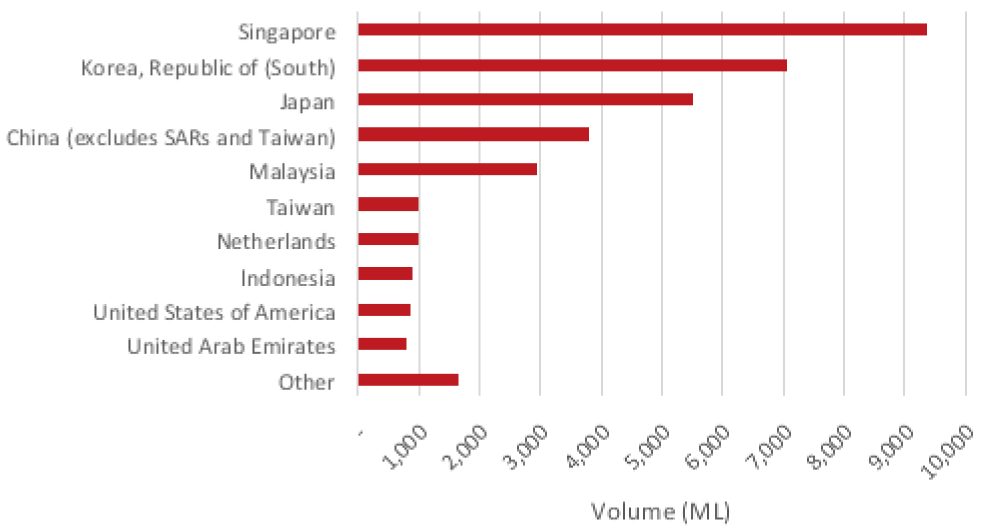
Crucially, the countries from which Australia imports refined fuels are much more geographically concentrated than the countries from which Australia imports crude (see figures 3.5 and 3.6). Around half of all refined imports come from countries in North Asia which depend on transport links through the South China Sea (with South Korea and Japan accounting collectively for 35% of refined imports and China and Taiwan a further 11% and 3% respectively in FY19). Over recent months, the geopolitical risks associated with the South China Sea and with China itself have been increasing. This has been identified as increasing risk to Australia's fuel security. Singapore was the biggest single source, accounting for over 26% of refined imports. However, it should be noted that Singapore sources a large proportion of its crude oil from the Middle East. The trade route from the Middle East oil suppliers is, in turn, dependent on the absence of military hostility in important trade routes such as the Strait of Hormuz, which is typically at risk from military interference by foreign powers. On the other hand, crude imports into Australia is sourced from a more diverse set of countries in Asia, the Middle East and Africa (figure 3.6).

Figure 3.4 Crude vs Refined Fuel Imports (ML)



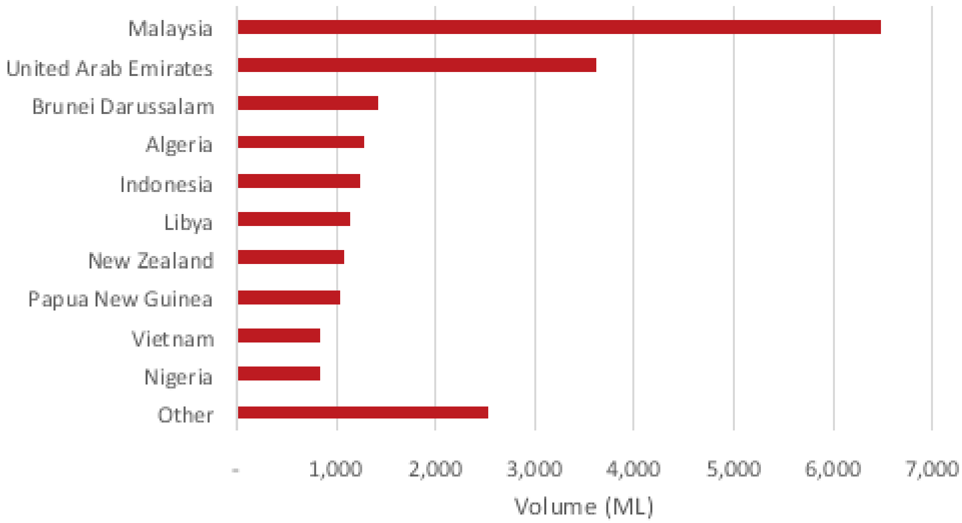
Source: BIS Oxford Economics, Office of the Chief Economist

Figure 3.5 Refined Oil Imports by Trading Partner FY2019 (ML)



Source: BIS Oxford Economics, ABS

Figure 3.6 Crude Oil Imports by Trading Partner FY2019 (ML)



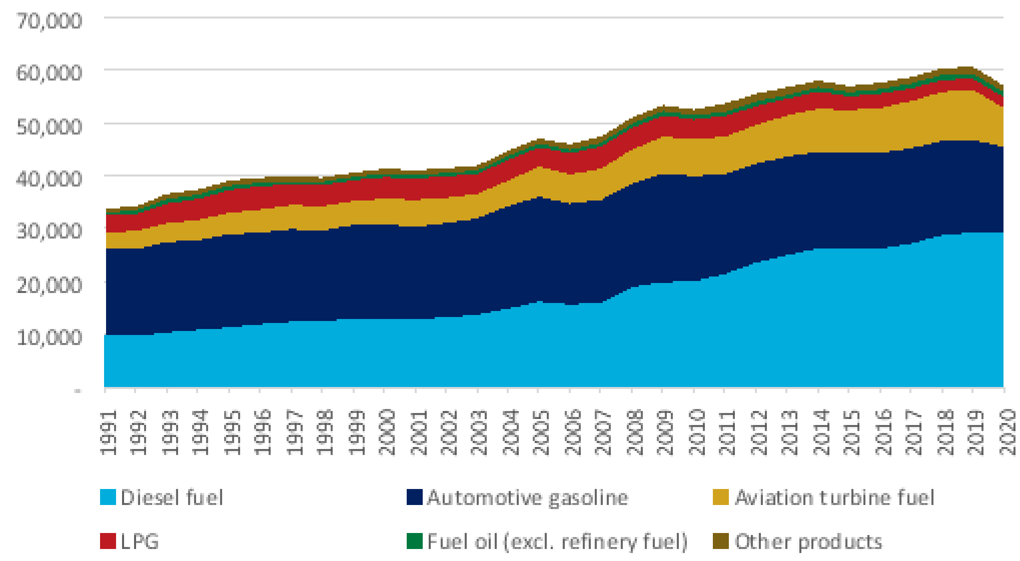
Source: BIS Oxford Economics, ABS

3.2 DEMAND

In FY2019, a total of 60,600ML of liquid fuel was consumed in Australia, where diesel fuel consisted of 44% of this demand and automotive gasoline and aviation turbine fuel made up the bulk of the remainder, totaling 26% and 15% respectively. The remaining 16% consisted of LPG and other refined products.

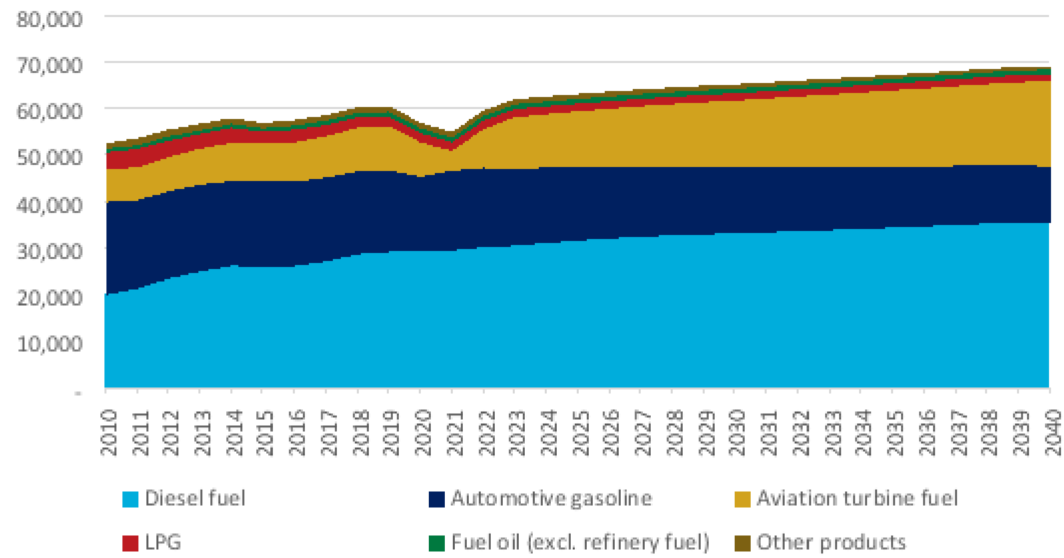
Australia's demand for liquid petroleum fuels has been growing at a slow pace. Despite strong growth in transport demand and industrial consumption, fuel efficiency gains have limited the overall pace of growth in fuel demand.

Figure 3.7 National Fuel Sales by Product (ML)



Source: BIS Oxford Economics, Australian Petroleum Statistics

Figure 3.8 National Fuel Sales Forecasts by Product (ML)



Source: BIS Oxford Economics, Australian Petroleum Statistics

3.2.1 COVID-19 Impact has been More Severe on Local Refineries compared to Imports

The spread of COVID-19 resulted in extreme shocks to the economy and impacted heavily on the demand for fuel. The latest data from the 'Australian Petroleum Statistics' (May 2020, Department of Industry, Science, Energy and Resources) showed that total sales of petroleum products were down 31% (year/year) in April 2020 compared to April 2019. A modest recovery occurred in May, but overall sales were still down 23% y/y compared to May 2019.

Motor vehicle use followed a 'business as usual' pattern until mid-March before falling significantly as lockdowns began. Automotive gasoline sales were down 43% y/y in April, improving somewhat to be 26% down y/y on May 2019 sales. This tallies with Apple Mobility data released daily, which suggests Australian passenger travel fell approximately 50% by mid-April but has rapidly recovered as the infection rate eased. Presently, apart from Melbourne (due to a second phase of lockdowns), major Australian cities have largely reverted to a 'normal' level of car use. However, we note there are notable risks of a second lockdown in NSW following the imposition of stage 4 measures in Victoria.

Diesel sales, although less affected, were down 10% y/y in April, but improved to be only 6.5% lower in May 2020, compared to May 2019. This also tallies with the Transurban traffic data, which also showed diesel demand appearing to have fallen less than petrol but may be taking longer to recover. Toll road data suggests that heavy vehicle traffic declined to approximately 87% of normal levels in April but has yet to recover as has occurred in the passenger vehicle space. This suggests that diesel demand is taking longer to recover than petrol demand as Trucks/Heavy Vehicle use lags behind the recovery in cars, and light commercial vehicles.

Aviation fuel demand has suffered an extreme fall as a result of COVID-19. Consumption has historically consisted of a 60%/40% split between international and domestic travel. With highly restricted international travel into and out of Australia, and many state borders closed, the impact of COVID19 on the consumption of aviation turbine fuel has been significant. Jet fuel sales in May are down 76% from the same time last year. Reduced travel, and therefore aviation fuel consumption is likely to take years before a return to normal. The industry expects prolonged weakness, especially for international travel. Qantas announced the grounding of its entire A380 fleet until mid-2023 as it expects international travel to reach only 50% of its pre-pandemic level in FY22.

The latest data from the APS and other information indicated that local production from the refineries has fared much worse than imports. Refineries in Australia have entered temporary shutdowns as a result of the low margin environment – Caltex has brought forward its planned shutdown/maintenance program at the Brisbane Lytton refinery but extended the shutdown to 4 months rather than the originally planned 2 months. Viva Energy and Mobil have scaled back production at the Geelong and Altona plants respectively. As a result, in May, overall production fell to its lowest level on record. The APS data shows that overall production of petroleum products was down 40% y/y in May, after a 22% y/y slump in April. This compares unfavourably to the 15% and 17.5% decline (in May and April respectively) in imported petroleum products.

The COVID19 impacts on refinery profitability have also seen some of the refineries slash or defer critical maintenance programs, which may affect future viability and reliability. Viva effectively halved the extent and budget of its major maintenance 'turnaround' program at the Geelong refinery, while also extending some aspects into 2021. BP has deferred a major turnaround at the Kwinana refinery, which was previously scheduled for early 2021 to late 2021. The danger here is that any delays to critical maintenance schedules leaves the refineries more prone to breakdowns (and thus increased costs) and compromises fuel security.

3.2.2 Outlook

Automotive Gasoline

Petrol in Australia made up the largest class of refined petroleum sales until the early 2000s. Improvements in fuel efficiency reduced the potential for demand growth while a shift to diesel emerged in the passenger and light commercial vehicle market. On top of this, strong growth in freight and industrial uses further increased diesel demand, reducing the prominence of petrol in the overall market.

Our forecast of petrol demand is based on rising motor vehicle use with adjustments for motor vehicle fuel efficiency based on latest international standards and electric vehicle penetration.

More stringent rules on emissions (NEDC standards) as well as fuel economy in Europe and elsewhere (eg, Corporate Average Fuel Efficiency Standards in the US) will mean that motor vehicles sold in Australia (a much smaller market) are likely to feature similar efficiency improvements. While at present Australia may not be able to import some of the more highly fuel-efficient vehicles due to local petrol standards, we expect this is only likely to delay inevitable market pressure. New low sulfur fuel standards in Australia are currently expected to come into force in 2027, which is expected to require around $1 billion of investment across the 4 existing refineries in order to upgrade their processes to comply with the new standards.

Based on these global efficiency standards, and the likely pace of electric vehicle penetration, we expect petrol demand in Australia to fall over the next 20 years and beyond. We expect growth in population and mobility requirements is unlikely to outpace the rise in fuel efficiency in the passenger and light commercial vehicle space.

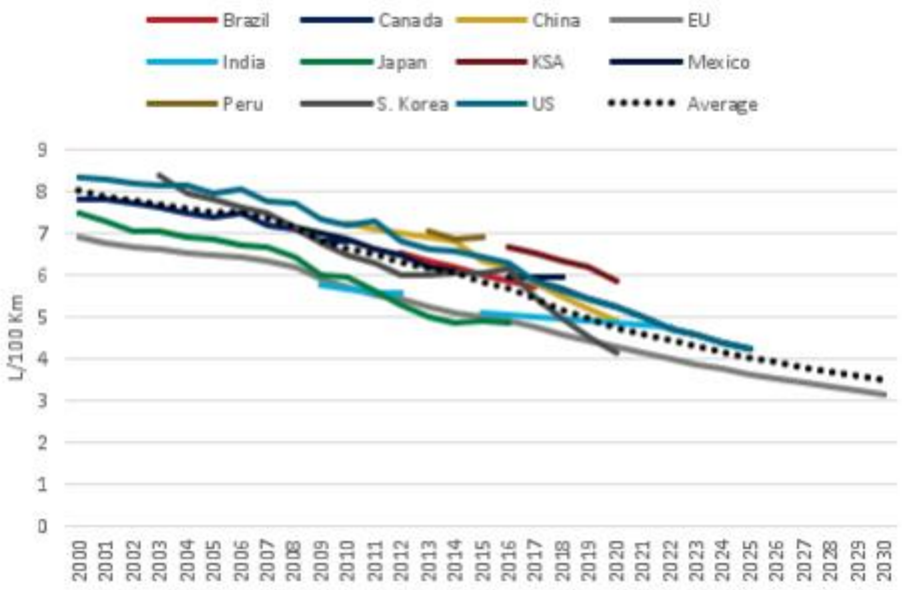
Electric Vehicles and Fuel Security

Many have argued that electric vehicle uptake will reduce liquid fuel security needs. Indeed, we believe a comprehensive fuel security policy should support a shift towards alternative fuels. This is because managing the demand for petroleum fuels reduces the fuel security investment required elsewhere.

Improvements in fuel efficiency and a likely ramp up in electric vehicle penetration in the 2030s and beyond (see figure 3.10) is expected to ease many of the fuel security concerns facing households over the decades that follow. But over the next 5-10 years, automotive gasoline demand will still stay elevated, given that the penetration of EVs will be under 10% until the early 2030s. This means a continued reliance on local fuel production and imports until well into the 2030s.

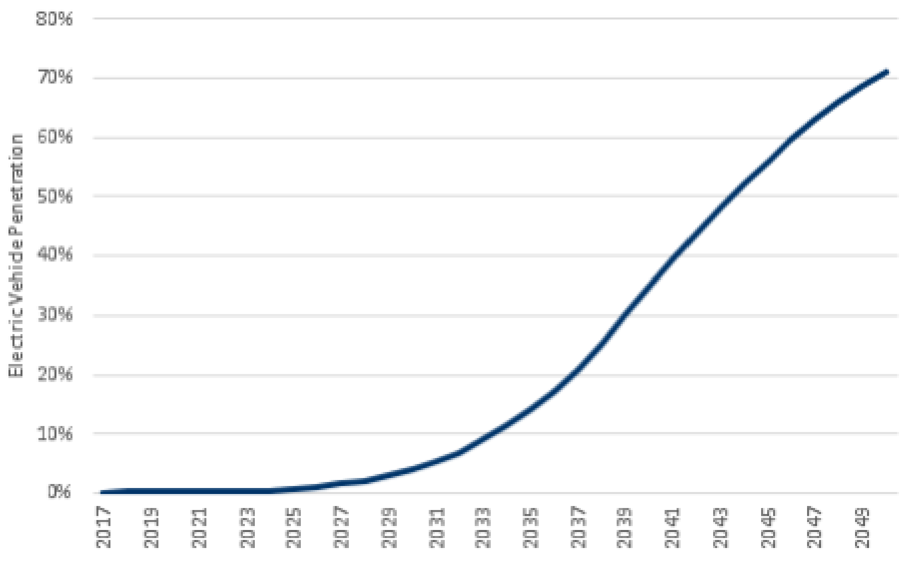
However, we note the effect of rising EV penetration is focused on the market for automotive gasoline, as opposed to diesel and jet fuel demand. We expect industrial demand (mainly diesel) and aviation demand will take longer to transition to alternative fuels. Fuel security investment is still critical for these fields over the near to medium term, even with a strong fuel transition policy.

Figure 3.9 Mandated Fleet Efficiency Improvements by Country



Source: BIS Oxford Economics, ICCT

Figure 3.10 CSIRO/AEMO 2018 Base-Case Electric Vehicle Penetration Projection

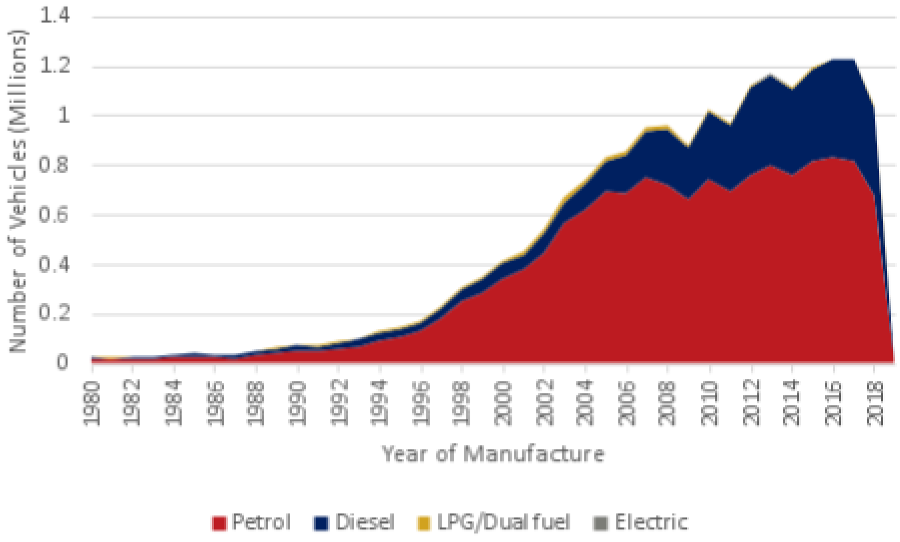


Source: BIS Oxford Economics, AEMO

Diesel

Diesel has been the primary driver of petroleum sales growth over the last 20 years. The majority of this growth has been related to strong growth in freight and industrial uses (notably mining) and comparably smaller efficiency improvements in comparison to light passenger vehicles. The increased prominence of passenger diesel vehicles (as demand for SUVs and utes has increased) has also been a driver.

Figure 3.12 Stock of Vehicles by Year of Manufacture and Fuel – Total Australia



Source: BIS Oxford Economics, ABS

Our outlook for Diesel sales growth at a national level is based primarily on Australia's economic outlook which is tied to demand for freight and industrial uses. One reason for this is because Australia's diesel demand contains a direct link to the fixed consumption margin population growth. For instance, a greater population requires greater food supplies, transport services capacity, health services, and more.

Continued growth in heavy vehicle use combined with milder fuel efficiency improvements is expected to drive ongoing growth in diesel demand over the next 20 years. EV penetration is likely be more drawn out for the heavy vehicle sector as the technology matures in the passenger vehicle space.

Aviation Turbine Fuel

As COVID-19 restrictions ease, we expect air travel to return to a near normal within the next 3 years.

Longer-term, air travel is expected to grow rapidly, driven by factors relating to population growth and wealth. Australia's increasing foreign born population will see significant increases in visitation rates of friends and family, while increasing wealth in Asia sees stronger tourism activity more generally. We expect jet fuel demand will likely be the fastest growing category of refined petroleum over the outlook period.

Other Fuel

The remaining refined liquid petroleum consist of several other types of fuel, the most substantial volumes being LPG, aviation gasoline and fuel oils. Broadly, we expect demand for other fuels to fall, primarily due to LPG. LPG sales are expected to fall significantly as the last of the stock of LPG vehicles are retired – automotive LPG use has halved from 1,300 ML in FY2016 to 600 ML in FY2019 and further steep declines are expected.

3.2.3 Supply Implications – Risk of Further Refinery Shutdowns

Supply and demand imbalance issues may increase the risk of further shutdowns in the local refining sector. Contraction in demand for automotive gasoline combined with strong demand for diesel and aviation fuels will cause local production to be overweight on petrol and underweight on aviation and diesel fuel.

Given the local production mix has been relatively stable, possibly due to the class of crude used by refineries, it would eventually be necessary for local refineries to find export markets for petrol if they are to remain in operation. This is because local demand for petrol is in decline and is likely to fall below current levels of local refinery output after 2040. This should be an area of concern for local refineries given the strong competition from overseas.

At the same time, imports would likely grow to support demand for aviation and diesel fuel as local refineries would be unable to produce enough of to satisfy local demand.

The current market context places notable constraints on the supply chain and highlights key risks. Most notably, refineries have entered temporary shutdowns because of low prices and the unbalanced nature of the pandemic - too much jet fuel is being produced and plants are having difficulty storing that output or shifting a large proportion of their jet fuel production into diesel output.

3.3 SIGNIFICANCE OF THE REFINING SECTOR IN THE AUSTRALIAN ECONOMY

The fuel refining sector makes up a relatively small share of GDP in Australia but has significant linkages to other sectors relative to its size.

We used ABS input output tables to assess the significance of the fuel refining sector in the Australian economy. The ABS groups petroleum refining and coal product manufacturing together in its sector classifications. However, we note that the former makes up the vast majority of activity in the sector.[4]

Our analysis shows that the refining sector makes up 0.36% of the overall GDP, which suggests the sector has contributed approximately $6.7 billion of direct value added in the economy in FY2018 and employed 5,520 people (see table 3.3). More recent Australian Industry data for FY2019 from the ABS indicates that the sector directly employs around 5,000 people.

To estimate employment in the broader ‘refining economy’, we calculated the share of each industry’s GVA that is generated by final demand for fuel refining. This helps us to identify the indirect employment and value added in the economy that is related to servicing demand for refined products.

The industry competes with and relies on overseas inputs to a greater degree than most other industries in the Australian economy. We estimate every dollar of final demand for refined products in Australia only contributes 53 cents to Australian GDP, with 47 cents contributed to the GDP of trading partners. This means that demand for refined petroleum is met by imports to a large degree – whether this is via direct imports of refined fuels or via imported inputs to the refining process (crude imports). Most other products in Australia have significantly higher levels of local production and contribute more to local GDP.

Despite this, demand for refined fuels supports significant employment in Australia. While the refining sector itself is a relatively small employer for its level of output, activity linked to the refining sector employs many more people per unit of output.

[4] Based on ANZSIC employment categories, fuel refining comprises around 80% of employment in the petroleum and coal product manufacturing industry.

Table 3.2 The Share of Australia's Economy tied to Petroleum Refining

Industry Composition of Petroleum Refining Economy Estimated share of nominal GVA, per cent - FY2018	
Total	
Total Petroleum and Coal Refining Economy	**0.48%**
Of Which:	
Petroleum and Coal Product Manufacturing	**0.36%**
Activity Related to Petroleum and Coal Product Manufacturing	**0.12%**
Of Which:	
Mining	0.02%
Professional, Scientific and Technical Services	0.01%
Rental, Hiring and Real Estate Services	0.01%
Transport, Postal and Warehousing	0.01%
Financial and Insurance Services	0.01%
Wholesale Trade	0.01%
Electricity, Gas, Water and Waste Services	0.01%
Manufacturing	0.01%
Administrative and Support Services	0.01%
Other Services	0.00%
Other	0.02%

Source: BIS Oxford Economics, ABS

Our analysis shows that 0.12% of value added in the economy is activity related to refining – this includes most notably, a fraction of the mining/resource extraction industry and the professional services sector, both of which provide significant inputs to the refining sector. Based on this, if we assume that the productivity of workers in an industry is consistent whichever its associated industry is, we estimate that approximately 13,800 people are employed in businesses that indirectly service final demand for refined products.

The sector is supporting significantly more employment and economic activity than is implied by its direct GDP contribution.

Table 3.3 Employment and Value of Production in Australia tied to Petroleum Refining

Industry Composition of Petroleum Refining Economy Employment
FY2018

	Share of industry GVA linked to the petroleum refining economy	Industry share of total employment	Petroleum refining economy employment (share of total employment)	Total employment related to the petroleum refining economy	Total GVA related to the petroleum refining economy ($ Million)
Petroleum and Coal Product Manufacturing	**100%**	**0.04%**	**0.04%**	**5,520**	**6,741**
Other industries	**0.13%**	**88.62%**	**0.11%**	**13,840**	**2,159**
Agriculture, Forestry and Fishing	0.04%	2.1%	0.00%	117	20
Mining	0.23%	1.6%	0.00%	442	346
Manufacturing	0.11%	5.4%	0.01%	735	109
Electricity, Gas, Water and Waste Services	0.35%	0.9%	0.00%	391	164
Construction	0.06%	7.5%	0.00%	562	86
Wholesale Trade	0.24%	2.7%	0.01%	798	169
Retail Trade	0.06%	9.4%	0.01%	647	43
Accommodation and Food Services	0.13%	6.7%	0.01%	1,088	56
Transport, Postal and Warehousing	0.21%	4.3%	0.01%	1,127	181
Information Media and Telecommunications	0.17%	1.4%	0.00%	292	74
Financial and Insurance Services	0.11%	3.3%	0.00%	455	178
Rental, Hiring and Real Estate Services	0.10%	1.6%	0.00%	205	218
Professional, Scientific and Technical Services	0.20%	7.1%	0.01%	1,725	247
Administrative and Support Services	0.16%	3.4%	0.01%	673	98
Public Administration and Safety	0.06%	6.5%	0.00%	520	61
Education and Training	0.01%	8.3%	0.00%	145	12
Health Care and Social Assistance	0.00%	12.0%	0.00%	26	2
Arts and Recreation Services	0.03%	1.6%	0.00%	60	5
Other Services	0.27%	2.9%	0.01%	999	89
Total Petroleum and Coal Refining Economy	-	-	**0.16%**	**19,360**	**8,900**

Source: BIS Oxford Economics, ABS

3.4 THE POTENTIAL COSTS OF REFINERY SHUTDOWNS

A shutdown of the local fuel refining sector would see a direct contraction of $6.7 billion or 0.36% of overall GDP as well as a potential drop in employment of over 5,000 people. This includes a $32 million fall in associated payroll and fringe benefits tax revenues for the Commonwealth and state governments.

The capital infrastructure at Australia's existing refineries enhance fuel storage capacity due to stockholding captured in processing units. Refinery shutdowns would significantly worsen at Australia' fuel security, and require further storage capacity to be built and paid for.

In addition to this, there may be upstream (refinery input) and downstream (refinery output) effects.

Our analysis shows that $2.2 billion of value added in the economy (0.12% of GDP) with an associated employment of 13,800 is related to businesses providing inputs to service the final demand for refined products. This includes the crude inputs to the refining process, the consultant labour provided, the real estate and transport services among other inputs. In the event of refining shutdowns, this implies that much of this employment and $2.2 billion in value add may be at risk if these businesses are unable to pivot to servicing overseas or imported fuel demand, or other sectors of the economy.

Overall, up to a total of 0.48% of GDP – or $8.9 billion – and up to 18,800 jobs are at risk from a total shutdown of the Australian petroleum refining sector.

Added to this are the negative impacts on businesses that use the refinery outputs (see table 3.4). This includes the chemicals and pharmaceuticals sectors which often rely on petroleum by-products from the Australian refineries. This includes companies such as LyondellBasell and Qenos, who are respectively the only domestic manufacturers of polypropylene and polyethylene in Australia. LyondellBasell sources its propylene feedstock from local refineries and petro-chemical plants. In turn, these companies are key suppliers of these plastics and other feedstocks to a range of companies, such as Indorama and Dow chemicals, Domestic packaging companies are also heavily reliant on this supply chain, such as Amcor, with packaging in turn a key indirect input to the food and beverage sectors. If these companies that rely directly on the domestic petroleum refineries had to import these by-products and other refinery outputs as a result of a shutdown, it is likely that they will be exposed to increased transport costs for the (previously locally provided) refinery outputs and higher prices for these refinery outputs, which could have flow on effects to other downstream industries. It should not be underestimated that if the import of these inputs induced a cost increase, it could put significant pressure on the viability of these existing facilities – which have already endured significant increases in local gas prices over recent years, and pushed several companies to the brink of closure. Indeed, any disruption to key suppliers of companies like LyondellBasell and Qenos would have significant ramifications for the overall plastics and chemicals supply chain, and ultimately lead to a further 'hollowing-out' of Australia's manufacturing industries.

Of course the biggest potential cost to the downstream users of the domestic refining sector is the increased exposure to heightened fuel security considerations, as they would have to rely more on refined petroleum imports. As we have identified above, around half of these imports now come through the increasingly unstable South China Sea. These are likely to be the most prominent for many downstream businesses (among the prominent industry sectors in table 3.4) because they rely on fuel as a key input to deliver their goods and services (via the transport sector) or because fuel and other petroleum products are a key input into the production processes, such as in agriculture, mining and construction (e.g. bitumen) .

It is clear then that fuel security has implications for a range of sectors, most critically the transport, agriculture, manufacturing and mining sectors. Fuel security in Australia is therefore intrinsically tied -

and is critical - to the nation's food security and its economic security more broadly. In simple terms, if there is no fuel – particularly diesel – much of agriculture and mining production will grind to a halt, while the supply chains necessary to supply industries, construction sites, businesses and household goods will be seriously impacted.

The ongoing reliability of transportation required for health services and food supplies is a critical factor in servicing our communities and preserving the welfare of Australians. The remaining Australian refineries are located sparsely (with the exception of Victoria), where refineries and their locations have considerable bearing on the reliability of access to petroleum products in those regions. If a refinery were to close in any state, extra storage capacity would need to be built, and that storage would likely require refined petroleum due to the absence of a processing facility. This challenges the flexibility of fuel supply in the event of a crisis, which is integral to preserving our fuel security,

Australia's entire defense capabilities, including its maritime, ground and air force fleet, depend significantly on refined diesel and petroleum fuels. Particularly, the location of certain refineries have a significant bearing on the accessibility of fuel for different facets of our defence forces. Operations in Western Australia for instance rely on BP Kwinana and the shipping routes around the West coast. If those routes were compromised due to the closure of BP Kwinana, and/or fuel became generally less accessibility, there would be adjustments required for the location or infrastructure that service our defence force.

Table 3.4 Downstream Reliance on Refined Fuels

Industry Reliance on Petroleum Refining Outputs
Share of final demand contributed to refining GVA, per cent - FY2018

	Total Refining Utilisation
Agriculture, Forestry and Fishing	1.43%
Mining	0.99%
Manufacturing	1.04%
Electricity, Gas, Water and Waste Services	0.44%
Construction	0.87%
Wholesale Trade	0.46%
Retail Trade	0.30%
Accommodation and Food Services	0.36%
Transport, Postal and Warehousing	2.64%
Information Media and Telecommunications	0.51%
Financial and Insurance Services	0.18%
Rental, Hiring and Real Estate Services	0.09%
Professional, Scientific and Technical Services	0.28%
Administrative and Support Services	0.22%
Public Administration and Safety	0.36%
Education and Training	0.19%
Health Care and Social Assistance	0.19%
Arts and Recreation Services	0.38%
Other Services	0.31%

Source: BIS Oxford Economics, ABS

Refineries' Skill Base Will Support Future High-tech Energy Industries

Apart from the direct and indirect losses in economic activity and employment from a shutdown of domestic refineries – and the worsening of fuel security – the loss of the skill base in the petroleum manufacturing sector would significantly hamper the development of new alternative and future energy and other industries. These industries include hydrogen-based energy, which is potentially an important replacement for petroleum-based fuels in Australia and could be a major export industry. There are also other energy technologies now under development and those yet to be developed.

The domestic petroleum manufacturing sector contains a high proportion of highly skilled professionals and specific trades workers, many with specialist skills who have unique skill sets which can be harnessed for the emerging energy technologies. 2016 Census data (which has the highest degree of detail available) show that the sector has just over half of its workforce classified as 'professionals' or 'technicians and trade workers', according to ABS occupation classifications (see table 3.5). This is a very high proportion of such skilled workers in an industry. Given fairly stable employment numbers of around 5,000 persons since 2016 (the last refinery closure was in 2015), it is likely the occupation structure is currently similar to the 2016 Census splits.

The preservation of the existing refinery capacity and therefore the skilled workforce will provide a key part of the requisite skill base necessary to transition from petroleum-fuels energy to hydrogen-based (or other alternative) fuels as the basis for transport and similar uses in the agriculture and mining sectors. However, should the domestic refining sector be shut down (and the skill base lost) before these technologies are fully developed and 'rolled out' for mass transport systems or for export, the development of these industries and the switch away from fossil fuels will be severely hampered.

The key point here is that both near-term and future fuel and energy security will be markedly reduced by the shutdown of refineries, due not only to the direct and indirect economic effects discussed above, but also to the loss of the skill base the refineries support.

Table 3.5 Petroleum Refining - Employment by Place of Work by Occupation – 2016 Census

Petroleum and Coal Product Manufacturing		
Occupations: 1 digit and selected 2,3 digit classifications	**Employment by Occupation and POW**	
	persons employed	% of total
Managers	824	17.1%
Professionals	945	19.6%
- Design, Engineering Science and Transport Professionals	427	8.8%
Technicians and Trade Workers	1504	31.2%
- Engineering, ICT and Science Technicians	272	5.6%
- Other Technicians and Trades Workers	740	15.3%
Community and Personal Service Workers	41	0.8%
Clerical and Administrative Workers	586	12.1%
Sales Workers	126	2.6%
Machinery Operators and Drivers	445	9.2%
Labourers	268	5,6%
Inadequately described	79	1.6%
Not stated/not applicable	4	0.1%
Total	4828	100.0%

Source: Australian Bureau of Statistics

4. INTERNATIONAL ENERGY AGENCY FRAMEWORK REQUIREMENTS

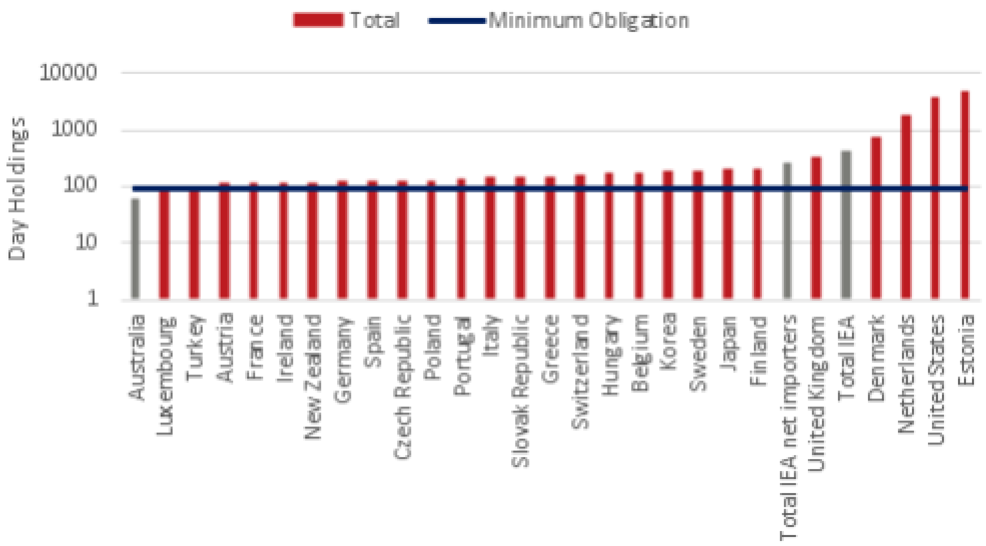
Australia is signatory to an International Energy Agency (IEA) binding treaty known as the Agreement on an International Energy Programme (IEP). Compliance with the IEP treaty requires member countries to hold oil stocks worth at least 90 days of the previous year's net imports.

The IEP treaty emerged in response to Middle East war and oil crisis of 1973, which made countries painfully aware of their vulnerabilities to oil shocks.

The IEA oil stockholding mechanism is designed to be an insurance reserve that can be used in a 'collective action' response by member countries—releasing oil to the global market to counter the risk of economic damage from oil price shocks resulting from significant global supply disruption. – Department of Energy and Environment, Liquid Fuel Security Review Draft Report

At present Australia is the only signatory that is failing to meet its minimum reserve requirements.

Figure 4.1 Emergency Stock Holdings by Country, April 2020, Log Scale



Source: BIS Oxford Economics, IEA Data

While a key goal of the IEP treaty is to improve resilience to oil price shocks, we do not believe the requirements represents a holistic energy security policy. There are many limitations to the current IEA methodology, which currently does not differentiate between different refined products, sub-national risks and does not factor in stocks en-route. Nevertheless, Australia's failure to meet the stockholding requirements is indicative of broader fuel security risks.

4.1 STOCKHOLDING IMPLICATIONS OF SHUTDOWNS IN THE FUEL REFINING SECTOR

The IEA treaty requires member countries to hold oil stocks worth at least 90 days of the previous year's net imports. However, at present these requirements do not explicitly specify the type of fuel. Rather they consider the aggregate volumes of refined and unrefined petroleum.

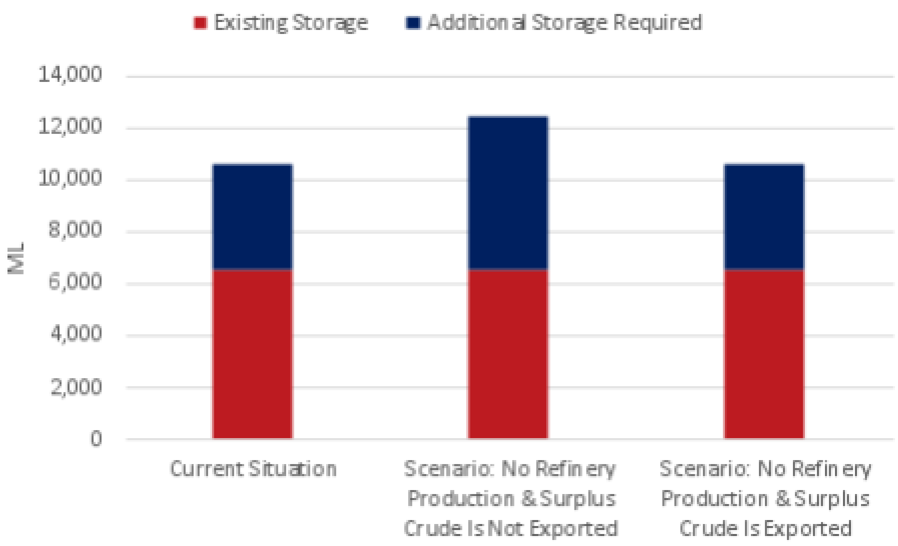
This means that a country that maintains no domestic refining capacity could have no holding requirement if it exports at least as much unrefined petroleum as it imports refined petroleum.

This hypothetical is relevant to the Australian context because Australia produces significant volumes of crude oil and condensate, primarily from offshore north west Australia. This production is primarily exported without further processing. Meanwhile, Australian refineries demand specific blends of crude which they import from overseas and (to a lesser degree) obtain from local crude extraction, mostly from offshore Victoria (Gippsland and Bass Strait/Otway basins).

In the Australian context, this means the impact on required holdings from refinery shutdowns depends on what happens to the local crude extraction that is refined locally. If this surplus crude oil (that would have otherwise been refined) is exported, storage requirements would be lower than if that crude extraction ceases.

For the former scenario where crude is competitive in the export market, we expect no significant change in stockholding requirements, as additional refined fuel imports are largely netted out by additional crude exports and reduced crude imports. However, for the latter scenario where local crude is uncompetitive, we would expect an increase in stockholding requirements due to a gap in exports.

Figure 4.1 IEA Storage Requirements & Scenarios, ML[5]



Source: BIS Oxford Economics, Department of Industry, Science, Energy, and Resources

Based on the Australian Petroleum Statistics publication from The Department of Industry, Science, Energy and Resources (DISER), Australia currently maintains approximately 6,500 ML of fuel storage but is required to keep 10,500 ML based on net-import volumes. Thus, a 4,000 ML gap is currently present.

[5] IEA requirements are specified in tonnage terms. We use a density factor of 0.82 to convert the storage requirement in tonnes to litres.

We estimate this holding requirement could increase to up to 12,400 ML in a scenario where all refineries cease operations, but crude exports do not increase. This sees a gap of up to 5,900 ML emerge as net imports increase. This could occur in a scenario where crude extracted locally in south eastern Australia is only competitive for domestic use because of the low transport costs – so once domestic refining ceases such a scenario would mean this crude is unable to find an export market.

On the other hand, in a scenario where crude extracted in south east Australia is cheap to produce and thus competitive globally, we would expect this crude to find an export market relatively easily in the event of local refinery shutdowns. In this scenario, the increase in imports is effectively balanced by an increase in crude exports, meaning net imports remain the same in aggregate. As a result, the IEA storage requirements would be unchanged from the current situation.

This means that whilst IEA compliance is a critical first step to enhancing Australia's fuel independence, the type, location, and characteristics of fuel holdings is a critical next step to developing fuel security.

For instance, access to crude oil (rather than refined petroleum) allows refineries to process petroleum in measured and adaptable ways. Whilst storage of refined petroleum helps us achieve IEA compliance and enhances security, Australia must store crude oil to be truly flexible and adaptable for a crisis.

Secondly, the quality or characteristics of crude oil is critical to practicably achieving independence. Australia's domestic refineries – whilst using 19% indigenous crude oil – at times require foreign crude oil to enhance the feedstock's compatibility with Australian capital infrastructure. This means that extra storage capacity in Australia must contain both indigenous and foreign crude oil to enhance our fuel security. The sources of this crude oil should be diverse and not concentrated, taking into account geopolitical risks stemming from particular trade routes. For instance, those disrupted by disruptions in the South China Sea, the Strait of Hormuz, and more.

Another critical factor is ensuring refineries build storage infrastructure adjacent to the existing refineries. This helps ensure that the fuel stocks are crude oil, which can be processed flexibly and quickly. It also reduces the risk of having to transport fuels domestically or shipped around Australia in the event of a pandemic or severe crisis.

In the section below, we use both scenarios (4,000 ML gap and 5,900 ML gap) to provide indicative high and low estimates of the cost to meet these storage needs.

4.2 THE COSTS OF STORAGE

We have based our estimates of storage costs on two sources:

- The IEA's 2018 report on Costs and benefits of emergency stockholding.
- A Hale & Twomey/Aurecon[6] report prepared for the Department of Industry in 2013.

These estimates factor in one-off capital and stocking costs, as well as operations, rent, maintenance, and turnover costs. They have been annualised using a 7% rate of return. We used the current exchange rate of 0.71 AUD/USD for currency conversions.

[6] Australia's Emergency Liquid Fuel Stockholding Update 2013: Oil Storage Options & Costs

Table 4.1 Unit Cost Estimates Per Annum

Facility Type	Source	$A per Litre per Year
Above ground: standalone facility	IEA 2018	0.110
Above ground: add-on facility	IEA 2018	0.106
Underground storage: salt cavern	IEA 2018	0.089
Underground storage: rock cavern	IEA 2018	0.104
Product storage: additional	Hale & Twomey/Aurecon 2013	0.104
Crude storage: stand alone	Hale & Twomey/Aurecon 2013	0.089
Product storage: stand alone	Hale & Twomey/Aurecon 2013	0.096
Permanent floating storage: crude	Hale & Twomey/Aurecon 2013	0.089

Source: BIS Oxford Economics

While the similarity of the cost estimates is promising, given the recent steep reduction in fuel prices, we expect these costs may now represent an overestimate, even given increases in inflation and construction costs over the last few years. Therefore, we would expect the costs presented below to represent something of an upper bound.

Given the unit costs from the IEA and Hale & Twomey, we can broadly identify the cost of storage under various scenarios. These are presented in the table below. This covers the cost per annum over the next thirty years.

Table 4.2 Annual Cost Estimates

Facility Type	4,000 ML Storage Scenario	5,900 ML Storage Scenario
Maximum Cost ($0.110/L/Year)	$440 Million	$649 Million
Minimum Cost ($0.089/L/Year)	$356 Million	$525 Million

Source: BIS Oxford Economics

These annual costs (over 30 years) are very small in comparison to the total volume of fuel sales in Australia.

These have then been normalised against total consumption in Australia. In FY19, sales of refined petroleum products totalled 60,600 ML in Australia. Therefore, we can infer the cost per litre of a fuel tax that would finance the additional required storage.

Crucially, under most scenarios, we would expect an additional tax of 1 cent per litre over a 30 year period would be adequate to pay for the additional storage requirements under the IEA framework.

Table 4.3 Annual Cost Estimates Per Litre of Consumption

Facility Type	4,000 ML Storage Scenario	5,900 ML Storage Scenario
Maximum Cost ($0.110/L/Year)	0.73 Cents Per litre	1.07 Cents Per Litre
Minimum Cost ($0.089/L/Year)	0.59 Cents Per Litre	0.87 Cents Per Litre

Source: BIS Oxford Economics

In the March quarter 2020, the average retail price of premium and regular unleaded petrol was 147 cents per litre, while the retail price of diesel was 145 cents per litre (with these prices close to the average price over the past 3 years). A 1 cent per litre tax on petrol and diesel would thus represent less than a 1% increase in the average fuel price (0.68% to be precise). In terms of the impact on household spending, automotive fuel accounts for 3.6% of household spending, so a 1 cent per litre tax would equate to an extra 0.02% addition to annual household budgets and to the Consumer Price Index (CPI). There would also be a minor addition to indirect costs if the extra freight costs from higher diesel prices was passed on to final retail prices, although this is likely to be less than 0.1%.

While the introduction of any tax has the potential to reduce demand (and thus storage requirements in this instance), we expect such a small tax would have a minimal impact.

4.3 THE OPPORTUNITIES OF STORAGE

To comply with IEA fuel standards, adequate storage facilities will need to be constructed at each refinery in Australia. The apportionment of storage capacity at each site and region will depend on several factors such as refining processing capacity, shipping and transport routes, fuel type, and other regional economic factors. The framework established to determine how that capacity will be shared amongst industry will present unique opportunities for each refinery.

As a whole, the viability of Australia's refineries will improve under an IEA compliance regime. A significant reason for this is due to the operational efficiencies available to refineries through the procurement and processing of crude. These include the following.

1. Procurement – procuring fuel at large scale significantly reduces the transport costs associated with crude oil inputs for refining processing. Having access to large crude oil reserves intermittently (within the prescribed rules) between peak and low capacity also avoids the fixed costs associated with procuring small loads of fuel.
2. Purchasing power – the government's purchase of 4000ML of fuel means that it has the consumer purchasing power equivalent to some of the largest mega refineries in Asia. This offsets some of the scale advantages that overseas refineries have over Australia's smaller, local refineries. Critically, this makes Australian refineries more competitive in the global marketplace.

The Government's storage facilities will also require servicing, presenting additional revenue streams for refining operations. This includes the physical maintenance and services associated with handling hazardous facilities. It also includes any requirements for operators to change the stocks of the tank, depending on the fuel-type stored.

The extent of these benefits will vary across each refinery, and ultimately depend on the framework established by government to enhance Australia's fuel security. This includes both the apportionment of fuel storage capacity across each refinery, and the standards and rules of compliance put in place for procuring and maintaining those reserves.

Critically, the refining industry as a whole will be more viable through reduced costs, additional revenue, and higher refining margins. The government's commitment to the regime also sends an important signal to the market and the operators that these facilities will be backed in the national interest.

5. INTERNATIONAL OVERVIEW

Fuel security is a key focus of the International Energy Association (IEA) and the framework described in the previous section lists the compliance requirements for any nation that has signed the international energy program (IEP) agreement. The most outstanding of these requirements is the benchmark 90-day stock of primary or refined oil products. However, the framework also requires that a member nation has emergency demand constraint measures in the case of a fuel supply shock and other policies regarding data provision and collection[7]. This section will provide an overview of how some select members of the IEA have implemented policy to comply with the overarching framework, in addition to current statistics regarding production, trade and fuel stock.

Before narrowing the focus down to these countries, it should be noted that net importer nations are broadly faced with the same two policy options in order to meet the 90-day requirement: (i) whether the obligation to maintain the emergency stock is placed on the government or industry – or a mixture of both and (ii) whether the emergency stock will be comprised entirely of physical product stored domestically or from 'ticket' contracts which guarantee supply from overseas, if needed, for a set period of time – or a mixture of both. These two decisions are first, 'who is responsible for compliance,' and second, 'where is the fuel stored'. Depending on the decisions made across these two categories, there are then further policy decisions to be made regarding regulation, storage and funding sources.

Table 5.1 International Policy Summary

International Energy Association Framework Summary			
Category	**New Zealand**	**Japan**	**United Kingdom**
Fuel Stock[1]	96	190	281
Responsibility	Government	Government & Industry	Industry
Method	Mainly Ticket with Physical Storage	Physical Storage	Mainly Physical Storage with Ticket
Storage	Overseas (ticket) + Domestic	Domestic	Domestic + Overseas (ticket)
Funding	Domestic fuel levy	-	-
Emergency Demand Constraints	- Information campaign - Fuel switching - Reduce speed-limit - Rationing & Allocation	- Limiting oil use in industrial sectors - Allocation of oil & oil products	- Allocation and rationing - Information campaign - Reduce driver hours and speed-limits

[1] Average monthly stock, in net import days, between May-19 & Apr-20

With regard to the second policy decision above, ticket contracts are an agreement between two parties that guarantees the supply of oil in the event of a fuel supply crisis. The 'ticket' acts similar to a financial option, allowing the owner of the contract to redeem it during an emergency and then use the oil as they wish. Practically, this allows countries to store oil supplies in another country to meet the IEA 90-day compliance. This is frequently used among nations that lack the infrastructure to hold enough physical stock on their own shore – such as Australia or New Zealand.

[7] International Energy Association, 1974. *Agreement on an International Energy Programme*, https://iea.uoregon.edu/treaty-text/1974-internationalenergyprogrammeaayyyymmddentxt

There are some additional complexities to consider with the usage of ticket contracts. As with an option, there is an ongoing fee (contracts usually on a quarterly basis) to hold the 'ticket' and contracts can only be formed between countries that have a government-to-government arrangement (to help ensure that in the case of a fuel crisis, the oil will actually be supplied)[8]. The clearest advantage of the ticket contracts is that they are a relatively cheap option (as opposed to a large one-off investment in storage infrastructure) to reach 90-day compliance. However, there are potential concerns as to whether these international storage options do ensure domestic fuel security.

The remaining parts of this section will provide more in-depth analysis of policy within New Zealand, Japan and the United Kingdom (UK). See Table 5.1 above for a summary of how these countries ensure that they reach compliance within the IEA framework.

5.1 NEW ZEALAND

5.1.1 Industry Overview

New Zealand is a relatively minor player in the global fuel industry owing to the small landmass and population. Crude extraction produces high quality product (low sulphur content) and almost all of it is then exported. Meanwhile, refined oil products are manufactured using imported crude at a single refinery. The relatively small size of the industry has forced fuel companies to co-operate, evidenced by the joint ownership of the refinery and other schemes that allow fuel stock trading to cope with the low population density.

The future of New Zealand's oil and fuel industry remains uncertain – crude production has declined from 2,725 to 1,095ktoe between 2008-2018 (the latest full year of data), with prospects worsened by the ban on offshore exploration implemented in 2018[9]. Refined production in New Zealand has a similarly bleak outlook, with international competition able to significantly undercut domestic production – worsened by the demand shock from COVID-19.

[8] Department of Industry, Science, Energy and Resources, 2020. *Oil stock ticketing*, https://www.energy.gov.au/government-priorities/international-activity/oil-stock-ticketing
[9] Davison, I, 2018. *Prime Minister Jacinda Ardern bans oils exploration*, https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=12030956

Table 5.2 Fuel Security Statistics – New Zealand

Fuel Security Statistics New Zealand	
Production	**Volume (ktoe 2018)**
Crude Oil	1,095
Natural Gas Liquids	180
LPG/Ethane	-
Motor Gasoline	1,328
Jet Kerosene	1,221
Gas/Diesel	1,878
Fuel Oil	435
Imports	**Volume (ktoe 2018)**
Crude Oil	4,965
Natural Gas Liquids	-
LPG/Ethane	10
Motor Gasoline	1,026
Jet Kerosene	254
Gas/Diesel	1,290
Fuel Oil	-
Exports	**Volume (ktoe 2018)**
Crude Oil	1,024
Natural Gas Liquids	-
LPG/Ethane	6
Motor Gasoline	15
Jet Kerosene	-
Gas/Diesel	31
Fuel Oil	167
Stock	**Volume (net import days)** [1]
Primary or equivalent refined oil products	96

Source: IEA, BIS Oxford Economics

[1] Average monthly stock for 12 month period from May-19 to Apr-20

5.1.2 Compliance with IEA Framework

New Zealand relied on domestic commercial stocks to comply with the 90-day requirement prior to 2007. Declining production subsequently saw them slip below the benchmark[10]. Since the 1st of January 2007, the government has supplemented these domestic stocks by the purchase of offshore 'tickets', which has allowed New Zealand to consistently stay compliant. New Zealand differs from some other member nations in that compliance and 'ticket' purchasing is handled solely by the government, there is no industry responsibility to maintain a benchmark. As with most 'tickets',

[10] New Zealand Institute of Economic Research, 2012. *New Zealand Oil Security Assessment Update*, https://www.mbie.govt.nz/assets/87ddd35df2/nz-oil-security-assessment-update.pdf

storage is handled by the country or corporation that sells the option[11]. Purchasing these fuel options can be a relatively inexpensive option for a country that lacks the infrastructure to adequately store large quantities of oil, such as New Zealand.

A review into oil security conducted by the Ministry of Business, Innovation & Employment in 2012 covered future policy options regarding fuel security, which ended in maintaining the current policy. Additionally, a permanent source of funding was decided (as it requires a fee to hold the ticket) - the petroleum or engine fuel monitoring levy (PEFML) on domestic fuels[12]. The past 12 months of available data has shown New Zealand having an average monthly stock level equal to 96 net import days – sitting above Australia's equivalent of 56 days.

New Zealand's approach to managing fuel supply helps them meet technical IEA obligations, but does not guarantee fuel security due to its vulnerable approach to fuel procurement. For instance, storing fuel supplies offshore – particularly for island countries like New Zealand or Australia – instantly exposes the country to insecurity of supply in the event of a crisis. In the case of genuine geopolitical risks that affect maritime trade routes, such as military hostility or posturing by countries in neighbouring regions,

Whilst the IEA benchmark is an important indication of a country's commitment to fuel security obligations and independence, strict compliance does not guarantee genuine fuel security, New Zealand's must not form the basis of an Australian government response to enhancing fuel independence.

There are other conditions beyond the 90-day benchmark which a member nation must meet – crucially, this involves having a plan to effectively restrain demand during a fuel emergency (such as a supply shock or similar). New Zealand meets this requirement by the, 'Oil Emergency Response Strategy,' which details the various avenues through which demand could be reduced during a fuel emergency. This includes voluntary demand restraint measures such as[13]:

- **Information campaigns**: Aim to inform the importance of reducing fuel consumption during an emergency and what measures can be taken (such as reduce speeding, using public transport, and other behavioural measures).
- **Fuel switching:** Less viable in New Zealand but involve replacing conventional fuels with biofuels or increased usage of electric vehicles.

and mandatory restraints such as:

- **Speed Limit Reduction**: Reducing speed limit below 100 on open roads.
- **Quantity Rationing**: Reduce amount of fuel that can be purchased at once.
- **Allocation Rationing**: Reduce amount of fuel that can be purchased and the frequency of purchasing.

5.2 JAPAN

5.2.1 Industry Overview

Japan has a significantly larger fuel industry than New Zealand, relying almost entirely on crude oil imports to feed their refined oil industry. Japan is the fourth largest consumer of crude oil (sitting behind the United States, China and India) – which is fed into the refinery industry and transformed

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[11] International Energy Association, 2017. *Energy Policies of IEA Countries: New Zealand 2017 Review*, https://www.iea.org/reports/energy-policies-of-iea-countries-new-zealand-2017-review
[12] New Zealand Customs Service, 2019. *Increase in the Petroleum or Engine Fuel Monitoring Levy on 1 July 2019*, https://www.customs.govt.nz/about-us/news/important-notices/increase-in-the-petroleum-or-engine-fuel-monitoring-levy-on-1-july-2019/
[13] Ministry of Economic Development, 2008. *Oil Emergency Response Strategy – Government Response to an Oil Supply Disruption.* https://www.mbie.govt.nz/assets/9930eabdda/oil-emergency-response-strategy.pdf

into oil products that are used extensively across industry and transport. There is limited capacity for the extraction of primary fuel products and historically, the government has placed a large focus on ensuring that they import crude from a diversified range of locations[14]. The storage of crude oil allows Japan to remain flexibility in its approach to servicing both the nation's ongoing fuel demand as well as its response to managing fuel supply in the event of a crisis.

Table 5.3 Fuel Security Statistics – Japan

Fuel Security Statistics
Japan

Production	Volume (ktoe 2018)
Crude Oil	167
Natural Gas Liquids	216
LPG/Ethane	3,977
Motor Gasoline	37,468
Jet Kerosene	12,183
Gas/Diesel	44,575
Fuel Oil	14,737
Imports	**Volume (ktoe 2018)**
Crude Oil	150,366
Natural Gas Liquids	1,725
LPG/Ethane	10,609
Motor Gasoline	1,572
Jet Kerosene	1,188
Gas/Diesel	634
Fuel Oil	1,689
Exports	**Volume (ktoe 2018)**
Crude Oil	-
Natural Gas Liquids	-
LPG/Ethane	66
Motor Gasoline	2,451
Jet Kerosene	2,430
Gas/Diesel	7,902
Fuel Oil	2,714
Stock	**Volume (net import days) [1]**
Primary or equivalent refined oil products	190

Source: IEA, BIS Oxford Economics

[1] Average monthly stock for 12 month period from May-19 to Apr-20

[14] International Energy Association, 2016. *Energy Policies of IEA Countries: Japan 2016 Review*, https://www.iea.org/reports/energy-policies-of-iea-countries-japan-2016-review

The usage of oil as a primary energy supply has been declining in Japan since the mid-1990's, driven by increasing diversification among fuel sources and the focus on nuclear power to reduce greenhouse gas emissions[15]. Government efficiency mandates aiming to decrease crude oil distillation and other planned capacity downgrades among Japan's refineries have decreased oil production to remain in line with the long-term downwards trend in oil usage as a primary energy source[14]. Resultingly, there has been significant consolidation among oil companies in Japan – among the 11 refiners and primary distributors part of the Petroleum Association of Japan (PAJ)[16], the IEA now identifies that there are only two 'large companies' remaining in fuel production.

5.2.2 Compliance with IEA Framework

The historical dependence on oil as a driver of industrial activity in Japan has led to substantially more infrastructure around the country that can store large quantities of crude oil at any given time. In fact, Japan has consistently remained above the IEA 90-day benchmark by physical fuel storage within the country (i.e. without the purchase of oil 'tickets'). Fuel storage and emergency stocks are handled by two separate government organisations, the Japan Oil, Gas and Metals National Corporation (JOGMEC) and the Ministry of Economy, Trade and Industry (METI). However, the 90-day benchmark is maintained by collaboration between government stocks and commercial storage requirements. The purchase and ownership of crude oil by the Japanese government is a critical function of their world-leading commitment to fuel security. In particular, it serves as a test case for how an island nation must approach meeting genuine fuel security, rather than mere compliance with IEA obligations.

The Oil Stockpiling Act requires the oil industry to maintain at least 70-days of net imports at any given time. This is further supplemented by JOGMEC's emergency holdings across ten national stockholding bases and 13 industry-leased tanks (capacity equal to 900mb at end of March 2014)[14]. The level of regulation is relatively more complex than New Zealand due to the scale of the fuel industry and the added oversight required to ensure government and industry effectively collaborate to comply with the IEA benchmark. Although this section focuses on Japan's compliance within the framework, it should be noted that South Korea ensures compliance within the framework by a similar method – physical storage shared between government and industry.

Japan tackles the demand constraint requirement of the IEA framework by the implementation of the Petroleum Supply and Demand Optimization Act – allowing the prime minister to announce fuel restriction policies. Similar to New Zealand, the categories are split between light-handed (voluntary restraint – information campaigns) and heavy-handed (mandatory restraint – allocating and limiting oil usage) measure[17].

5.3 UNITED KINGDOM

5.3.1 Industry Overview

The United Kingdom (UK) has a substantially different industry structure than Japan or New Zealand and the policies used to meet IEA compliance reflect that. While Japan or New Zealand produce little-to-no primary oil products, the UK is within the top 20 producers of crude in the world and is the 4th largest producer of crude in the IEA[18]. Production of crude oil has continued to slip since 1999, moving from 128,262 to 47,550ktoe in 2018 (the latest year of data) – leading to the UK becoming a

[15] International Energy Association, 2020. *Countries: Japan*, https://www.iea.org/countries/japan
[16] Petroleum Association of Japan, 2020. *Members of PAJ*, https://www.paj.gr.jp/english/members/
[17] International Energy Association, 2016. *Energy Policies of IEA Countries: Japan 2016 Review*, https://www.iea.org/reports/energy-policies-of-iea-countries-japan-2016-review
[18] United Nations Data, 2017. *Conventional Crude Oil,* http://data.un.org/Data.aspx?q=oil+datamart%5bEDATA%5d&d=EDATA&f=cmID%3aCR

net importer of oil since 2005[19]. The recent review by the IEA indicates that the remaining crude available to the UK (mostly offshore) will be able to sustain full production for the next 20 years and beyond. However, the cost of accessing it will steadily increase as more technical expertise and infrastructure is required to mine the depleting reserves[20].

Refined oil products are following a similar trajectory as crude, imports have been steadily increasing since the 1990's – accompanied by stable domestic production. It is evident that the UK will need to increasingly rely on fuel product imports as domestic production is expected to remain stable across the six major crude oil refineries[20].

5.3.2 Compliance with IEA Framework

We have included in this report an analysis of the UK's compliance with the IEA framework because it presents a significantly different policy outlook than New Zealand or Japan & South Korea. The UK is a net importer of crude oil and refined oil product. However, their relatively larger primary and refined oil production has allowed them to easily comply with the 90-day benchmark (5th largest oil stock among net import IEA members as at April 2020, behind the US, Estonia, Netherlands and Denmark[21]). The UK places the full responsibility of meeting the fuel storage benchmark on oil companies – the Energy Act 1976 law requires refiners to hold 67.5 days minimum and importing companies to hold 58 days minimum[22].

The UK has the required infrastructure to store oil products that meet the 90-day benchmark. However, the IEA review of UK's energy policies indicates that the country will need to become increasingly reliant on foreign 'ticket' purchases as imports continue to increase in the nation (as the 90-day benchmark is based on the net import consumption). As at 2019, the UK had approximately one-third of their stock located overseas with foreign 'tickets'. However, the nation would continue to meet the benchmark regardless of these foreign holdings. As industry is responsible for IEA compliance, the 'ticket' purchases are coordinated between foreign corporations and the UK oil companies[23].

Emergency demand restraint policy in the UK follows the other nations examined, a mixture of voluntary and compulsory measures that are aimed to slow down domestic consumption. These measures include information campaigns, allocation & rationing, fuel switching and other policy targeting transport behaviour. As with other IEA members, there is the possibility of severe oil restrictions if an emergency situation escalates[23].

[19] International Energy Association, 2020. *Countries: United Kingdom,* https://www.iea.org/countries/united-kingdom
[20] International Energy Assocation, 2019. *Energy Policies of IEA Countries: United Kingdom 2019 Review*, https://www.iea.org/reports/energy-policies-of-iea-countries-united-kingdom-2019-review
[21] International Energy Association, 2020. *Oil Stocks of IEA Countries*, https://www.iea.org/articles/oil-stocks-of-iea-countries
[22] Department of Energy & Climate Change, 2015. *UK Emergency Oil Stocks*, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/401952/Guidance_for_Stakeholders_version_FEBRUARY_2015.pdf
[23] International Energy Association, 2020. *Countries: United Kingdom,* https://www.iea.org/countries/united-kingdom

Table 5.4 Fuel Security Statistics – United Kingdom

Fuel Security Statistics
United Kingdom

Production	Volume (ktoe 2018)
Crude Oil	47,550
Natural Gas Liquids	3,320
LPG/Ethane	2,079
Motor Gasoline	16,575
Jet Kerosene	5,129
Gas/Diesel	20,123
Fuel Oil	3,361
Imports	**Volume (ktoe 2018)**
Crude Oil	44,289
Natural Gas Liquids	2,111
LPG/Ethane	1,147
Motor Gasoline	3,429
Jet Kerosene	9,403
Gas/Diesel	16,359
Fuel Oil	680
Exports	**Volume (ktoe 2018)**
Crude Oil	40,662
Natural Gas Liquids	2,321
LPG/Ethane	872
Motor Gasoline	10,292
Jet Kerosene	1,572
Gas/Diesel	4,299
Fuel Oil	2,490
Stock	**Volume (net import days) [1]**
Primary or equivalent refined oil products	281

Source: IEA, BIS Oxford Economics

[1] Average monthly stock for 12 month period from May-19 to Apr-20

6. POLICY END GOALS FOR AUSTRALIA

We have identified several potential risks to fuel security in this report, including:

- Insufficient storage to withstand large supply shocks.
- Factors impacting the viability of local refining. This includes supply and demand imbalance that sees refineries over-produce products with low demand and underproduce products with high demand which could restrict profitability.
- Concentration of refined imports from countries that share similar geopolitical risks.

In this section we look for policy goals that can aid in improving fuel security in Australia.

We expect meeting IEA requirements would improve resilience in Australia to a range of potential shocks. As we have detailed in section 4.2, it would not be overly costly to do so, likely able to be paid for by a 1 cent per litre tax.

However, we also note that global IEA requirements should be treated as part of a larger fuel security goal. There are many local considerations that make tailored policy critical: Australia is a large land mass with great physical distances to/from other countries, it is sparsely populated but maintains great physical resources.

Informed by our resilience model (detailed below), we suggest attention should be paid to factors including local refinery capacity and the capability of refineries to process domestic sources of crude, local storage capacity, and the strength of inter-state transport links.

Our modelling shows that a significant deficit in any one of these factors can significantly increase the vulnerability to shocks. While avoiding refinery shutdowns is an important factor in improving resilience it should not be treated in isolation. There are significant amplifying benefits associated with also improving storage capacity, interstate linkages, and investing in an improved capability for processing local crude.

Each of these factors are interrelated. Should Australia be cut off from petroleum imports, local crude extraction and local refinery production would be unable to support local demand for an extended period. A policy that supports higher stockholdings or stronger local refining capability would help extend this duration but if we are unable to transport fuel from where it is stored/produced to where it is needed, the usefulness of either policy would be limited.

The modelling shows that maintaining refinery capacity is generally associated with higher resilience, but improvements in resilience are most significant when this is paired with investment in stronger inter-state links and storage capacity.

6.1 MODELLING RESILIENCE

There are a range of methods to assess the resilience of supply chains. In general, high decentralisation and connectivity significantly improves robustness in logistics chains. This sees shocks and shortages in one area easily supported by strong connections to others. On the other hand, high centralisation and poor connectivity is associated with very poor resilience – in such circumstances, any shock to the central hub can effectively shut down the entire logistics chain.

To model the resilience of the fuel supply chain in Australia, we employed tools developed in the field of Network Science. Namely, we employ the robustness measure developed by Schneider et al.

(2011).[24] This measures the ability of systems to maintain supply lines and transport links should disruption occur in key hubs.

It does this by mapping the supply chains in Australia's liquid fuels market and progressively removing the hubs with the most links to other centres and identifying the size of the clusters that remain. In this context it represents an assessment of the level of integrity remaining in the system after attacks on key trade, consumption and production hubs.

Our modelling suggests three key factors that have a strong influence on fuel resilience – namely refinery capacity and the capability to process domestic sources of crude, local storage capacity, and the strength of inter-state links.

6.1.1 Scenario Development

We developed a high-level network map of the domestic Australian supply chain and used this to assess the impact of refinery shutdowns and how this depends on three broad factors.

- **Refinery Capability:** Whether all Australian Refineries are equipped to process domestic sources of crude.
- **Inter-state Links:** Whether Australia maintain a shipping fleet, with inland transport as an adequate fallback
- **Storage Capacity:** Whether there is adequate storage to meet near term shocks

We compared each of these scenarios against an 'optimal conditions' baseline, where all Australian Refineries are equipped to process domestic sources of crude, and Australia maintains strong interstate links and adequate storage. This represents an approximation of the target policy outcome.

6.1.2 Other Considerations

The model developed is a high-level approximation of reality. Its goal is to point to factors that are likely to support increased fuel resilience. In addition to the dynamics modelled, we believe that other factors should also be considered. These key factors include:

Trading Partner and Import centralisation:

Generally, Australia's crude oil imports tend to be sourced from a more diverse set of countries than Australia's refined oil imports. The latter is primarily tied to countries near the South-China Sea, which represents highly centralised geopolitical risk. Thus, refinery closures in Australia would likely see increased reliance on refined oil imports and thus greater exposure to this risk factor.

Poor Overland Linkages and Shipping Risks:

Overland linkages in Australia can be very poor, subjecting cities to notable risks.

In States with no refineries (South Australia, Northern Territory, Tasmania and NSW [by 2014]) all liquid fuels must be imported. Ports can be subject to disruption from a range of incidents including accidents, equipment failures, industrial action, natural disasters and terrorist attacks. For example, the primary fuel port in South Australia is at Port Adelaide; a single, narrow, shipping channel services the port. A blockage of that channel as the result of a shipping accident/incident, could result in significant and prolonged disruption to fuel

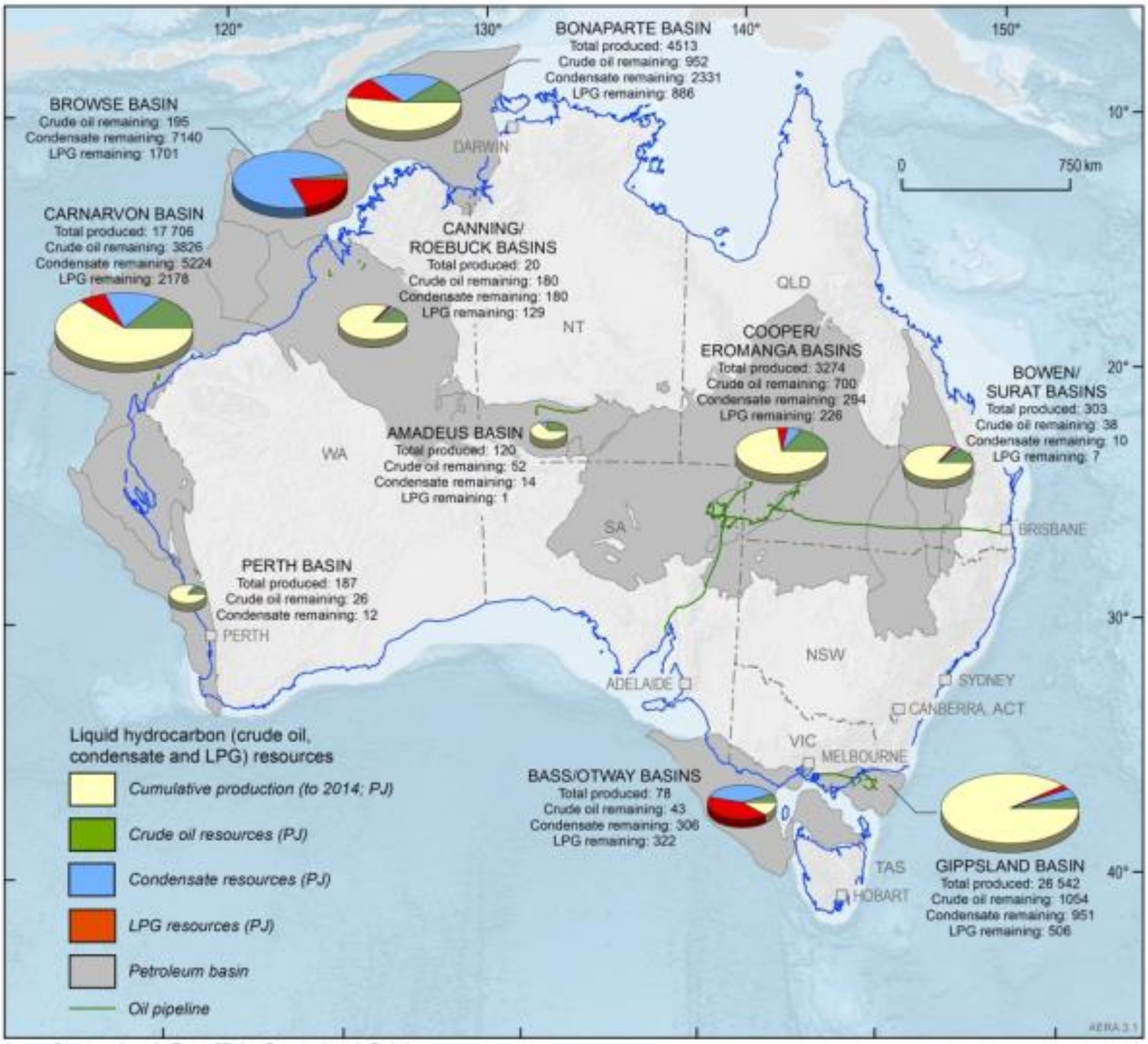
[24] Schneider C M, Moreira A A, Andrade J S, Havlin S, Herrmann H J. "Mitigation of malicious attacks on networks". Proceedings of National Academy of Sciences, 2011, 108(10): 3838–3841

supplies for Adelaide and a large part of the state. Such a disruption would be beyond the ability of market forces to respond, given the inability to transport sufficient fuel stocks overland to South Australia. – John Blackburn AO; Australia's Liquid Fuel Security, A Report for NRMA Motoring and Services

Australian Crude Resources:

In August 2017, Geoscience Australia reported that much of Australia's available crude oil and condensate resources are focussed in the north west of Australia. Much of the resources in basins in the south east of Australia have been largely exhausted.

Figure 6.1 Crude Resources in Australia



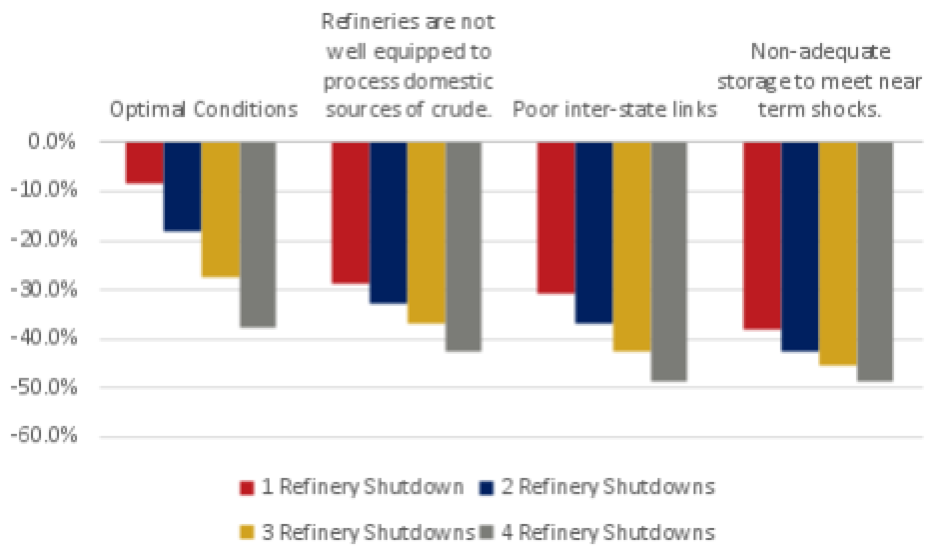
Source: Geoscience Australia, Encom GPinfo, a Datamine Australia Pty Ltd.
Whilst all care is taken in the compilation of the petroleum pipelines by Datamine, no warranty is provided re the accuracy or completeness of the information, and it is the responsibility of the Customer to ensure, by independent means, that those parts of the information used by it are correct before any reliance is placed on them. Accurate at August 2017.

Source: Geoscience Australia

6.1.3 Model Results

As would naturally be expected, the more refinery shutdowns Australia sees, the more centralised the reliance on international imports, and the less resilient the economy is to shocks. This is generally true under all scenarios.

Figure 6.2 Impact on Resilience: Average measured reduction in the Schneider resilience score



Source: BIS Oxford Economics

The results also show that there are significant detrimental effects associated with inadequate storage, poor interstate links and poor alignment with local sources.

In fact, this high-level modelling suggests that, while avoiding refinery shutdowns is an important factor in improving resilience it should not be treated in isolation. There are significant amplifying benefits associated with also improving storage capacity, interstate linkages, and investing in an improved capability for processing local crude.

These factors all build on one-another. Any incidents that restrict the flow of fuel to a consumption point can be made significantly less severe in the event of high stock holdings and – should the incident be significant enough to threaten exhaustion of those stocks – strong interstate linkages could readily provide support, drawing from a combination of other fuel storage, local refining and imports.

Our modelling suggests that over-reliance on any one source will have a detrimental impact on fuel resilience. While this applies to both an over-reliance on imports as well as an over-reliance on local production (especially if it is centralised), the former represents the largest potential risk factor in Australia today.

6.2 FIVE KEY POLICY OBJECTIVES

Given the analysis above, there are at least 5 key policy objectives (or end-goals) that should be pursued in order to significantly enhance Australia's overall liquid fuel security. It should be noted that there are key interdependencies among the following objectives:

1. **Maintain existing refining capacity** – the ongoing operation of all 4 refineries is absolutely critical to fuel security and will prevent a further increase in what is already an over-reliance on refined imports from north Asia, which has been identified as a region of escalating geo-political risks.

However, Australia's refineries are under enormous pressure from low margins and strong import competition, with these pressures only exacerbated by the COVID-19 pandemic. Critically, the capital infrastructure at existing refineries enhance Australia's fuel storage by holding stock through processing units, and if no longer operational, would significantly worsen Australia's fuel security. Shutdowns would also enhance Australia's dependability on overseas fuel sources. In addition, the 4 refineries will need to undertake a collective $1 billion in investment to meet the regulated change in fuel standards to a lower sulphur, which is due in 2027. As part of the policy options, there should be consideration of a subsidy to help pay for the investment required for this regulated change, which is largely aimed at improving environmental and health outcomes

2. **Immediately increase Australia's fuel storage capacity** by a minimum of 4,000 million litres (ML), to both comply with IEA standards and have an adequate storage in the case of an emergency. The fuel stored must be crude oil that is compatible for processing at Australia's refineries to guarantee processing flexibility and adaptability in the event of a crisis. This crude oil must also be purchased by and remain in the sovereign control of the Australian government. Whilst private sector maintenance and servicing will be required, the Australian government must at all times retain ownership of those fuel reserves. Estimated to cost $440 million, this investment would have the added benefit of creating jobs and aid the recovery from the current recession. Enhanced storage capacity must be supplemented with the ongoing operation of all four refineries (objective 1) and be located adjacent to those refineries to guarantee dependable response times in the event of a crisis. Any shutdowns would require extra capacity to be built – but would create a further dependence on imports and not provide any true fuel security for an island nation and is therefore not recommended. A nation that needs to store fuel produced overseas will eventually run out under severe disruption or blockade.

3. **Increase the production of diesel,** possibly at the expense of petrol (automotive gasoline) at the existing refineries, assuming no increase in overall capacity. Diesel has been identified as crucial to the defence, transport, agricultural, mining, construction and manufacturing sectors – as such it can be argued it is the key fuel for Australia's food and economic security. It is also the key fuel for the defence sector. As identified in section 3, the demand for diesel is set to experience sustained increases over the next two decades. There already is a significant reliance on imports of diesel. On the other hand, demand for petrol is expected to decline over the next two decades and by 2040 the local refineries will need to find export markets for this product. As this objective is indirectly linked to objective 2, once again a subsidy may need to be considered for this policy which will greatly improve fuel security.

4. **Increase the volume of processing of local crude production** by the existing (or even new) refineries. In FY19, the local refineries only used 19% of indigenous crude as feedstock for their refineries – or 5,695ML (equivalent to an average monthly rate of 474ML/mth. Over the 9 months to March 2020, the average monthly indigenous usage had increased to 615ML/mth – which equated to over 25% of feedstock, a higher rate than FY17, FY18 and FY19. Processing of more local crude rather than importing enhances Australia's overall fuel security. However, to lift the proportion of indigenous crude in refinery production has technical and logistics challenges. To overcome the technical obstacle, it may require considerable investment in the refineries to change their processes to be able to use more local condensate as feedstock, as condensate will constitute a higher proportion of local crude output over the medium to long term. Meanwhile the logistics challenge may require dedicated tankers (which ideally should be Australian 'controlled' and domestically crewed to enhance fuel security) to bring the condensate from the north-west of Australia to the refineries in the south and east of the continent.

5. **Improve interstate transport of fuel.** Poor interstate transport and shipping links have been identified in section 6.1 as a risk to fuel security. Objective 4 may need to include an Australian owned and operated oil tanker to bring local crude from the north-west to the south-east of Australia. Within this objective and the increased storage objective (#1), there is also the imperative that fuel security for Australia's defence sector needs to be addressed. A number of the domestic defence installations

are spread across northern Australia, where there is not only inadequate storage for defence-related emergencies but transport linkages are inadequate and prone to risk.

7. POLICY OPTIONS

As explored in the policy-end goals section, Australia faces a range of risks in relation to fuel security. These relate to transportation issues, emergency storage and local refinery capability. In this section we explore a possible avenue for financing a broad fuel security policy. Our starting assumption is that the Australian petroleum refining sector does not have the capacity or willingness to provide the necessary funding for the investment needed to improve fuel security, as outlined in the key objectives of section 6.2. Therefore, this will necessitate the Australian Commonwealth government to fund the chosen policies. In this section we show that small increases in fuel taxation can generate significant revenues which can fund a strong fuel security program.

7.1 BROAD POLICY OPTIONS

As a default fuel storage policy, we have assumed a model where the federal government underwrites the initial construction of the storage facilities and recoups the initial investment by way of taxes on consumers/industry. This also involves the government purchasing and paying for crude oil to be stored in those facilities, or some arrangement whereby the fuel stocks retain sovereign ownership and control. While fuel stocks and storage require servicing, maintenance, and other activities associated with their holdings that require private sector engagement, the control and ownership of those stocks in the event of a crisis must remain reliably in the hands of the Australian government.

This would allow for flexibility on targets and financing approach. Most notably, this would facilitate easy expansion of the policy to take into account broader fuel security requirements than is possible using explicit command-and-control-approaches. This includes the additional policy objectives identified in section 6.2 (specifically 2 to 5).

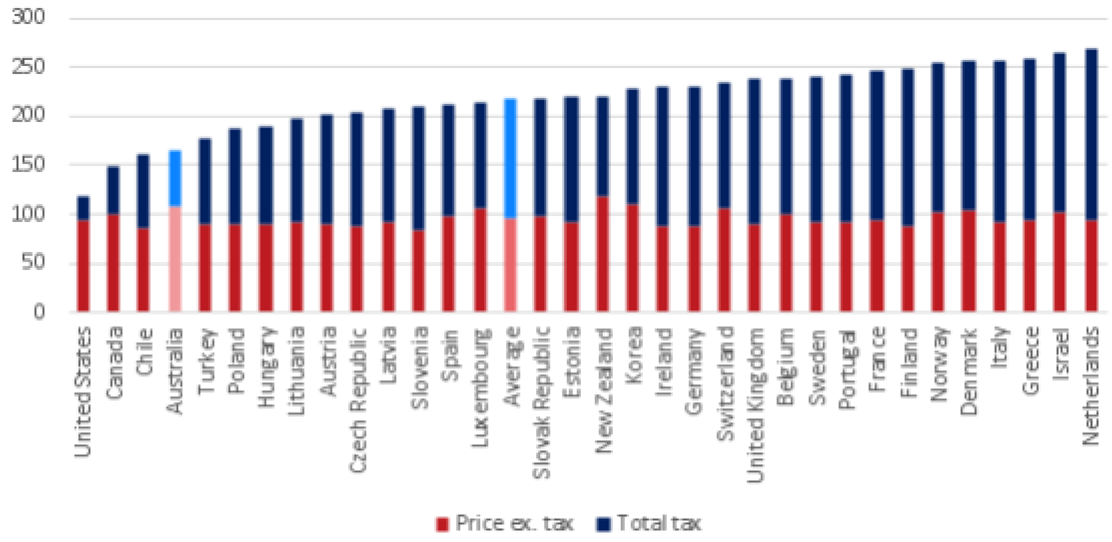
7.2 FINANCING OPTIONS – INCREASE FUEL TAXES

Ultimately, any taxes on the fuel supply chain would get passed on to end-users. Thus, broadly speaking, financing a fuel security policy is a question of a 'user pays' tax against a more general tax that is not aimed explicitly at fuel users.

The former – so called hypothecated taxes – are often viewed more favourably by consumers than an increase in broader taxes. While there are equity considerations, we expect there is significant scope to increase indirect fuel taxes to address a range of potential policy objectives from such a financing approach.

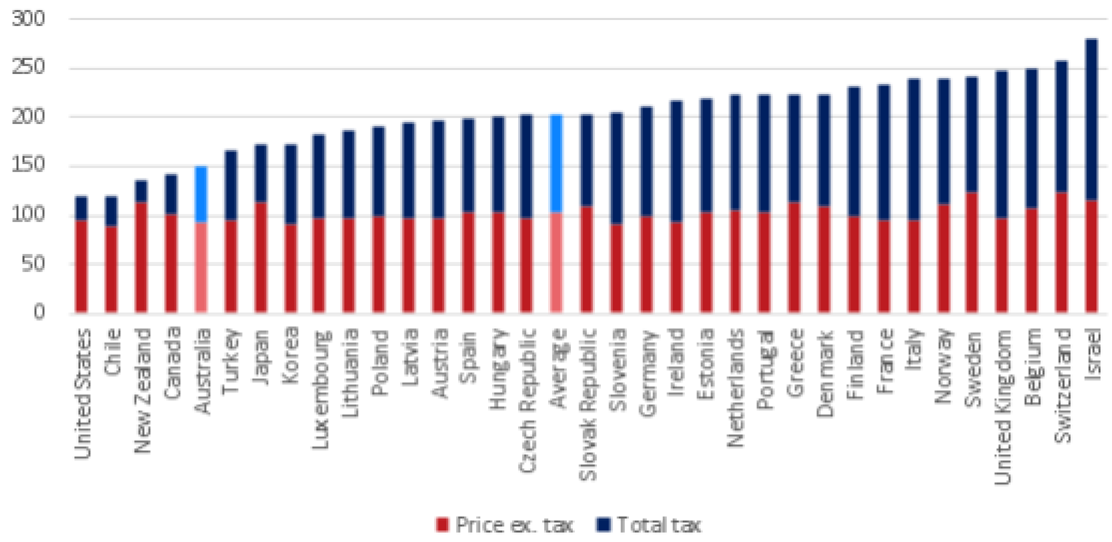
It is critical to note that Australia's fuel prices are some of the lowest in the OECD, to a large degree because taxes on fuels are very low. For 'premium' unleaded petrol and automotive diesel, Australian prices are around 50 cents below the average as of December quarter 2019. As the only OECD country that is non-compliant with IEA fuel standard obligations – by a significant margin of approximately 40% in net import stock volume – this fact is unsurprising.

Figure 7.1 Premium Unleaded Petrol Price in OECD Countries, Australian cents/litre, Dec Quarter 2019



Source: BIS Oxford Economics, Department of Industry, Science, Energy, and Resources

Figure 7.2 Automotive Diesel Price in OECD Countries, Australian cents/litre, Dec Quarter 2019



Source: BIS Oxford Economics, Department of Industry, Science, Energy, and Resources

Taking the 90-day reserve as a presumptive model, we expect meeting these requirements is possible using a 0.7 to 1 cent per litre tax on all petroleum product consumption over 30 years (see section 4.2). This will fund the solution described in key policy objective number 2 in section 6.2.

Note that the 0.7 cents represents the upper range of the cost estimates of the IEA and Hale &Twomey. The 4,000 (ML) storage is estimated to involve an annual cost of $440 million per annum, which represents the upper range of the cost estimates of recent years. However, given the decline in interest rates and oil prices, the cost and ultimate fuel tax could be lower – but we have been deliberately conservative because of the considerable variation in cost estimates, which also depend on the location of storage. Storage near existing facilities (such as operating refineries) is less expensive. Using information from current industry sources, we estimate the upfront capital cost to build and stock (fill) 4,000ML of storage (with crude feedstock comprising 2/3 of the new storage and refined product the other 1/3) is around $4.7 billion. This assumes that all storage is at existing refineries and sites (which would be the cheapest option) and thus does not include the extra costs of locating refined products in green-field locations. It does also not include discounted cost of capital (7% over 30 years - see footnote 25 below). Adding these in, we believe, would bring the total overall cost close to the lower range of the IEA and Hale & Twomey estimates.

Compared to the price of refined petroleum in other OECD countries, this price is remarkably modest and almost undetectable in the swings and cycles of fuel price volatility. For instance, with Australia's fuel price 25% lower than the overall average in OECD countries, this proposed tax increase leaves Australia in the same position along the fuel price pecking order. It should also be noted that even some of the few countries ahead of Australia on fuel price affordability (and only just) – such as the United States – meet their fuel security obligations through means of general taxation. This means where Australian's might have slightly higher fuel excises than three other countries – United States, Chile, and New Zealand – consumers in the other countries are still taxed for fuel security compliance. This leaves Australia as the only country in the OECD that does not raise enough money through taxation to meet its fuel security obligations.

Higher fuel taxes have other benefits as well. They help to hasten the pace of transition towards electric vehicles or hydrogen fuel-cell vehicles, which further reduces exposure to future fuel related risks - assuming the hydrogen fuel is produced in Australia and not imported.

As a broad rule of thumb, a 1 cent tax is able to generate $600 million in annual revenue, based on consumption levels in FY 2019. This revenue would fall as fuel consumption falls, which would be broadly in line with the reduction in the necessity for fuel security.

Broadly speaking, we would expect many initiatives to support fuel security as identified in section 6.2 to be easily financed through such a mechanism. For instance, the estimated $1 billion investment required by the fuel refining industry to meet new petrol standards can be achieved by the imposition of a 1.66 cent tax over only a 1 year period.[25] Given the $1billion investment is required by 2026, a 5 year period may represent a better policy. This would require a 0.42 cent tax per litre of fuel over the 5 years. This fuel tax will fund the solution to key policy objective number 1 in section 6.2.

In terms of the key policy objectives numbers 3 and 4 (i.e. increasing the production of diesel and the proportion of indigenous crude processed by the refineries), we do not have an estimate of the value of investment required to meet these objectives. Similarly, the estimation of the quantum of infrastructure and transport equipment spending required to improve interstate transport links is not available (and in any case is outside the scope of this paper). This includes any additional expenditure that may be specifically required to bolster storage and transport of fuels to remote defence facilities. The funding (or part funding) of the solutions to objectives 3, 4 and 5 could also be included in any increases to the taxes on fuel. However, given a mere 0.42 cents/litre over 5 years will raise $1billion, it could be argued that there is ample scope to fund the other objectives, which collectively and in combination with the solution to objectives 1 and 2, will substantially enhance Australia's overall fuel security.

[25] If the tax is imposed over a longer time period, this figure would be lower. $1 billion annualised at a standard 7% discount rate over an approximate 30-year lifespan is equivalent to $81 million per year. This is equivalent to a 0.14 cent tax per annum over 30 years – as a 1 cent tax is roughly equivalent to $600 million in annual revenue. Note that this discount rate and 'lifespan' is a standard convention for CBA (cost-benefit analysis), and is used by both the IEA and Hale & Twomey in their analyses. If a lower discount is used the annual $ pay-off is lower, while a shorter lifespan will increase the annual $ cost.

As a minimum policy, the government should enact a revenue-raising policy to at least achieve funding for the first two objectives: immediately increase domestic fuel storage capacity by 4,000 ML adjacent to existing refineries (including government purchasing of crude oil stocks) and sustain the operation of all 4 domestic refineries.

We note, however, that the direct consumer funding (via taxes) of the $1billion investment required for the higher quality fuels does not necessarily ensure the ongoing operation of the refineries. As such, the provision of this funding will require guarantees and mutual obligations from the refineries themselves, regarding their ongoing operation. In any case, a government subsidy (either from the broader tax base or via hypothecated taxes) has a number of precedents, including motor vehicle manufacturing and renewable energy infrastructure.

Overall, the cost to consumers to fund objectives 1 and 2, via increased taxes on fuel (including diesel fuel used by the agriculture and mining sectors), is estimated to be 1.2 cents per litre. This includes 0.73 cents per litre (over 30 years) to fund the immediate construction of 4,000 ML of storage facilities; and 0.42 cents per litre (for a period of 5 years) to fund the approximate $1 billion in funding required to meet the higher fuel standards.

A 1.2 cent per litre tax on petrol and diesel would represent a 0.8% increase in the average fuel price of $1.40 per litre – which is equivalent to the pre-COVID average prices for past 3 years and also the forecast average price expected over the next six years. In terms of the impact on household spending, automotive fuel accounts for 3.6% of household spending, so a 1.2 cent per litre tax would equate to an extra 0.03% addition to annual household budgets and to the Consumer Price Index (CPI). There would also be a minor addition to indirect costs if the extra freight costs from higher diesel prices was passed on to final retail prices, although this is likely to be less than 0.1%. The overall impact on households from addressing the first two objectives is around a mere 0.1% (or less) on the CPI and average household expenditure. It should also be noted that a 1.2 cents/litre impost is in the range of weekly price movements for many suburban petrol stations.

Given the very low impact on households from addressing the first two objectives, it is apparent that there is scope to raise funding from a higher impost on fuel to address some or all of the other necessary objectives. Indeed, if a 5 year period was chosen for objective 1, the tax could be left unchanged in order to fund other policies which will help maintain the operation of the Australian refineries and further enhance fuel security.

In terms of the cost impact on industries that have a relatively high usage of fuel, it is likely that a 1.2 cents per litre tax on diesel would have the greatest impact on the costs of production for agriculture, mining and some parts of manufacturing. Although the greatest impact cost-wise will be on the Transport sector, we would expect that the higher costs will be passed onto end-consumers via higher transport charges.

It should be noted however that Australia's overall tax raising to meet fuel security obligations is the lowest across OECD countries. Whether taxes are raised directly through a fuel excise, or through general taxation, consumers inevitably contribute to the enhancement of fuel security and community welfare in Australia.

Critically, the immaterial increase on petroleum price costs – 1.2 cents per lite – remains well within the weekly fluctuations of the petroleum price driven by global fuel prices, ironically also driven by geopolitical tensions that bear on oil supply forecasts. The mild revenue capture also insures the consumer against significant price hikes in the event of a crisis, where Australia will remain independent of overseas geopolitical posturing due to sourcing fuel prices from its own fuel stocks.