Petroleum import infrastructure in Australia

Main report

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ACIL Tasman

Economics Policy Strategy

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1 Introduction

1.1 Terms of reference

This report was commissioned by the Department of Resources, Energy and Tourism to address the outlook for supply and demand for imported crude oil and petroleum product and the capacity of Australia's existing import infrastructure to meet foreshadowed petroleum import requirements. The terms of reference are provided at Attachment 8.

The evaluation was required to address the following issues:

i. Location of existing major petroleum import infrastructure currently used (or that could be used) for imported crude oil and petroleum products;

ii. Ownership and usage arrangements, including joint venture, sharing, hosting, leasing and other commercial arrangements;

iii. Capacity and capacity utilisation of existing major petroleum import infrastructure currently used (or that could be used) for imported crude oil and petroleum products;

iv. Cost and charging strategies related to usage;

v. Planned capacity extensions or new infrastructure developments;

vi. Current and forecast Australian demand and supply for imported crude oil and petroleum products covering the period to 2030;

vii. The adequacy of major existing or planned infrastructure facilities to meet current and forecast supply and demand for imported crude oil and petroleum products to 2030;

viii. Current and potential barriers to competition and efficient investment in respect of Australia's petroleum import infrastructure;

ix. Strategies to address any issues identified in (viii); and

x. Any other relevant factors.

1.2 Methodology and approach

The audit was conducted through a questionnaire that was sent to the refiner-marketers and independent terminal operators. Interviews were also held with selected port corporations and independent fuel suppliers.

Future expansions were divided into committed investments and planned investments.

ACIL Tasman undertook econometric analysis to develop forecasts of petrol, diesel and jet fuel by State and Territory. The methodology and approach to the forecasts is discussed in Chapter 6 and Appendix G. The forecasts were used to assist with judgements on adequacy and future requirements.

ACIL Tasman also consulted with the Australian Competition and Consumer Commission, the Department of Treasury and the Australian Bureau of Agricultural Economics, the Australian Institute of Petroleum (AIP) and LPG Australia (LGPA).

A list of organisations consulted is provided in Attachment C.

ACIL Tasman would like to thank the Department of Resources, Energy and Tourism and people in all of these organisations that provided information and assistance in the preparation of this report.

While relevant government agencies were consulted in the preparation of the report, the contents of the report reflect the views of ACIL Tasman and do not necessarily reflect the views of the Government.

2 Background and context

The adequacy of Australia's infrastructure for the import of petroleum fuels and refinery feedstock has become a focus of policy concern relatively recently.

Over the 30 years to 2000, Australia enjoyed relatively high levels of liquid fuels self sufficiency based on production from fields such as those in the Gippsland and Cooper Basins plus other smaller fields mainly onshore. Since that time however, total production from Australian fields suitable for Australian refineries has been declining. New production from more recently discovered fields has either not been able to arrest the decline or is not always suitable for Australian refineries and is exported.

Petroleum import infrastructure in Australia evolved in this earlier era of high liquid fuels self sufficiency. At issue is whether this infrastructure will be adequate to meet the emerging needs as self sufficiency declines.

Added to this, public concern over rising petrol and diesel prices has drawn attention to levels of competition in Australian petroleum markets. Access to and adequacy of import infrastructure and the resulting impact on levels of competition received policy attention during 2008.

The following sections briefly outline the supply and demand situation for imported petroleum fuels and the issues that arise.

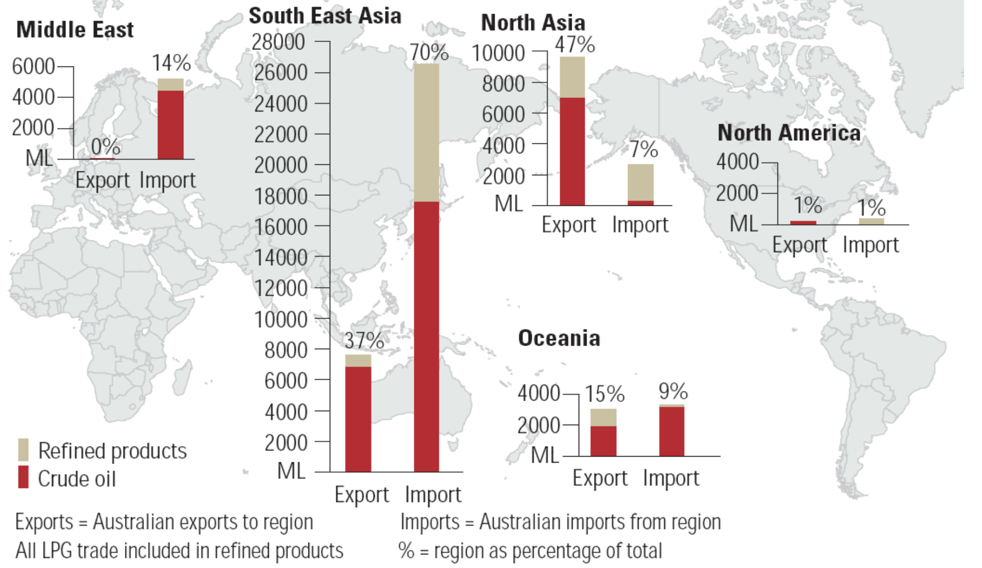
2.1 Past trends in imports of liquid fuels

Australia has been an oil producer for over 30 years. Australian production of crude oil and LPG grew steadily from the early 1970s to 2000, so that, for a brief period, Australia became a net exporter of petroleum in energy terms. Since that time however net imports have increased as Australia's domestic supply of crude oil and LPG declined (IEA, 2005).

Despite relatively high levels of domestic oil production in the past, imports of crude oil and of refined petroleum products have always played an important role in supplying the Australian demand for liquid petroleum fuels.

The volume of exports and imports of liquid fuels in 2006-07 by geographical regions is shown in Figure 1. The data indicates that Australia imports crude oil and refined products primarily from South East Asia. The major export markets for Australian crude oil are in North Asia and South East Asia.

Figure 1 **Australian liquid fuels exports and imports, 2006-07**

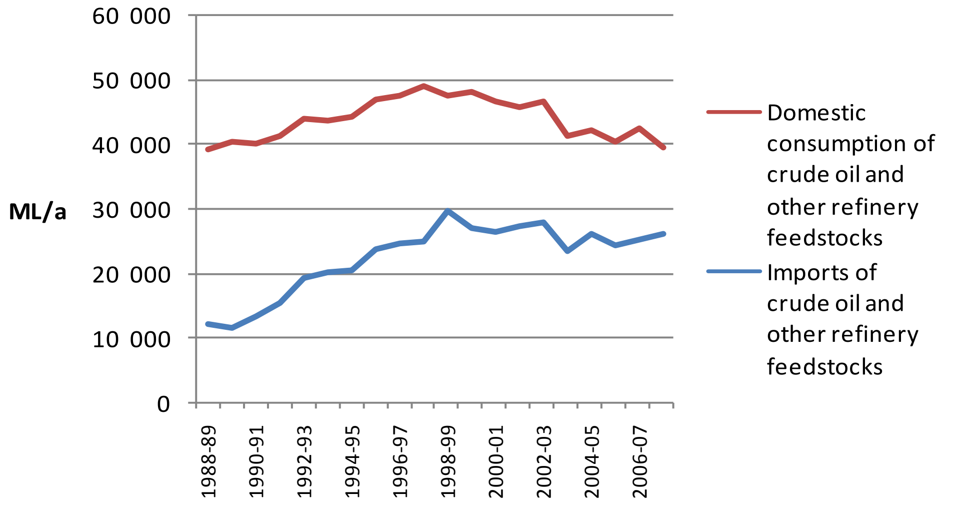


Data source: RET, Energy in Australia 2008

2.2 Crude oil and other refinery feedstocks

Imports and domestic consumption of crude oil and other refinery feedstocks for the past 20 years are shown in Figure 2. Imports rose from around 12,000 ML per annum in 1988-99 to a peak of around 29,700 ML per annum in 1998-99. Imports of crude oil subsequently fell as a result of generally lower demand for refinery feedstock and the mothballing of the refinery at Port Stanvac in South Australia in 2002.

Figure 2 **Imports and domestic consumption of crude oil and other refinery feedstock**



Note: Domestic consumption includes stock change

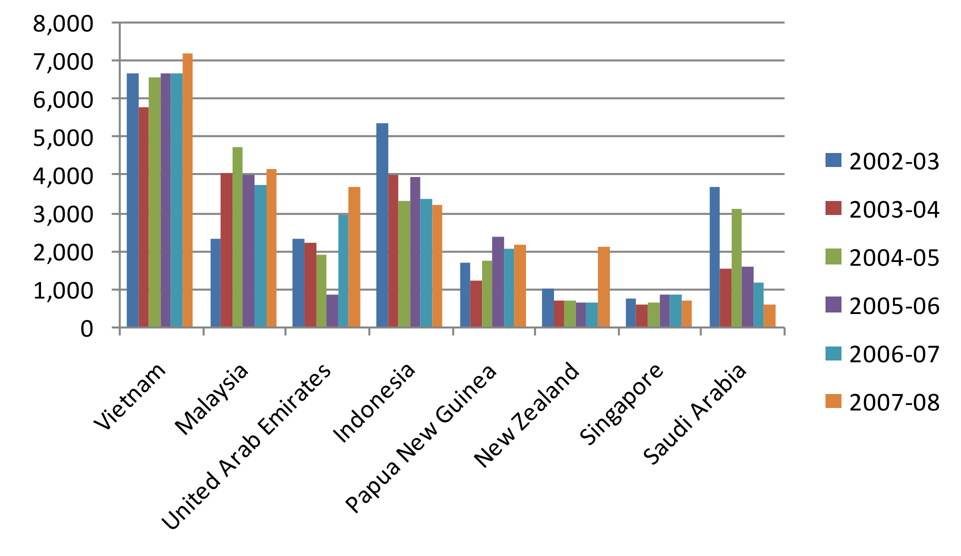
Data source: *ABARE, 2008*

The gradual increase in imports over the ten years to 1998-99 was a result of the decline in production from producing fields in the eastern states – notably the onshore fields in the Cooper and Surat Basins and in the offshore producing fields in the Gippsland Basin. Australian refineries require a range of crudes from heavy to light. As most Australian production has been lighter crudes, refiners have always imported heavier crudes to make up the balance.

The sources of crude oil imports to Australia are shown in Figure 3. The four most important sources are Vietnam, Malaysia, United Arab Emirates (UAE) and Indonesia. As can be seen in the figure, there is considerable volatility in the volume of crude oil imports from many of the source countries (particularly the UAE, New Zealand and Saudi Arabia).

Infrastructure for importing crude is located at or close to the seven major refineries. The capacity in each has been determined by the commercial and operational needs of each refinery. This is discussed in more detail in Chapter 4.

Figure 3 **Sources of crude oil imports to Australia, 2002-03 to 2007-08 (ML per annum)**

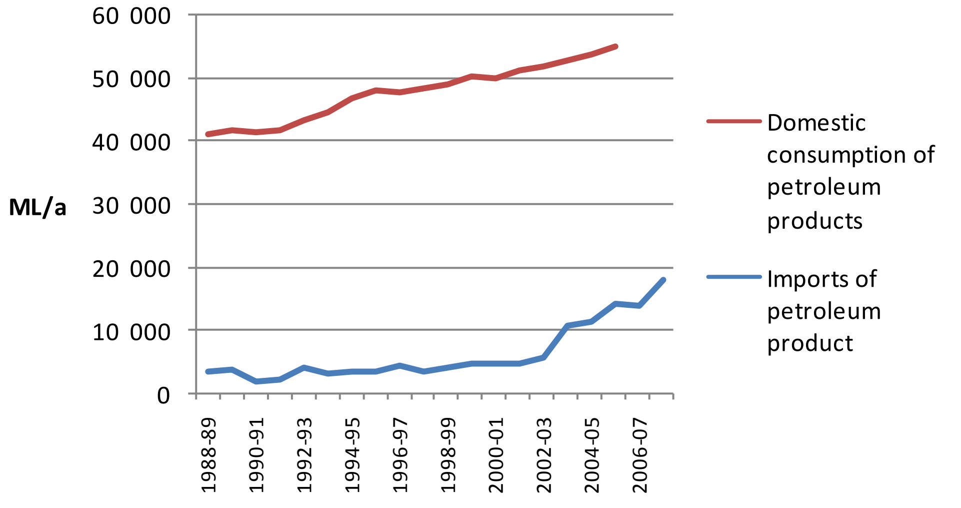


Data source: DRET, *Australian Petroleum Statistics*

2.3 Refinery products

Imports and domestic consumption of petroleum products for Australia is shown in Figure 4. Imports of petroleum products ranged between 2,000 ML per year and 4,500 ML per year over the ten years from 1988-89 to 1998-99. Over this period, total consumption rose from around 41,000 ML per annum to 49,000 ML per annum. By 2005-06 total demand had risen to around 55,000 ML per annum.

Figure 4 **Imports and total consumption of petroleum products**



Note: No data for total consumption for 2006-07 and 2008-09
Data source: *ABARE, 2008*

Imports of petroleum products rose by around 5,000 ML per annum to 10,500 ML per annum following the mothballing of the Port Stanvac refinery. In 2007-08 total imports of petroleum products had risen to 17,982 ML per annum, around 30 per cent of total consumption.

A significant component of this growth has been for diesel to meet growing demand from the resources and agricultural sectors and for jet fuel. There is anecdotal evidence that this has placed additional pressures on import infrastructure and concerns over lack of spare capacity in certain areas as demand has increased. This is discussed further in the next section and details of the infrastructure are discussed in Chapter 4.

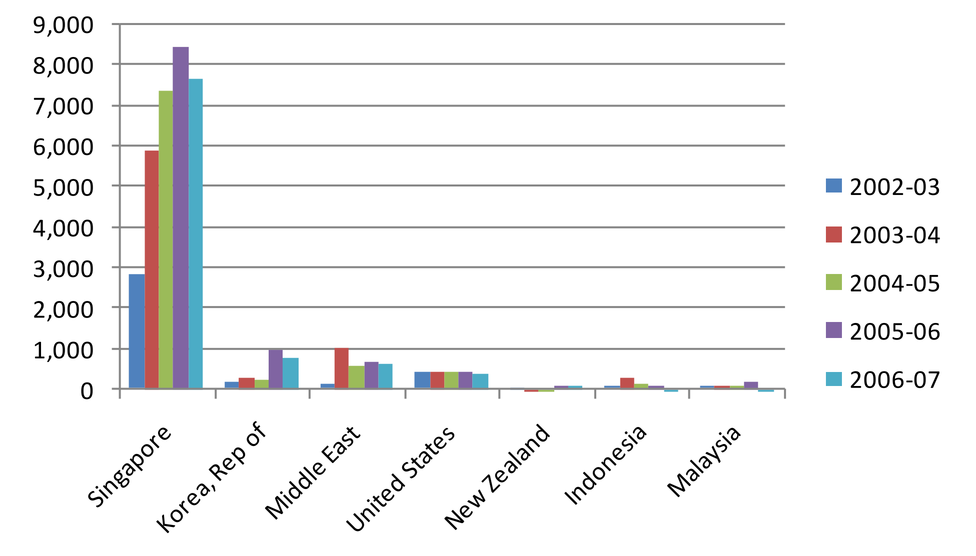
The major source countries for petroleum products imported into Australia are shown in Figure 5. As can be seen in the figure, a very large proportion of petroleum products imported into Australia are sourced from Singapore.

2.4 LPG

Australia is a net exporter of LPG. LPG is produced from petroleum production fields in Gippsland, the Otway and Bass Basins, the Cooper Basin and from the Carnarvon Basin in north west of Western Australia. It is also manufactured at Australia's seven petroleum refineries.

In general terms there is a surplus of LPG production in Western Australia, South Australia and Victoria. LPG is imported into the other States and Territories either by ship or road transport.

Figure 5 **Sources of petroleum product imports to Australia, 2002-03 to 2006-07 (ML per annum)**



Data source: DRET, *Energy in Australia 2008*

LPG import infrastructure exists in general petroleum import infrastructure around Australia. There are also specific storage facilities dedicated to LPG alone. These are discussed separately in this report.

2.5 Policy issues

The above mentioned developments have raised a number of policy issues in relation to levels of competitiveness in the Australian market for petroleum products. The longer term outlook has also raised concerns over the adequacy of infrastructure as Australia's domestic production of crude oil declines and as imports of petroleum products increase.

The Australian Competition and Consumer Commission (ACCC) report *Petrol Prices and Australian Consumers*, released in December 2007, discussed the role of independent importers as competitors in the Australian petroleum products market. In its report the ACCC noted a number of factors that it concluded had enabled the four domestic refiner marketers to dominate the market (ACCC, 2007). These factors were:

- highly concentrated ownership structure of domestic refineries
- commercial dependencies between domestic refiners arising from their buy–sell arrangements
- very small proportion (around 2 per cent) of the wholesale market being supplied by independent imports
- limited prospect of large-scale importing of refined petrol
- extremely low likelihood of substantial new entry into domestic refining.

The report noted that the most significant competitive threat to domestic refiners would be large scale importing of petrol by a reseller or independent retailer. However the ACCC report concluded that this was unlikely for a number of reasons. One of these reasons was lack of access to import terminal facilities of sufficient scale in the major markets.

The ACCC recommended:

- a comprehensive audit of terminals suitable for importing refined petrol in Australia. The audit should cover current and future terminal capacity, current and future use of terminal capacity, and details of terminal leases and terminal sharing arrangements.
- following the audit, there be on-going monitoring of the use, leasing and sharing of terminals suitable for importing refined petrol into Australia.

In its 15 April 2008 response to the ACCC Report*,* the Government agreed that "a comprehensive Audit of terminals suitable for importing refined petrol in Australia be conducted".

The ACCC released a further report on petrol prices in December 2008 which, among other things, discussed the level of import competition in the Australian market (ACCC, 2008). In this report the ACCC noted

> The refiner–marketers accounted for about 93 per cent of the petrol imported into Australia in 2007–08. This high share is unsurprising because the refiner–marketers control most terminals that are capable of receiving imports. Of the 55 terminals around Australia that are capable of receiving imports, 46 of these are owned by the refiner–marketers while a further four are controlled by them through lease arrangements. Consequently, the constraint imposed by actual or potential import competition is reduced. The Department of Resources, Energy and Tourism (RET) is currently managing an audit of terminal facilities.

This report addresses the audit of terminal facilities referred to in the ACCC's latest report. This report also addresses the audit of facilities for import of refinery feedstock.

A further policy issue is the adequacy of both terminal and refinery facilities to manage greater imports of crude oil and other refinery feedstock as well as refined product, as Australia's production of crude oil suitable for Australian refineries declines.

These issues are discussed in the following sections, and conclusions are drawn at the end of the report.

3 Characteristics of import infrastructure

Petroleum import infrastructure comprises a collection of facilities and installations for importing a wide range of liquid petroleum fuels, including crude oil, petrol, diesel, jet fuel as well as other petroleum fuels and products. The configuration of the infrastructure varies from city to city and from region to region.

In general, petroleum import infrastructure includes ports, wharves/berths, discharge facilities, storage tanks, pipelines, storage tanks at terminals and other remote locations and facilities for loading petroleum products onto road and rail transport.

Terminals are those storage facilities where refined petroleum products are received from either refineries or import facilities. Fuel is distributed from terminals by truck or rail to retailers. Terminals are the points where wholesalers, distributors, retailers and other end users access petroleum products. Terminals have loading gantries and storage and can be supplied by pipeline, ship and in some cases by road transport. Import terminals, however, are only supplied by pipeline from refineries or ports.

There are important differences between the import supply chain through refineries and the import supply chain for refined products. The operating parameters and economics of these two supply chains differ in important ways.

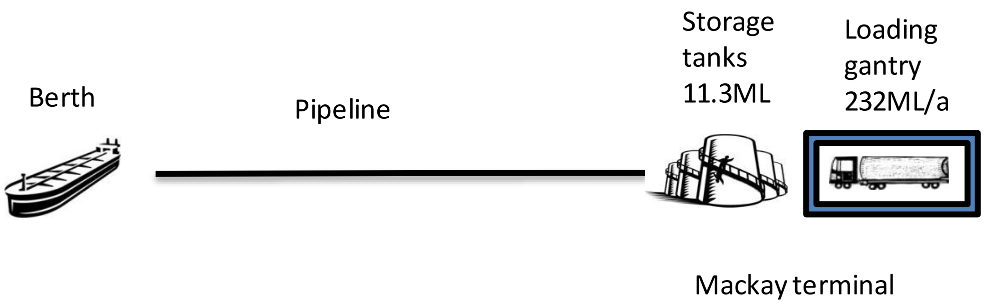
3.1 Import terminals for refined petroleum products

Import terminals are generally located close to ports, and distribute petroleum products delivered by ship to berths (via pipelines) to storage facilities at the terminals. The supply chain for import terminals comprises wharves/ berths, pipelines to terminals, storage and loading gantries for loading product onto road or rail tankers.

The Caltex import terminal at Mackay is an example of a pure petroleum product import terminal. Petroleum products are imported though Berth 1 in the Port of Mackay. Product is piped to the terminal where it is stored, blended (if necessary) and then loaded out by truck gantry for distribution by road tanker (see Figure 6).

The terminal has total storage capacity of 11.3 ML and a throughput of 232 ML per annum of petroleum products. Throughput is determined by shipping schedules and storage capacity.

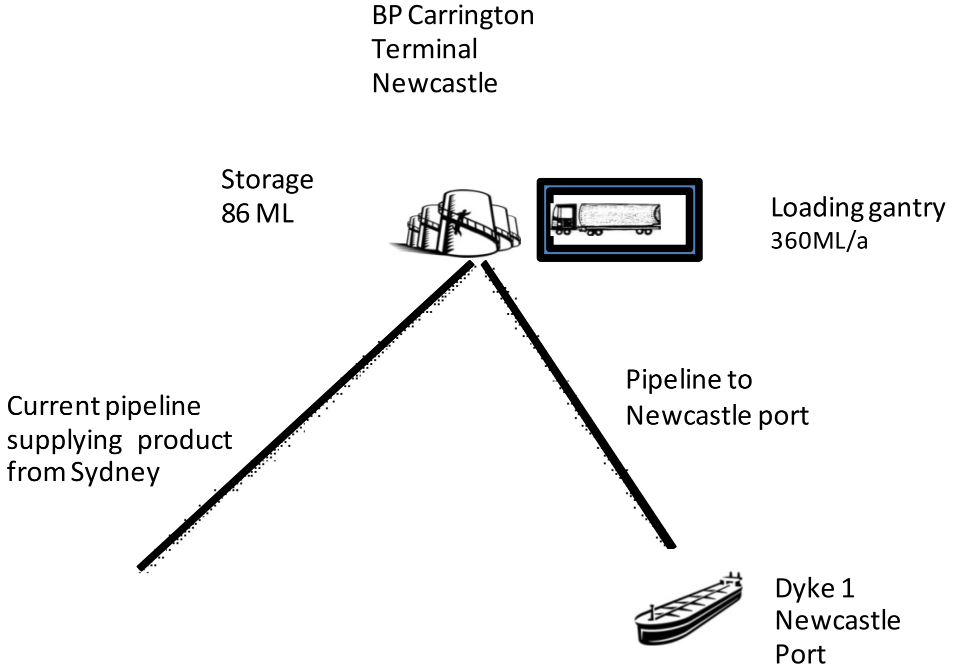
Figure 6 **Example of an import terminal – Caltex Mackay**



Data source: Caltex

Terminals can also be supplied by ships as well as by pipeline from a domestic refinery. The BP terminal arrangements in Newcastle provide a good example (see Figure 7).

Figure 7 **Schematic of dual supplied terminal – BP Newcastle NSW**



Data source: BP Australia, Newcastle Port Authority

The terminal located in Carrington was previously supplied by the Caltex pipeline from Sydney. However BP has now completed an investment program to provide for supplies by ship through Newcastle port. The terminal has a total storage capacity of 86 ML and an annual throughput of around 360

ML per annum – a greater storage to throughput ratio than with the Caltex terminal at Mackay.

Throughput capacity therefore depends on a range of factors such as shipping schedules and loading capacity among a range of other factors. As an example of an 'other' factor, the Vopak terminal in Darwin has high storage capacity to manage supplies through the cyclone season when shipping may be delayed.

The BP Kewdale terminal in Kwinana on the other hand has relatively low storage capacity compared with throughput because it is directly connected to the BP refinery that can provide a more consistent supply direct from the refinery.

Storage capacity on its own is therefore not an indicator of throughput capacity to import petroleum products.

3.2 Terminals supplied from refineries

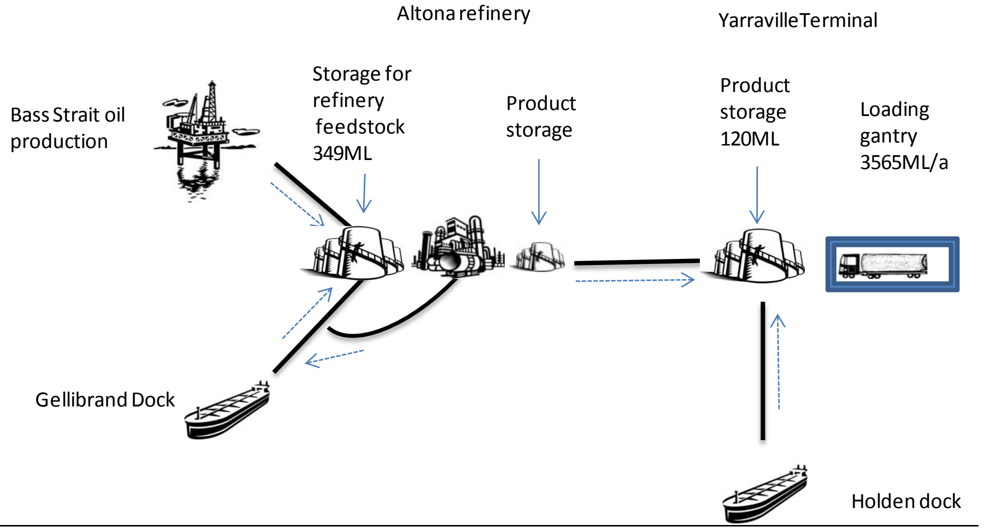
Import facilities for refinery feedstock can include wharves and berths, crude oil storage, pipelines to refinery intake valves, the refining plant and infrastructure, product storage facilities, pipelines to terminals and the terminals themselves. The arrangements can vary depending on the infrastructure configuration at each site, shipping schedules, interconnections and truck loading and scheduling.

An illustration of a port to terminal arrangement for a refinery is provided in Figure 8 using the Exxon Mobil refinery at Altona as an example. At Altona refinery feedstock is received by pipeline from the Bass Strait fields and by ship from the Gellibrand Pier at Williamstown. Gellibrand Pier can take crude oil tankers up to 80,000 dead weight tonnes (DWT) as well as smaller product tankers. Storage for refinery feedstock caters for delivery from crude oil tankers as well as from pipeline for domestic crude.

The refinery has some storage for refined product that is then shipped by pipeline to four terminals (only Yarraville is shown in the diagram) or to product tankers via Holden Dock.

The size of storage required at each point is determined by many different factors. The size and frequency of deliveries from crude oil tankers is an important influence on storage requirements. The facilities must be able to store large quantities of crude oil and other refinery feedstock offloaded from tankers. The larger crude oil tankers exhibit economies of scale for shipping transport but require larger storage capacity to optimise shipping schedules and store a cargo before it is transferred to the refinery for processing.

Figure 8 **Schematic of Altona refinery arrangements and Yarraville terminal**



Note: Product is also delivered by pipeline to the Newport and Sommerton terminals. These are not shown on the diagram.

Data source: ACIL Tasman, Exxon Mobil, *(ACCC, 2008)*

Crude oil delivered by pipeline from domestic oil fields requires less storage at the refinery. This is because flow rates from such pipelines are more flexible and are more suited to accommodating variations in refinery demand for feedstock.

Throughput capacity through the system is a function of a number of factors including, but not limited to, shipping logistics, loading requirements at terminals and demand variability (see Section 3.3 for a more detailed discussion). Storage at any point in the supply chain is therefore not a unique indicator of throughput or import capacity.

In cities where refineries are located, storage requirements will also be influenced by the interaction with other systems that in some cases, such as Melbourne and Sydney, are interconnected networks of domestic and imported supply infrastructure.

3.3 Determinants of import capacity

Australia's overall fuel import capacity is determined by the number of fuel terminals around the country and by the capacity of each terminal and its associated infrastructure. The capacity of each terminal is, in turn, determined by a complex set of factors rather than simply by the sum of the 'static' storage capacity of each tank in the terminal.

It is important to recognise that a fuel terminal's capacity should be measured as a *flow* or throughput over a period of time (such as a year) rather than as a *stock* at a given point in time. This is because of the dynamic nature of the process in which fuel is moved through a terminal from a refinery or a ship berthed at a nearby wharf to the storage tanks in the terminal, and then onto fuel road tankers or rail tankers.

The key determinants of the capacity of a terminal are discussed below.

3.3.1 Demand fluctuations

The expected peak demand for various types of fuel in geographical areas supplied by a terminal is the primary determinant of that terminal's throughput. Demand levels will fluctuate from month to month. Terminal owners must provide sufficient throughput capacity to meet peak demand periods. However there is a balance to be struck between the additional capital investment necessary to meet all possible peak demand periods and a lower level of capital investment sufficient to meet most peak demands while incurring additional operating costs (demurrage etc) for extreme peak periods.

3.3.2 Mode of supply

A terminal may be supplied by fuel from a nearby refinery or from fuel imported from overseas via ships. Capacity is therefore potentially affected by wharfline capacity and refinery transfer pipeline capacity.

3.3.3 Shipping

A significant amount of fuel is brought into terminals across Australia from abroad via ships of varying sizes. Shipping is impacted by many factors, including:

- proximity, reliability and control over supply sources
- shipping rotations and vessel scheduling at filling and discharge points
- weather on the journey
- tidal restrictions on channels and berthing
- the number of products on a given ship – single product or combination cargoes
- the appetite for demurrage (costs incurred when ships are delayed at ports while discharging their cargo).

3.3.4 Berths

Factors relating to berthing that impact on terminal throughput and import capacity include:

- access arrangements at wharfs
- usage of berths by other industry users and their scheduling
- draught restrictions.

Most crude oil tankers are tankers in excess of 60,000 DWT Panamax, Aframax, Suezmax, VLCC and ULCC tankers. The smaller product tankers from 10,000 DWT to 45,000 DWT, require less depth along side. For a fully laden product tanker around 12 metres is required. The larger Panamax tankers require at least 14.5 metres depth alongside.

Where ports do not have sufficient depth, product tankers can only enter the port partly laden. This requires careful scheduling of shipping operations to allow vessels to offload at deeper ports first. Such logistics can be a factor in the throughputs that terminals in more shallow ports experience.

3.3.5 Usable storage tankage by grade

Tank-related factors that determine terminal throughput and import capacity include the following:

- the number of storage tanks at a terminal
- individual tank capacity by type of fuel and fuel grade
- the number of tanks that are out of commission at any point in time
- the scheduling and duration of tank maintenance
- tank settling and other quality assurance processes
- the minimum operating level of tanks (including any strategic or contractual minimum stockholding)
- the requirement to "batch" tanks (as products cannot be run into and out of a tank simultaneously)
- the need to match tank capacities to a ship load (as it is more expensive to half unload a ship due to insufficient space in the tanks to receive the fuel).

The supply of fuel into the terminal from overseas is determined in part by the "calling grade", which is the grade of fuel with the least days of cover.

3.3.6 Gantries

The number and arrangement of gantries at a terminal determine the rate at which fuel can be moved out of the terminal onto fuel road tankers for delivery down the fuel supply chain.

3.3.7 Case study

To demonstrate how the above factors influence throughput, comparison is included of different terminal set-ups: BP's Kewdale terminal versus its Newcastle terminal, and BP's joint venture Parramatta terminal versus its Yarraville joint terminal.

BP Kewdale terminal compared with Newcastle terminal

BP's Kewdale Terminal is situated on the end of a pipeline fed from Kwinana Refinery. The refinery has significant storage on its site which means that the terminal operates like a bulge in the pipeline. All batches of product are fully tested and certified at the refinery site. When product is pumped to the terminal it is only required to do nominal checks against a few key specifications during the pumping process to ensure the product has not been contaminated. As such, the tanks at the Kewdale can be filled and lifted at the same time. Storage requirements are significantly less for a terminal that is supplied in this manner. Kewdale has extremely large volumes, around (2000 ML/a) and yet the useable storage volume at the site is only 28.6 ML, which is small compared to most other terminal sites. Throughput capacity at Kewdale would be limited by the capacity of the transfer line from the refinery before its storage capacity would be a factor.

In comparison product is now supplied to the BP Newcastle terminal via ships, with different grades being supplied from different locations. The terminal has an annual throughout of around 360 ML/pa and a usable storage volume of 85.7 ML. This is nearly 3 times the storage at Kewdale. The volume is required to be able to supply diesel by imports from Singapore or North Asia on an optimal economic shipping basis and/or a combination of coastal shipping of refinery product.

Some petrol and diesel is supplied by the Sydney refineries from the Caltex pipeline. In order to optimise the local supply economics it is desirable to push the rotations out as far as possible and carry larger parcels of product. This requires that reasonable storage is provided for that grade to ensure continuity of supply. Imported product has to be fully tested against the product specifications before it is available for lifting again. This requires that the product be kept segregated until clearance is obtained. All of this complexity places additional requirements on storage at the terminal.

Parramatta and Yarraville

Another comparison is between the terminals in Parramatta and Yarraville. In NSW there are terminals at Botany, Newcastle, Silverwater and Banksmeadow, as well as at Parramatta. The Parramatta Terminal owned and operated by Shell provides BP with access to four grades of product, diesel, heating oil and two grades of motor spirit. The operation is relatively simple. BP uses tankage at Newcastle and at the Vopak terminal at Botany as the supply source for other grades such as Jet, Ultimate gasoline and E10.

The Yarraville terminal in Melbourne is one of four major terminals in Victoria and usable storage at the facility is close to 130 ML. Yarraville in comparison is quite a complicated operation which receives product from the two refineries in Melbourne plus imports that are independently sourced by the two partners creating potential for ship congestion and associated inefficiencies and cost. It has 25 tanks and caters for 8 grades of product, diesel, 3 grades of motor spirit, fuel oil, heating oil, jet and avgas.

In summary, there are many factors that affect the capacity of a terminal besides the volume of storage available. The capacity is going to be affected by the grades that are moved through the terminal and the manner in which they are supplied, the demand and lifting arrangements (i.e. required minimum stock levels) and alternative supply options.

3.4 Ownership and access arrangements

There are a variety of ownership and access arrangements regarding fuel terminals in Australia.

3.4.1 Ownership arrangements

The main types of ownership arrangements with regard to fuel terminals are:

- **terminals solely owned and operated by refiner-marketers**
  - these are terminals solely owned and operated by BP, Caltex, Mobil and Shell
- **terminals owned and operated by an independent importer**
  - independent importers that own fuel terminals include Neumann Petroleum and United Petroleum
- **terminals owned and operated by independent terminal operator**
  - companies operating fuel terminals include Coogee Chemicals, Marstel, Terminals Pty Ltd, Terminals West and Vopak
- **joint venture terminals**
  - These are terminals where a number of companies have equity interests (typically, two joint venture companies have a joint terminal agreement that provides both companies access). Costs are shared according to an agreement but typically capital costs are shared on a 50:50 basis and operating costs on the basis of throughput.
  - Some unincorporated joint ventures however are owned by one party and operating costs are shared. The arrangements can vary widely.
  - The terminal is usually operated by one of the equity holders on behalf of the joint venture
  - Fixed costs are typically shared on a joint venture basis (e.g. 50:50) while operating costs are usually allocated on a volumetric basis

- Approximately 20 per cent of Australian import terminals operate under a joint venture arrangement.

3.4.2 Access arrangements

There are two major types of fuel storage arrangements that provide refiner-marketers and independent importers with access to terminals that they do not own:

- **hosting arrangements**
  - under a hosting arrangement, a 'guest' is allowed to store product and load it onto tankers at the host's terminal
  - the company being hosted generally secures its own shipment of fuel and delivers it to its tanks at the terminal
  - the arrangement may be on a 'spot' or 'term' basis
  - short term hosting arrangements may be made to facilitate the maintenance of the 'guest's' own tanks
  - longer-term hosting is offered by the host if there is excess capacity and there are no adverse operational or quality impacts
  - under some hosting arrangements, a 'guest' may lease a specific amount of capacity but not necessarily in tanks exclusive to the 'guest', that is, its fuel may be "co-mingled" with those of other guests (this co-mingling generally occurs in the case of generic ULP and PULP or diesel products)
  - hosting charges are market-based and situation specific, and are determined by factors such as *cost recovery* (return to capital and operating costs such as expenses and depreciation), *cost of alternatives for hosted parties* (such as hosting charges at other terminals or the cost of constructing their own infrastructure) and *strategic considerations* (such as the host's own anticipated future capacity needs)
- **leasing arrangements**
  - under this type of arrangement, refiner-marketers and independent importers lease storage capacity, either on an exclusive or non-exclusive arrangement, from independently owned terminals
  - leases are typically long-term and may involve the leasing of an entire terminal or of individual tanks in a terminal
  - leases may not involve direct leasing of tanks but provide a terminal storage agreement.
  - In some cases, such with the Shell access agreement at the Vopak terminal in Sydney, a company may comingle products with other companies but use separate tanks for company specific products.

3.5 Sales into and out of terminals

Australian import terminals are not necessarily supplied only from overseas refineries. Many regional terminals are supplied by ship from Australian refineries as in the case of some supplies to Adelaide that are sourced from BP's Kwinana refinery or Gladstone that is supplied from Caltex's Lytton refinery. Domestic refineries and imported supplies effectively compete for market through import terminals sometimes owned by others. Contracts for sales of product into terminals whether from domestic or overseas are based on import parity price (IPP). The cost of fuel landed at an import terminal will include the IPP of purchasing the product in Singapore for an equivalent Australian fuel standard, freight, port and other charges including demurrage etc.

Sales of product from import terminals are negotiated on commercial terms mainly to contracted wholesale or retail customers although some spot purchases occur from time to time. Discount or premium adjustments may also apply depending on the volume, term and any branding or marketing support that might be involved.

3.6 Shipping terms and issues

Petroleum import terminals rely on shipping and port facilities. As discussed above, shipping size and frequency can affect the throughput capacity of a terminal.

Most product tankers are in the Medium Range (MR) category that range between 10,000 DWT and 45,000 DWT. These tankers generally require around 11 metres depth at the berth when fully laden with cargo. Shallower depths can be navigated if the tankers are only partly laden. In some ports in Queensland for example, MR tankers can only enter when they are less than 100 per cent full. This requires scheduling of deliveries so that the deeper ports are served first allowing the tanker to navigate the shallower ports when less than fully laden.

MR tankers are not as economically efficient as larger tankers. The Panamax tankers that are up to 80,000 DWT generally used for crude oil require deeper berths but are lower cost per volume of petroleum delivered.

Demurrage is a charge applied by a shipping company when a vessel is required to stand by out of port while waiting to enter. Generally shipping schedules seek to minimise demurrage costs through scheduling of deliveries. This can limit throughput. It is possible, for example, to increase throughput by lining vessels up to continuously supply an import terminal. However the increase in demurrage cost increases the landed cost of the product.

3.7 Assessing import capacity

The terms of reference require an assessment of the capacity utilisation of existing major petroleum import infrastructure. This requires an assessment of the maximum throughput that an existing terminal could achieve. This is not a simple concept or calculation. As discussed above, the import capacity depends on a range of factors along the supply chain from shipping cycles, berthing logistics, pipeline and storage utilisation and the loading bay operations.

Terminal owners optimise their investment to meet their own needs and the needs of their longer term hosted customers. At some points in the investment cycle, additional capacity is available. However for the majority of Australian import terminals, the existing throughput levels reflect the capacity of the terminal under normal operating circumstances.

In the short run, it is possible to increase throughput above these levels through steps such as increasing shipping rotations, running the terminal assets harder or making adjustments elsewhere in the supply chain. However this generally comes at additional cost such as in demurrage charges or additional pipeline and other charges. The higher costs, that are associated with higher throughput in such circumstances, are usually only sustainable in special circumstances and do not reflect maximum capacity under normal operating circumstances.

To establish import capacity for the purpose of this report it has been assumed that capacity is defined under business as usual conditions. We have not considered emergency or other arrangements that might increase capacity at a higher cost for a limited period.

We have taken throughput in 2007-08 as a baseline of throughput. Although the terms of reference requested figures for 2008-09, most respondents advised that it was difficult to predict throughput for 2008-09, given the economic slowdown and its likely impact on demand for some products notably diesel.

Where the report identifies spare capacity, it is capacity that is in excess of the throughputs for 2007-08.

4 Import Infrastructure in Australia

This chapter provides a detailed description of petroleum import facilities in Australia by location (including capital cities and regional ports) across all State and Territories. In addition to detailing the network of import infrastructure in each location (such as the linkages between berths, refineries and terminals), the storage capacity and annual throughput of terminals at the location by product are also presented. The chapter also includes discussions on current and emerging bottlenecks regarding additional importation of petroleum products in each location.

4.1 Overview

This section presents an overview of the location of petroleum import facilities in Australia, a summary of the ownership structure of facilities in each State and Territory, and the aggregate storage capacities and throughputs of different petroleum products by State/Territory and in major metropolitan areas.

4.1.1 Location of petroleum import facilities

As discussed in the previous chapter, key petroleum import facilities and infrastructure include berths, terminals and pipelines. The locations of these facilities and refineries (which supply product to some of the terminals) around Australia are shown in Figure 9. Not surprisingly, they are dotted around the coastline of the various States and Territories.

4.1.2 Petroleum refineries in Australia

The location, ownership and berth arrangements of the seven refineries in Australia is summarised in Table 1. Each refinery has pipeline connections to deepwater berths that can receive large crude oil tankers and has both crude oil and product storage infrastructure to support operations.

In addition to the above there is also a mothballed refinery at Port Stanvac in South Australia formerly operated by ExxonMobil. In June 2009, the company announced that it intended to demolish the refinery.

Figure 9 **Principal petroleum import facilities around Australia**

Data source: ACIL Tasman Survey

Table 1 **Australian Refineries**

City	Location	Owner	Berth
Sydney	Clyde	Shell	Gore Bay
Sydney	Kurnell	Caltex	Kurnell
Melbourne	Altona	ExxonMobil	Gellibrand Dock
Geelong	Geelong	Shell	Geelong Port
Brisbane	Lytton	Caltex	Fisherman Island crude oil berth
Brisbane	Bulwer Island	BP	Luggage Point crude oil berth
Perth	Kwinana	BP	Kwinana BP Jetty

Data source: Australian Institute of Petroleum *(AIP, 2007)*

Storage at refineries

The amount of crude oil and product stored at refineries by state is summarised in Table 2.

Table 2 **Crude Oil and product storage at refineries in Australia**

	Crude oil	Petrol	Diesel	Jet fuel	Other	Total product
	ML	ML	ML	ML	ML	ML
Sydney	502	214	140	81	37	472
Melbourne/ Geelong	388	79	82	48	117	327
Brisbane	531	194	161	73	1	519
Perth	347	263	99	66	13	440
Total	1,769	719	515	356	169	1,758

Data source: ACIL Tasman Survey

The total storage capacity at refineries in 2007-08 was 1,769 ML of crude oil and 1,758 ML of petroleum products.

Crude oil storage requirements are determined by operating conditions, the nature of supply and ship delivery cycles. This storage is generally located at the refinery site. However, in the case of Shell's Clyde refinery, storage is also located at the Gore Bay berth and delivered by pipeline to the refinery site.

4.1.3 Petroleum import terminals

The ownership structure of petroleum import terminals around Australia are shown in Table 3. There are a total of 64 such terminals in Australia. This includes nine terminals that were not included in the ACCC report *Monitoring of the Australian Petroleum Industry* released in December 2008 (ACCC, 2008).

As can be seen from the table, the majority (44) of the terminals are owned by refiner-marketers (BP, Caltex, Mobil and Shell), usually under sole ownership but sometimes under a joint venture arrangement described in the previous chapter of this report. Fifteen terminals are owned by independent importers of petroleum such as Gull Petroleum, United Petroleum and Neumann Petroleum, independent bulk liquids terminal operators such as Marstel, Coogee Chemicals and Terminals Pty Ltd, and mining companies such as Rio Tinto and GEMCO. Approximately half of terminals around Australia offer hosting arrangements, from short-term spot hosting arrangements to more permanent arrangements.

Table 3 **Ownership arrangements at petroleum import terminals in various States and Territories**

Location	Refiner-marketer – sole ownership	Refiner-marketer – joint venture	Independent (2)	Total	With hosting arrange-ments(1)
New South Wales					
Sydney/Newcastle	4	3	4	11	5
Victoria					
Melbourne/Hastings	2	1	1	4	0
Queensland					
Brisbane	2	1	1	4	3
Other (Bundaberg, Cairns, Gladstone, Mackay, Rockhampton, Townsville, Weipa)	7	3	3 *	13	6
Western Australia					
Perth/Fremantle	2	1	2	5	4
Other (Albany, Broome, Cape Lambert, Dampier, Esperance, Geraldton, Port Hedland)	9	0	3[(3)]	12	9
South Australia					
Adelaide	2	1	1	4	2
Other (Port Lincoln)	2	0	0	2	1
Tasmania					
Hobart	2	0	0	2	2
Other (Bell Bay, Burnie, Devonport)	2		1	3	2
Northern Territory					
Darwin	0	0	1	1	0
Other (Gove, McArthur River, Groote Eylandt)			3*	3	
Total	34	10	20	64	34

Note: 1. Hosting arrangements do not include leasing arrangements at terminals owned by independents. Estimate of terminals with hosting arrangements indicate current hosting and may not reflect all potential hosting arrangements.

2 Independents include mining companies; Table does not include JUHI facilities at airports.

3. Does not include Bundaberg or Port Alma

Data source: ACIL Tasman

Of the 64 terminals, 10 are joint ventures and 20 are independent. Hosting or leasing arrangements exist at 34 of the terminals.

Storage capacity at terminals

The storage by State and Territory as at December 2008 is summarised in Table 4.

Table 4 **Summary of storage at terminals in Australia by region**

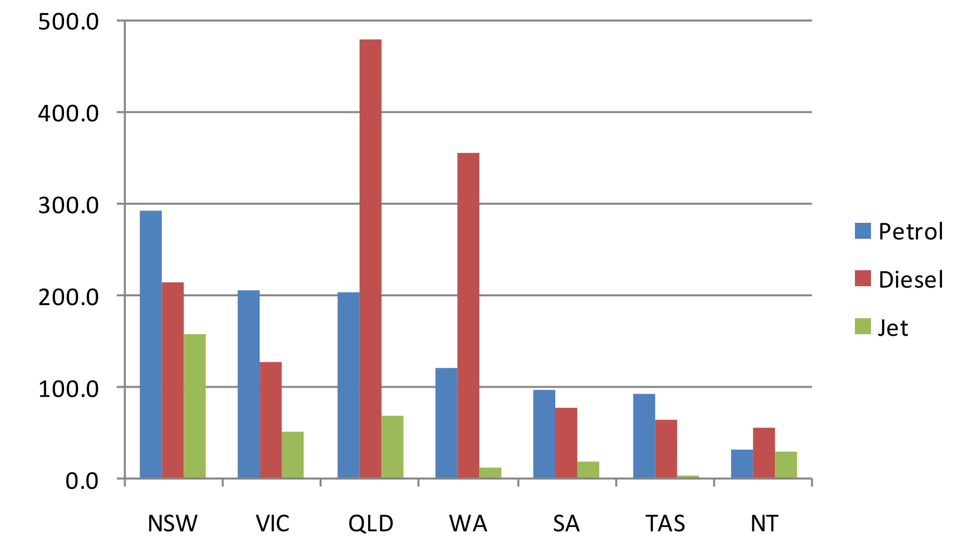
State/Territory	Region	Petrol storage	Diesel storage	Jet fuel storage	Other fuel storage	Total product Storage
	ML	ML	ML	ML	ML	ML
NSW	Sydney	248	152	153	58	610
	Newcastle	47	63	6	29	144
	Total	295	214	159	86	**754**
Victoria	Melbourne	145	98	54	29	327
	Hastings	62	30	-	-	91
	Total	**207**	**128**	**54**	**29**	**418**
Queensland	Brisbane	90	82	21	47	241
	Regional	114	399	57	17	586
	Total	**204**	**481**	**78**	**65**	**827**
Western Australia	Perth	89	77	13	27	206
	Regional	32	278	6	3	319
	Total	**121**	**355**	**19**	**29**	**524**
South Australia	Adelaide	95	60	20	1	176
	Port Lincoln	4	17	-	-	22
	Total	**99**	**78**	**20**	**1**	**198**
Tasmania	Hobart	39	14	4	3	60
	North	54	51	-	-	105
	Total	**94**	**65**	**4**	**3**	**165**
NT	Darwin	33	56	35	-	124
	Mining	-	18	1	138	157
	Total	**33**	**73**	**36**	**138**	**281**
Australia total		**1,052**	**1,394**	**369**	**351**	**3,166**

Data source: ACIL Taman Survey

By State and Territory

The aggregate storage capacity of petroleum products in terminals in each State and Territory by product type is shown in Figure 10. New South Wales has a storage capacity for petrol (ULP and PULP) of nearly 300 ML, while Victoria and Queensland have a storage capacity for petrol of approximately 200 ML. The states with the largest mineral sectors, Queensland and Western Australia, possess the greatest storage capacity for diesel (about 480 ML and 300 ML respectively). Jet fuel storage capacity is largest in New South Wales (at around 150 ML), followed by Queensland (70 ML) and Victoria (50 ML).

Figure 10 **Storage capacity in each State/Territory by fuel type, 2008 (ML)**

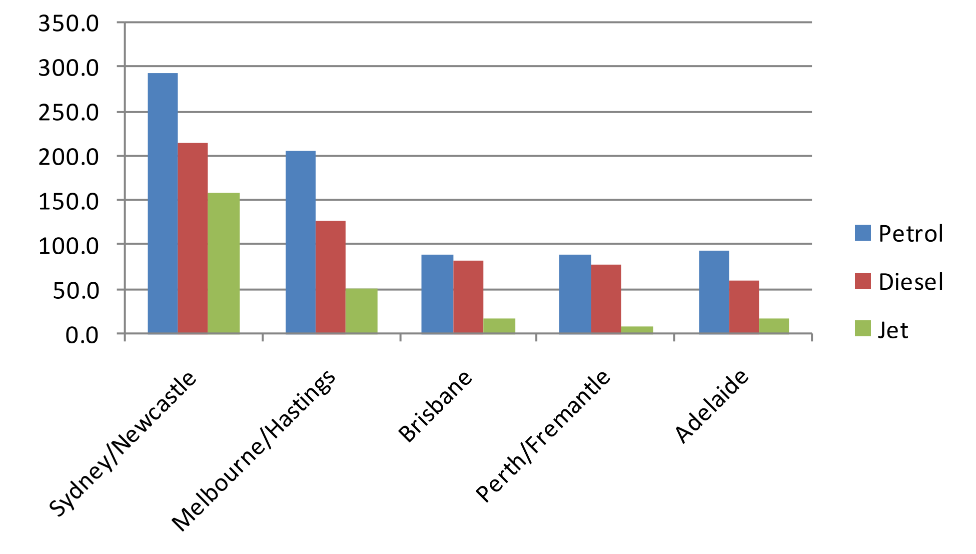


Data source: ACIL Tasman

By major metropolitan areas

The aggregate storage capacity of terminals in major metropolitan areas are shown in Figure 11.

Figure 11 **Storage capacity in major metropolitan areas by fuel type, 2008 (ML)**



Data source: ACIL Tasman

The combined storage capacity for petrol in Sydney and Newcastle is around 290 ML, while the combined petrol storage capacity for Melbourne and Hastings (Western Port) is approximately 200 ML. The storage capacity for diesel in the two regions is approximately 210 ML and 130 ML respectively. The importance of diesel to the resources industry in Western Australia is apparent when one compares the storage capacity for the fuel in Perth and Fremantle and the storage capacity for the fuel in the entire state (20 ML versus 300 ML).

4.1.4 Annual throughput of terminals

Total throughput of petrol, diesel and jet fuel through terminals in Australia was 46,371 ML in 2007-08 according to the returns from the questionnaire. The throughputs by region are summarised in Table 5.

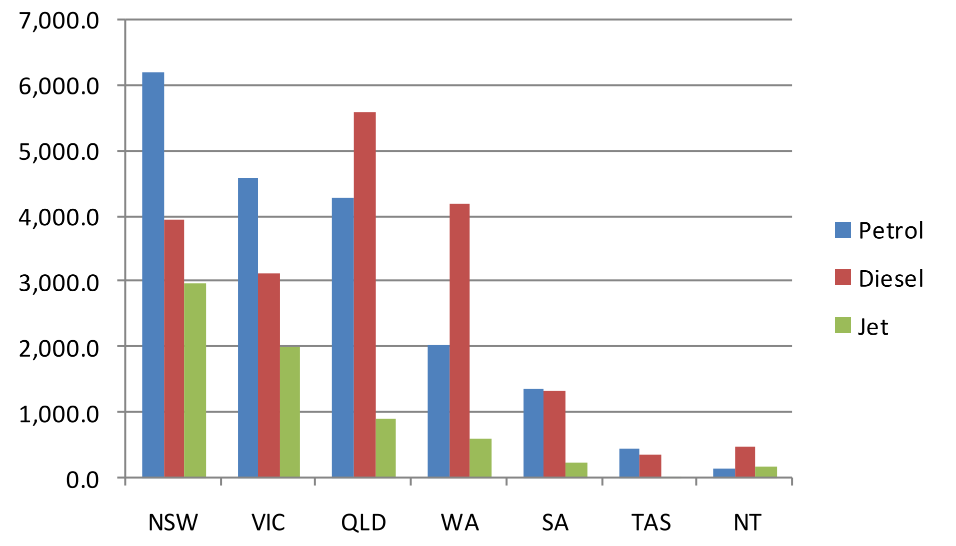
Table 5 **Terminal throughput by State in 2007-08**

State	Petrol	Diesel	Jet fuel	Lubes, solvents other	Total
	ML/a	ML/a	ML/a	ML/a	ML/a
NSW	6,197	3,958	2,995	340	13,491
Victoria	4,590	3,120	2,004	157	9,871
Queensland	4,305	5,598	915	5	10,823
Western Australia	2,025	4,187	609	193	7,013
South Australia	1,367	1,325	237	15	2,944
Tasmania	453	355	33	1	842
NT	142	529	210	508	1,388
Australia total	19,079	19,072	7,003	1,218	46,371

Note: The throughputs relate to terminals and do not include all petroleum products or LPG
Data source: ACIL Tasman survey

The 2007-08 annual throughputs for various petroleum products in each State and Territory are shown in Figure 12. The data shows that diesel throughput in Queensland and Western Australia is very high relative to these states' populations. This reflects the heavy use of the fuel by primary industries, which feature prominently in the Queensland and WA economies.

Figure 12 **Annual throughput in each State/Territory by fuel type, 2007-08 (ML/a)**

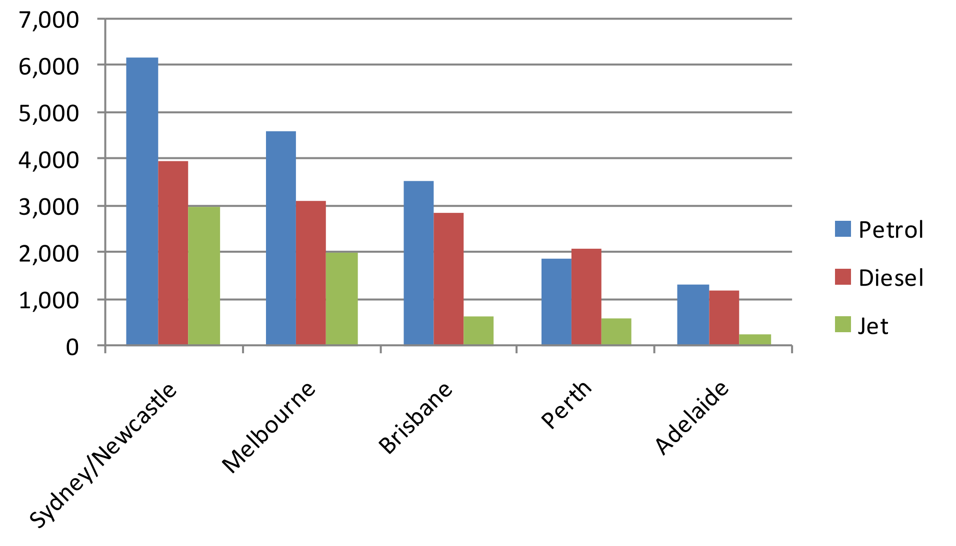


Data source: ACIL Tasman

By major metropolitan areas

The annual throughputs of petrol, diesel and jet fuel of terminals in major metropolitan areas around Australia are shown in Figure 13. The data shows that the petrol throughput of these areas reflects the relative size of their populations. The high throughput of jet fuel in Sydney reflects its position as Australia's main aviation hub.

Figure 13 **Annual throughput in major metropolitan areas by fuel type (ML/a)**



Data source: ACIL Tasman

4.2 New South Wales

4.2.1 Location and Infrastructure

Refineries

There are two refineries in New South Wales. Both are located in Sydney: the Shell refinery at Clyde; and the Caltex refinery at Kurnell. The capacities of the two refineries in 2007-08 were 4,930 ML per annum and 7,540 ML per annum respectively (AIP, 2007).

Berths

There are two ship berths at Gore Bay where crude oil is brought into Sydney and transferred to Shell's Clyde refinery via an 19 km 300 mm diameter underground pipeline, a wharf with three berths at Kurnell where crude oil is unloaded for processing at the Caltex refinery, and a bulk liquids berth at Port Botany (maximum draught of 14 metres) that is owned by the Sydney Port Corporation. There is a liquids berth at Port Kembla used to bring in bunker fuel.

Terminals

There are a total of eleven fuel terminals in New South Wales: seven in Sydney (not including the JUHI at Sydney airport), four in Newcastle and one in Port Kembla. Nine of the terminals are listed in Table 6. (Two are not listed for commercial-in-confidence reasons.)

Table 6 **Summary of major petroleum importing ports: NSW**

Port	Fuels	Terminals
Sydney	ULP PULP Diesel Avgas Jet fuel Bunker fuel	Caltex Mobil Terminals Pty Ltd Vopak Shell/BP Caltex and Mobil in JV JUHI (Exxon Mobil, Caltex, Qantas, Shell)
Newcastle	ULP PULP Diesel Aviation gas Jet fuel Bunker fuel	BP Caltex Shell in JV with Mobil

Note: Two terminals are not included for commercial reasons

4.2.2 Ownership and usage arrangements

Sydney

The petroleum terminals in Sydney (four owned by refiner-marketers and two by independent bulk logistics companies) are listed in Table 7 and shown in Figure 14.

Table 7 **Fuel terminals in Sydney**

Terminal location	Terminal owner(s)	Terminal operator	Supply arrangements
Banksmeadow	Caltex	Caltex	Supplied from Kurnell refinery
Botany	Mobil	Mobil	Supplied from Port Botany
Botany	Terminals Pty Ltd	Terminals Pty Ltd	Supplied from Port Botany
Botany	Vopak	Vopak	Supplied primarily from Port Botany
Parramatta	Shell	Shell	Supplied from Clyde refinery or direct from Gore Bay
Silverwater	Caltex and Mobil	Mobil	Supplied from Clyde refinery and Banksmeadow
Sydney Airport	Caltex, ExxonMobil, Qantas, Shell Joint Venture	Shell	Supplied from Caltex and Shell refineries and imports though Port Botany

Data source: Caltex, Shell, Mobil and Vopak

Caltex and Mobil have a joint terminal in Silverwater that is operated by Mobil. Mobil owns a terminal in Botany used for holding aviation fuel. Caltex has a terminal at Banksmeadow. In addition, Terminals Pty Ltd has a small facility at Botany where it leases storage capacity to one refiner-marketer and one independent importer.

Shell and BP have a joint venture terminal at Parramatta which distributes fuel from Shell's Clyde refinery. The storage tanks are primarily located within the compound of the refinery rather than in the adjacent "terminal", which comprises mainly of truck gantries. Shell also has berths at Gore Bay near Gladesville that feed imported crude oil for the refinery. Product can also be imported through Gore Bay. At the time of writing the refinery at Clyde was not operating and product was being imported through Gore Bay.

Vopak leases tank space at its Botany terminal under long term lease agreements.

The JUHI stores and distributes jet fuel at Sydney Airport. The JUHI is an unincorporated joint venture comprising BP, Caltex, ExxonMobil, Shell and Qantas. Shell operates the facility on behalf of the participants.

Figure 14 **Aerial view of terminals in Sydney**

Data source: Google Earth

Petroleum infrastructure network in Sydney

Shell's Clyde refinery receives its feedstock via pipeline from the twin berths at Gore Bay (which have no other distribution facilities). The refined product is then distributed by truck and rail gantries at Shell's Parramatta terminal, which is connected by a pipeline to the Clyde refinery. The refinery is also connected to the Caltex and Mobil joint terminal at Silverwater via a Shell-owned pipeline, where it joins up with the Caltex-owned 14.9 ML-capacity Sydney-Newcastle Pipeline to the Newcastle terminals.

Caltex's terminal at Banksmeadow receives imports as well as product from Caltex's Kurnell refinery, which, in turn, receives its crude though the Kurnell Wharf. Product from this terminal is then distributed to retailers by truck or sent to the Caltex/Mobil joint terminal at Silverwater via the Sydney

Metropolitan Pipeline (SMP). The SMP is jointly owned by Caltex (60 per cent) and Mobil (40 per cent). Vopak has now completed a pipeline from its Botany terminal to the Sydney metropolitan pipeline.

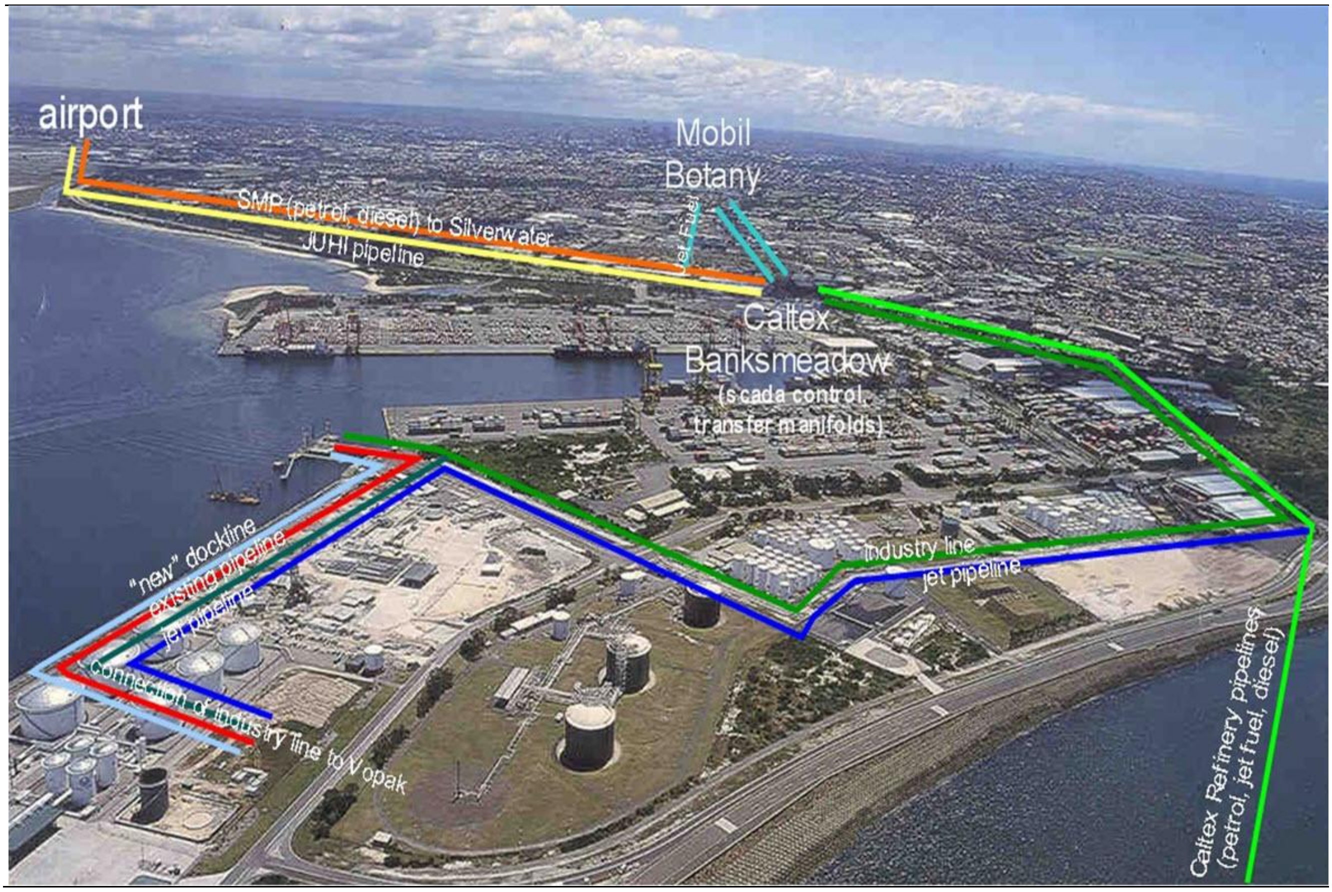
Mobil's Botany terminal, which currently stores only aviation fuel, is joined to the Joint User Hydrant Installation (JUHI) pipeline from Caltex's Banksmeadow terminal that delivers aviation fuel to Sydney Airport at nearby Mascot. The JUHI is also supplied by Shell's Clyde refinery.

The Mobil and Vopak Botany terminals receive imported petroleum products from the Port Botany common-user bulk liquids berth.

As described above, the Silverwater joint terminal receives product through pipelines from both the Shell Clyde and the Caltex Banksmeadow terminal.

The petroleum infrastructure network around Port Botany is shown in Figure 15.

Figure 15 **Petroleum infrastructure network – Port Botany in Sydney**

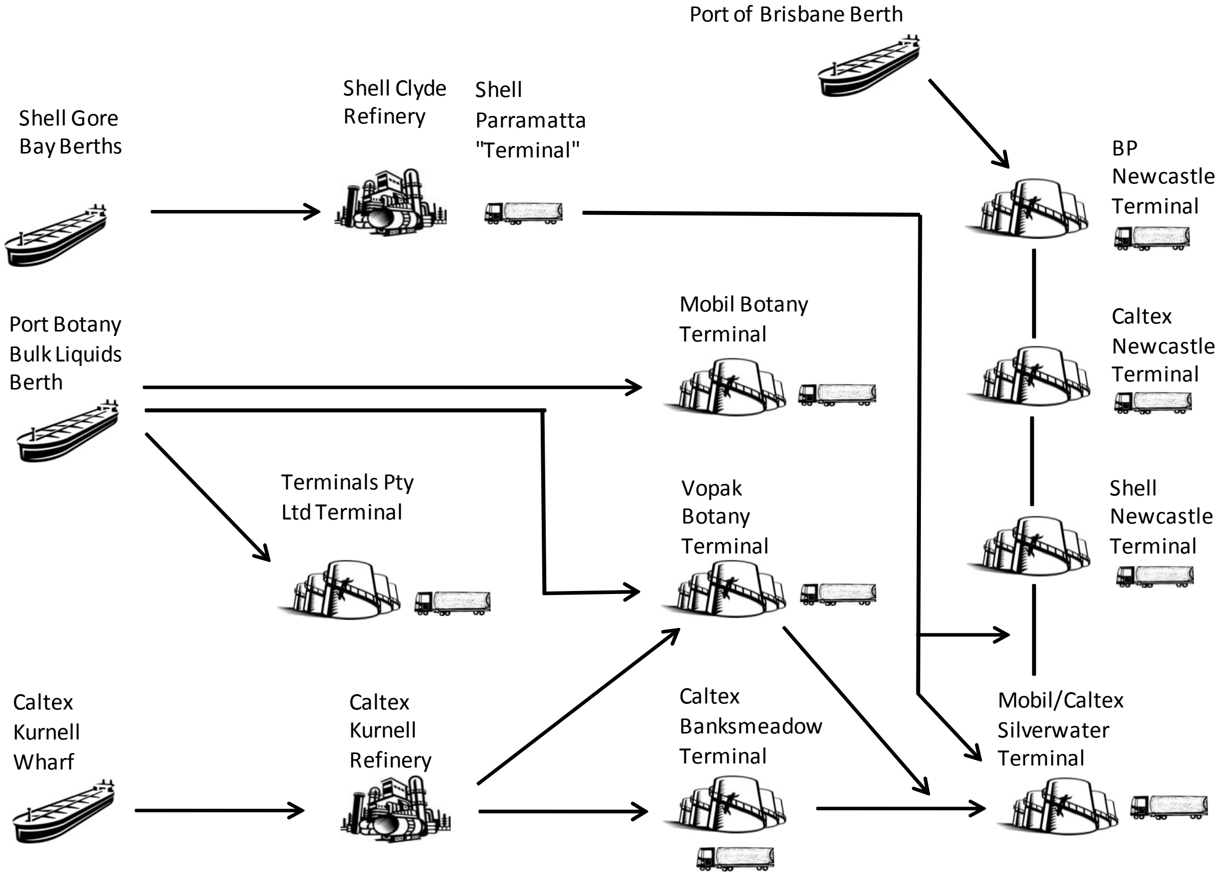


Data source: Vopak

The superimposed orange line depicts the SMP that runs from Caltex Banksmeadow terminal to the Mobil/Caltex Silverwater joint terminal (from where it becomes the Sydney-Newcastle Pipeline). Figure 15 also shows the JUHI pipeline supplying jet fuel from Caltex's Kurnell refinery to Sydney Airport, incorporating links from the Vopak and Mobil Botany terminals and the Caltex Banksmeadow terminal.

The petroleum infrastructure network in Sydney is illustrated in the form of a schematic in Figure 16. A schematic of the jet fuel network around Sydney Airport is presented in Figure 17. BP at Newcastle now has port access.

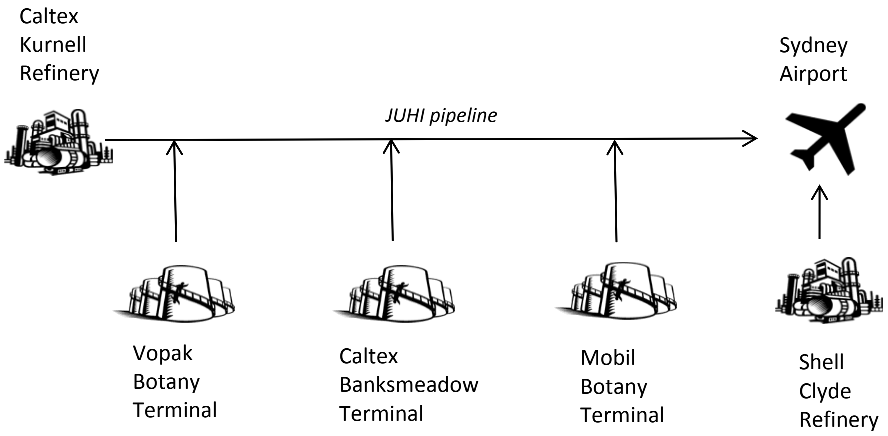
Figure 16 **Petroleum infrastructure network – Sydney and Newcastle**



Note: One terminal in Newcastle is not shown on this diagram

Data source: ACIL Tasman

Figure 17 **Jet fuel infrastructure around the Sydney Airport JUHI**



Data source: ACIL Tasman

Newcastle

Terminal location and ownership

The three main terminals in Newcastle are owned and operated by refiner-marketers (see Table 8). The Shell Newcastle terminal is a joint venture with Mobil, while the BP and Caltex terminals offer spot hosting arrangements to third parties.

Table 8 **Fuel terminals in Newcastle**

Terminal location	Terminal owner(s)	Terminal operator	Supply arrangements
Newcastle	BP	BP	Supplied from the Caltex pipeline and from Newcastle port.
Newcastle	Caltex	Caltex	Supplied from the Caltex pipeline
Newcastle	Shell and Mobil	Shell	Supplied from the Caltex pipeline

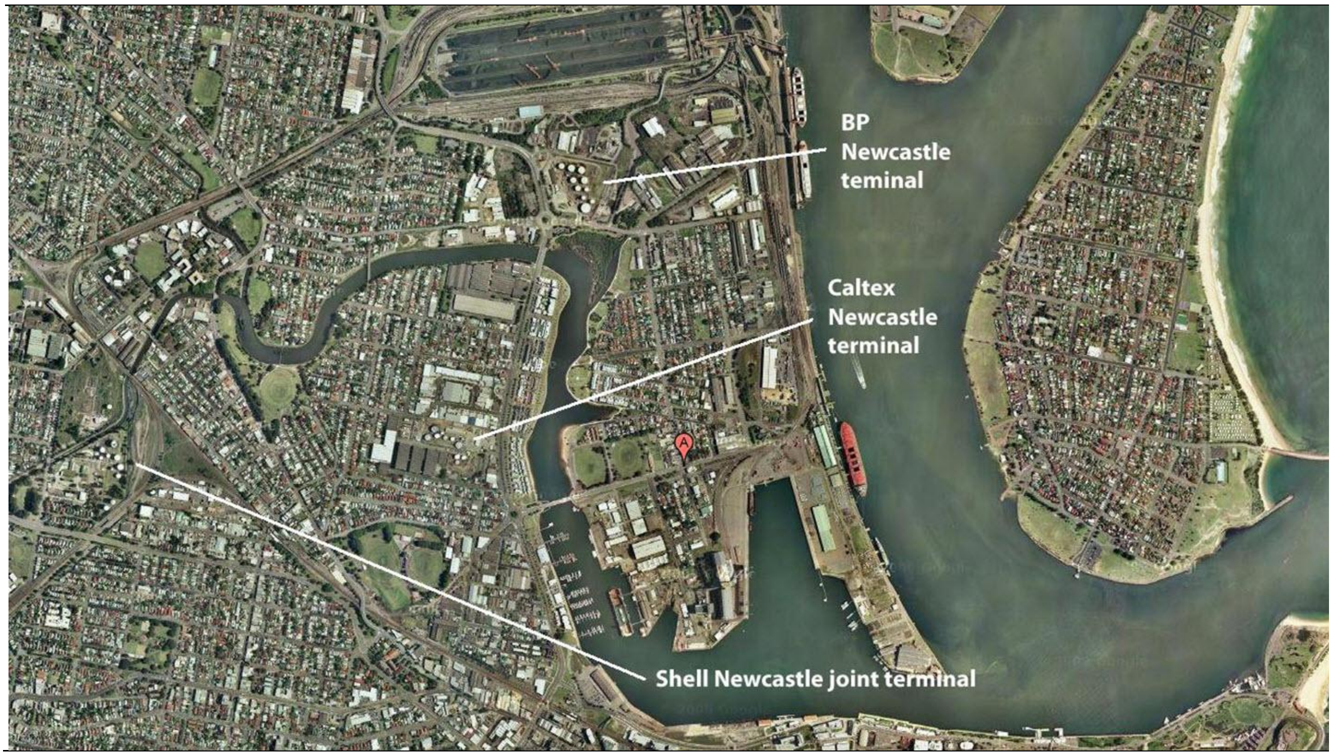
Note: Does not include all terminals in Newcastle for confidentiality reasons

Data source: BP, Caltex and Shell

The three terminals receive petroleum products from both the Caltex Kurnell and Shell Clyde refineries in Sydney via the Sydney-Newcastle Pipeline. They also receive product from several of the terminals in Sydney via the Caltex/Mobil Silverwater joint terminal.

The locations of the terminals are illustrated in Figure 18.

Figure 18 **Petroleum infrastructure network – Newcastle, NSW**



Data source: Google Maps

The BP and Caltex terminals offer spot hosting. BP has increased capacity at its Newcastle terminal by 40 ML and completed a pipeline to a berth in Newcastle Harbour.

Marstel has announced plans for a new terminal in Newcastle which will have the capacity to accept both products refined domestically as well as imports.

Commercial arrangements for terminals in New South Wales

The commercial arrangements for terminals in New South Wales are summarised in Table 9. Three of the ten terminals in New South Wales are currently involved in spot hosting. Two terminals at Botany operate on a leasing arrangement. The remaining five terminals are currently dedicated to their own products.

Hosting is negotiated on a commercial basis. Charges recover capital and operating costs and take into account items such as volume discounts, marketing, blending or credit risk. The cost of alternative arrangements is taken into account in some cases. While each arrangement is considered on a case by case basis there is no discrimination between types of customers.

Table 9 **Commercial arrangements for terminals in New South Wales**

Arrangements	Terminal owner(s)	Terminal operator	Hosting / leasing arrangements
Terminals with current hosting arrangements	Caltex Banksmeadow BP Newcastle Caltex Newcastle	Caltex BP Caltex	Spot hosting Spot hosting Spot hosting
Terminals with leasing arrangements	Vopak Botany Terminals Pty Ltd Botany	Vopak Terminals Pty Ltd	Leases to others Leasing arrangements
Terminals without current hosting arrangements	Mobil Botany Shell-BP Parramatta Caltex -Mobil Silverwater - Joint Venture Shell-Mobil Joint Venture Newcastle	Mobil Shell Mobil Shell	No current hosting arrangements

Note: Two smaller terminals have been excluded for confidentiality reasons
Data source: ACIL Tasman survey

Leasing arrangements for the independent terminals are based on a commercial return on capital and operating costs and include rental fees and/or throughput fees. Vopak advised that there were no constraints on access by independents, however the company required long term agreements with companies that had established distribution contracts to markets. All products imported were required to meet product quality specifications set by Australian fuel standards.

4.2.3 Capacity utilisation

As at December 2008, New South Wales had a total product storage capacity in import terminals of 754 ML of which 81 per cent was located in Sydney (see Table 10).

Table 10 **Terminal storage in New South Wales**

Port	Petrol	Diesel	Jet fuel	Lubes, Solvents, others	Total
	ML	ML	ML	ML	ML
Sydney	248	152	153	58	610
Newcastle	47	63	6	29	144
Total	294	214	159	86	754

Note: Does not include two smaller terminals in NSW
Data source: ACIL Tasman Survey

The annual throughput of petroleum products in New South Wales import terminals was 13491 ML in 2007-08.

Both Sydney and Newcastle had little spare capacity to increase throughput as at December 2008. The major constraints in Sydney were the single bulk liquids berth at Port Botany and the Sydney Metropolitan Pipeline. The Sydney to Newcastle pipeline was also approaching its capacity.

The Shell and Caltex supply pipelines to the Sydney JUHI are theoretically capable of delivering a combined capacity of 8.8 ML per day but are in need of expansion.

Table 11 **Capacity utilisation**

Port	Ability to meet current demand as at December 2008	Bottlenecks and constraints
Sydney	Fully committed.	Single bulk liquids berth Sydney Metropolitan pipeline JUHI pipeline
Newcastle	Close to fully committed.	Sydney to Newcastle pipeline was at around 80 % full capacity before the connection of the BP terminal to Newcastle Port

4.2.4 Committed and planned developments

There are several important capacity expansions in Sydney that will alter the above assessment for December 2008. In April 2009, BP commissioned an expansion of its terminal in Newcastle adding an additional 40 ML storage and a pipeline connection to Newcastle Port. This will increase import capacity in Newcastle and take pressure of the Sydney to Newcastle pipeline.

On 24 April 2009, Sydney Ports Corporation made an in-principle decision to proceed with the second bulk liquids terminal at Port Botany.

Vopak is implementing a 75 ML expansion in storage capacity at its Port Botany terminal and has completed construction of a pipeline from its terminal to the Sydney Metropolitan Pipeline.

Marstel is in the final planning stages for a 60 ML storage terminal at Newcastle port. Subject to final approvals and contract arrangements the project could proceed in 2010.

Committed and planned expansions are summarised in Table 12. Committed increases in storage capacity in New South Wales are 15 per cent of current capacity. If planned increases proceed, storage capacity will be increased by a total of 23 per cent.

Vopak has indicated that it could double the current expansion of capacity at its Botany terminal if market conditions justified further investment.

Table 12 **Committed and planned developments**

Port	Ability to meet current demand as at December 2008	Committed expansion	Planned expansion
Sydney	Capacity as at December 2008 was fully committed	Vopak is constructing additional 75 ML storage at Port Botany	Sydney Ports Corporation made an in principle decision to proceed with a second bulk liquids terminal Increase in the JUHI pipeline capacity is under consideration
Newcastle	The Caltex liquids pipeline to Newcastle is around 80 percent utilised	BP increased storage at Newcastle by 40 ML and created import capacity.	Marstel is planning an additional terminal at Newcastle of 60 ML storage capacity

4.3 Victoria

4.3.1 Location and infrastructure

Refineries

There are two refineries in Victoria: the Shell refinery at Corio near Geelong and the Mobil refinery at the western Melbourne suburb of Altona. The capacities of the two refineries are approximately 6,380 ML per annum and 4530 ML per annum respectively (AIP, 2007).

According to Mobil, about 45 per cent of the feedstock at its Altona refinery is piped in from the Gippsland Basin oil fields. Of the remaining 55 per cent that arrives via ship, a small proportion come from Western Australia's North West Shelf, some from New Zealand, while the rest comes primarily from Asia (Vietnam, Indonesia etc).

Berths

In Melbourne, refined petroleum products are received at the Holden Dock in the Port of Melbourne while crude oil is received at the Mobil-operated Gellibrand Pier at Williamstown. Holden Dock is a common-user liquid bulk berth, with Mobil being its primary user. Mobil operates the pipeline from Holden Dock into Yarraville.

The Shell refinery at Corio is supplied from the refinery piers at the Port of Geelong.

Crude oil, such as that from the Gippsland Basin oil fields, also arrives via the Western Port-Altona-Geelong (WAG) pipeline to both the Altona and Geelong refineries.

Terminals

There are a total of four import terminals in Victoria: three in Melbourne and one at Hastings on the Mornington Peninsula southeast of Melbourne. In addition, there is a terminal for aviation fuels at Somerton that is connected to the Melbourne Airport JUHI.

The ports through which petroleum products are imported in Victoria and the terminals they serve are summarised in Table 13.

Table 13 **Summary of major petroleum importing ports: Victoria**

Port	Fuels	Terminals
Melbourne	ULP PULP Diesel Avgas Jet fuel	Caltex Shell Mobil JV with BP Sommerton Melbourne Airport JUHI
Hastings	ULP PULP Diesel	United

4.3.2 Ownership and usage arrangements

Melbourne

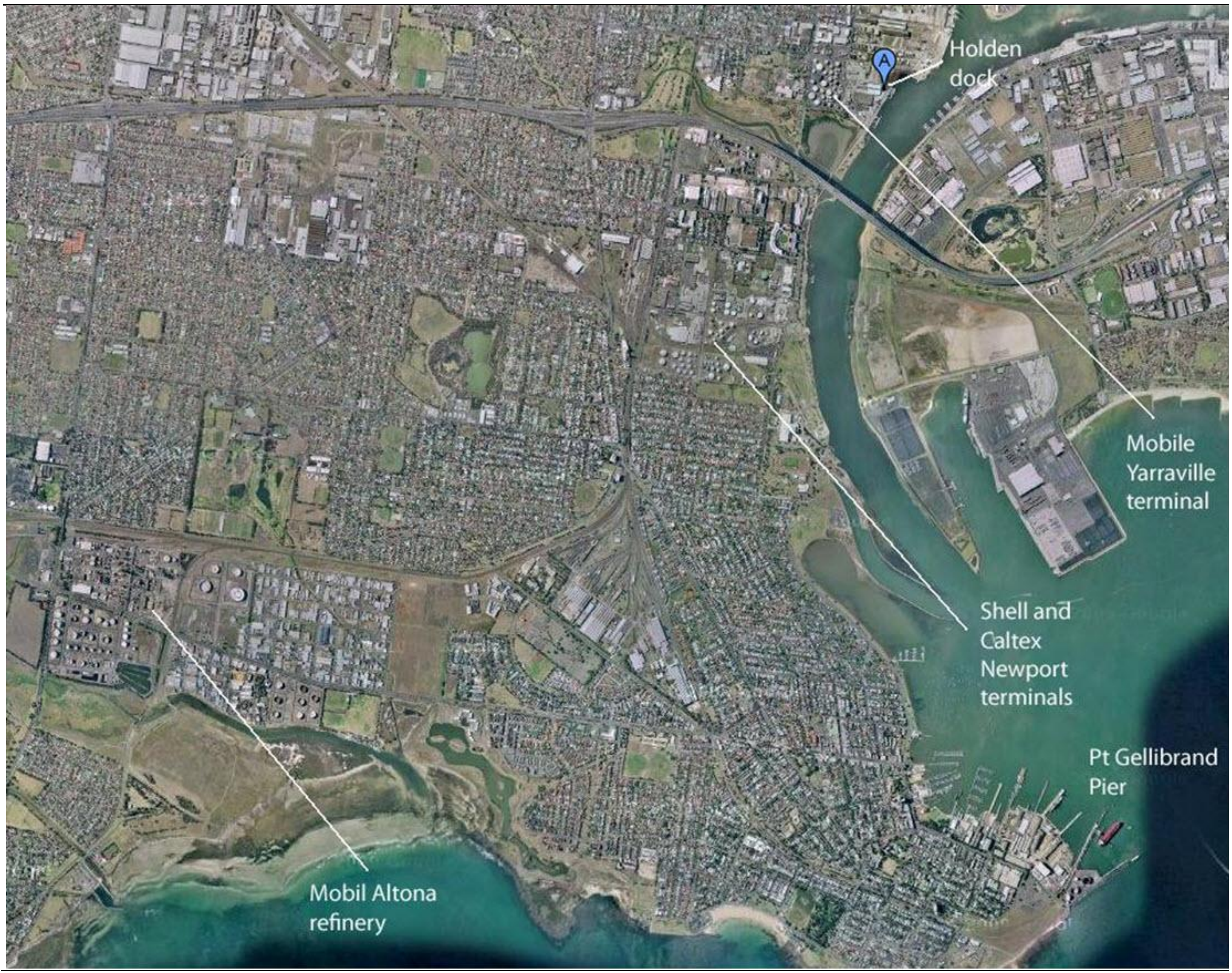
The terminals in Melbourne, all owned by refiner-marketers, are listed in Table 14 and shown in Figure 19. Shell and Caltex both own and operate terminals in Newport near the mouth of the Yarra River. The Yarraville terminal is a joint venture between Mobil and BP, and operated by the former. None of the three terminals in Melbourne are currently involved in any hosting arrangements.

Table 14 **Fuel terminals in Melbourne**

Terminal location	Terminal owner(s)	Terminal operator	Hosting arrangements
Newport	Caltex	Caltex	None
Newport	Shell	Shell	None
Yarraville	Mobil and BP (JV)	Mobil	None
Sommerton/Melbourne Airport	Mobil/BP/Shell		None

Note: JV = joint venture
Data source: Caltex, Shell, Mobil and BP

Figure 19 **Aerial view of refinery, berths and terminals in Melbourne**



Data source: Google Maps

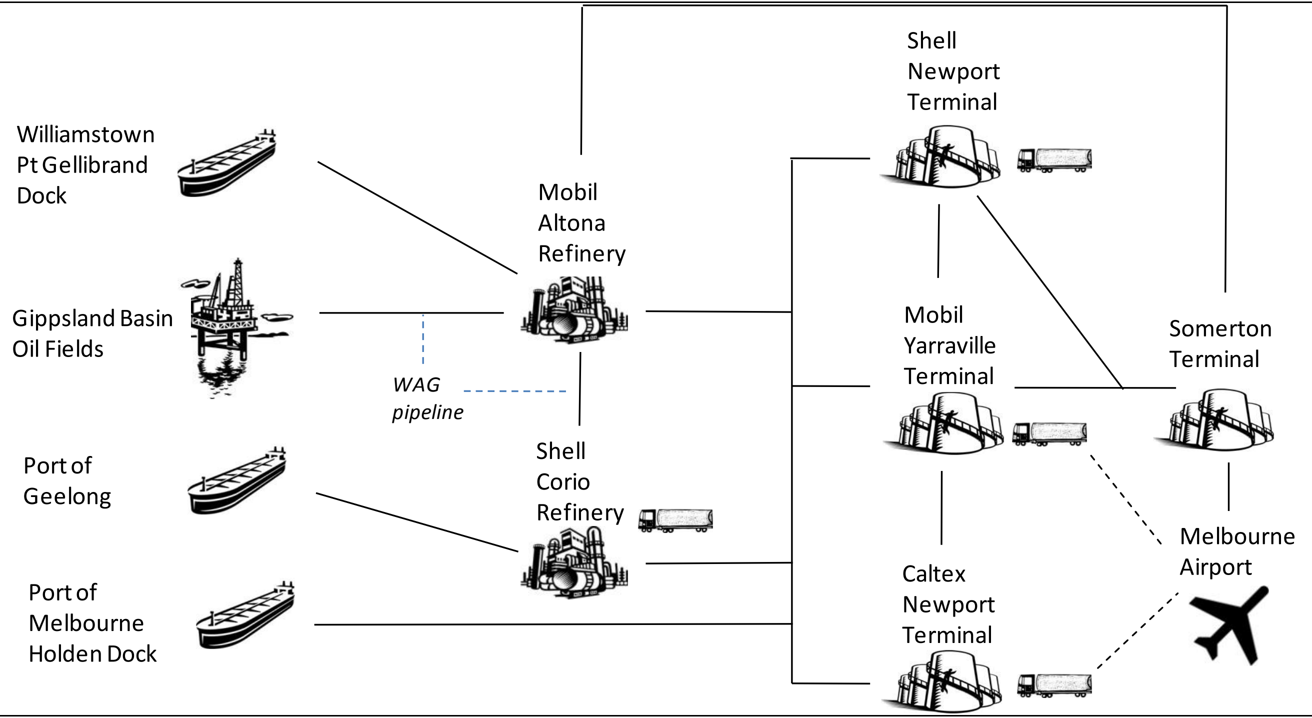
Unlike Sydney, there are no independently owned terminals in west Melbourne, although such capacity is available at Hastings (which will be discussed subsequently).

All three main terminals are connected by a pipeline network to the Holden Dock at the Port of Melbourne, from which imports can be received. Fuel is distributed from all three terminals by truck gantries.

In addition, there is a storage facility for aviation fuels at Somerton that is connected to the Melbourne Airport JUHI at Tullamarine. The facility receives fuel via pipelines from Mobil's Altona refinery and Shell's Corio (Geelong) refinery, and is connected to Shell's Newport terminal via a 200 cubic metre per hour pipeline. It also receives fuel by truck from the Mobil/BP Yarraville joint terminal. In addition, Caltex also delivers jet fuel directly to the JUHI by truck from its Newport terminal.

The petroleum infrastructure network around Melbourne is illustrated in Figure 20.

Figure 20 **Petroleum infrastructure network – Melbourne and Geelong**



Data source: ACIL Tasman

Shell

The Shell terminal at Newport receives product from Shell's refinery in Geelong (approximately 60 kilometres way) via two one-way pipelines. It can also receive fuel from Mobil's refinery at Altona. These refineries obtain crude oil from the Gippsland Basin Oil Fields (via the Longford Processing Plant, BHP Billiton/Esso's Long Island terminal, the Dandenong terminal and WAG pipelines) as well as overseas crude oil shipped in tankers (via the Gellibrand Pier in Williamstown in the case of the Altona refinery and the Port of Geelong in the case of Shell's refinery at Corio).

While the Shell refinery has historically been reliant on Gippsland crude, the use of this crude has fallen due to a change in the character of the crude from heavy, waxy crude to a light crude (ACCC, 2007). Over time increasing reliance on imports will require additions to crude storage at Geelong.

Shell owns and operates a terminal at Newport. Shell is increasing its ULP storage to relieve ULP tankage constraints that are expected to bind in 2009.

ExxonMobil

The Mobil refinery is located at Altona (approximately six kilometres southwest of Newport). The refinery receives around half its crude oil supplies from the Gippsland Basin Oil Fields and about half is imported. As Gippsland crude declines the crude oil storage at Altona may need to be increased.

The Mobil terminal is located at Yarraville where it receives fuel primarily from Mobil's Altona refinery. It can also receive fuel from Shell's Geelong refinery as well as imported products from Singapore.

Mobil and BP own the Yarraville terminal in a joint venture arrangement which is operated by Mobil.

Caltex

Caltex owns and operates a terminal at Newport. The terminal receives fuel from both the Mobil Altona and Shell Geelong refineries.

Western Port (Hastings)

In 2008, United Petroleum acquired Trafigura's terminal at Hastings in the Mornington Peninsula. The terminal is connected to berthing facilities at Crib Point Pier via a 9.5 km pipeline. The pier, which has a deep draught of 15 metres and can accommodate tankers of up to 80,000 tonnes, is currently under-utilised, resulting in high port costs. Ships carry petrol and diesel from Singapore, Japan, India, Korea and the West Coast of the United States.

There are currently no hosting arrangements at this terminal. However United Petroleum will consider hosting opportunities.

4.3.3 Commercial arrangements

None of the terminals operating in Victoria currently host other fuel supplies. United Petroleum has capacity for hosting at the present time. The west Melbourne terminals have limited spare capacity to offer long term hosting.

The arrangements for purchasing wholesale fuels from terminals are consistent with those described in section 3.5 and subsequently for terminals operating in New South Wales.

4.3.4 Capacity utilisation

Total useable storage capacity of terminals in Victoria is currently 418ML (see Table 15). Seventy eight percent of this capacity is located in western Melbourne.

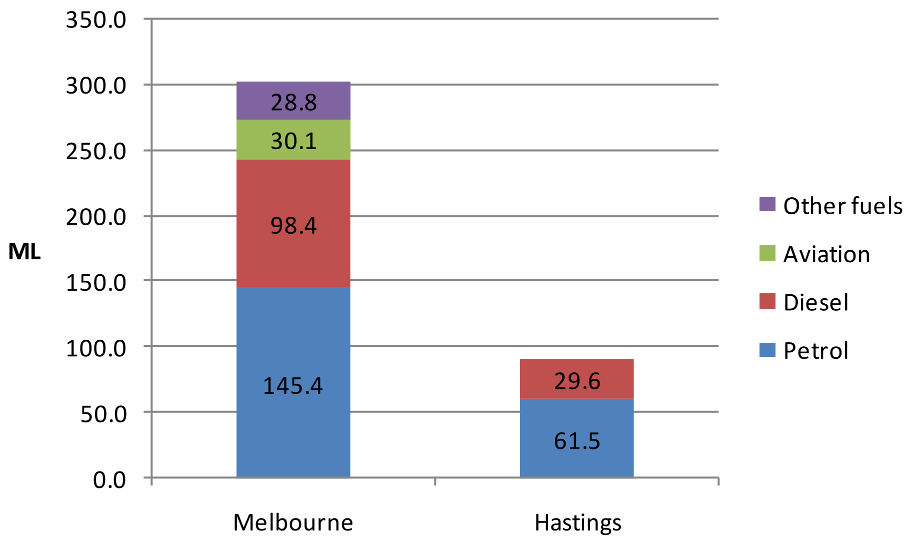
Table 15 **Capacity in Victoria**

Port	Petrol	Diesel	Jet fuel	Lubes, Solvents, others	Total
	ML	ML	ML	ML	ML
Melbourne	145	99	54	29	327
Hastings	62	30	0		91
Total	207	129	54	29	418

Data source: ACIL Tasman survey

A comparison of the total storage capacities for various petroleum products at Melbourne and Hastings is shown in Figure 21.

Figure 21 **Storage capacity for various fuels at Melbourne and Hastings**



Data source: ACIL Tasman

The throughput through terminals in Victoria was 10,190 ML in 2007-08.

There appear to be few serious current or emerging bottlenecks in Victoria. One terminal has identified tankage constraint for ULP. Holden dock is at around 80 per cent utilisation.

The pipeline capacity to the JUHI is somewhat constrained and may require augmentation to its capacity in the near future.

United Petroleum currently has around 20 per cent spare capacity and has land available for additional storage capacity if market conditions justify further investment.

4.3.5 Committed and planned developments

There are no major planned capacity extensions in Melbourne. There has been a conversion of some tank capacity to ULP in one of the west Melbourne terminals.

United has the space to add capacity to its terminal at Hastings but at the present time the market does not warrant further investment.

4.4 Queensland

4.4.1 Location, infrastructure and capacity

Refineries

There are two refineries adjacent to the mouth of the Brisbane River. Reported capacities are 5,110 ML per annum for BP's Bulwer Island refinery and 6,270 ML per annum in the case of Caltex's Lytton refinery.

Terminals

There are four petroleum product terminals (storage and road load-out facilities) in Brisbane supplied by pipelines from refineries, which process Australian and overseas crude oil, and by pipelines from petroleum product import facilities.

In Queensland coastal regional centres, there are 13 terminals fed by petroleum product import facilities: Gladstone (2), Mackay (3), Townsville (2), Cairns (3), Torres Strait (2) and Weipa (1).

In addition, there are other import facilities. Petroleum products are imported at Cape Flattery for the silica mining operation and community and Horn Island for community consumption. When road access is cut to Karumba, petroleum products are brought in by sea.

Berths

In Brisbane, there are two crude oil berths and 4 petroleum products berths. There are active berths for importing petroleum products at Gladstone, Mackay, Townsville, Cairns, Cape Flattery, Horn Island, Thursday Island, Weipa and Karumba (see Table 16).

Table 16 **Terminals and refineries in Queensland**

Port	Fuels	Refineries/terminals
Brisbane	PULP,ULP, diesel, LPG	BP Bulwer Island Refinery and terminal Caltex Lytton Refinery Caltex Lytton and Tanker Street Terminals BP-Mobil Whinstanes terminal Shell Pinkenba terminal Neumman Petroleum's Eagle Farm terminal
Gladstone	PULP,ULP, diesel, LPG	Caltex-Mobil terminal BP-Shell joint terminal
Mackay	PULP, ULP, diesel	BP terminal - also hosts Shell terminal Caltex terminal
Townsville	PULP, ULP, diesel	BP terminal – hosts other Shell-Caltex Joint Venture
Cairns	PULP, ULP, diesel	BP terminal – hosts other Caltex terminal – spot hosting Shell terminal
Weipa	PULP, ULP and diesel	Rio Tinto – hosts others
Others - Cape Flattery	Petrol, diesel	
Horn Island	Petrol diesel	
Karumba	Petrol and diesel during flood periods	Gold engineering and construction

Data source: ACIL Tasman survey

4.4.2 Brisbane

Refineries

Brisbane's two refineries are located adjacent to the Brisbane River, close to the river mouth. Both were commissioned in 1965.

BP's Bulwer Island refinery is located on the north side of the river. Its reported capacity is 5,110 ML per annum. Caltex's Lytton refinery on the south side of the river has reported capacity of 6,270 ML per annum (AIP, 2007).

BP and Caltex receive crude oil by ship from Australian and overseas oil fields. Some south-west Queensland crude oil is trucked to the Santos storage tank at Lytton and then piped to the two refineries. Total crude oil storage capacity of the two refineries is around 530 ML.

Both refineries also store product at their refineries for delivery to local terminals as well as shipping to regional terminals on the Queensland coast. Total product storage in Brisbane is 395 ML comprising 163 ML petrol, 157 ML diesel, 72 ML jet fuel and 1 ML of other fuels.

Terminals

There are four petroleum product terminals (storage and road load-out facilities) in Brisbane supplied by pipelines from refineries, which process Australian and overseas crude oil, and by pipelines from petroleum product import facilities. They are listed in Table 17, where ownership, operating and usage arrangements are also shown.

Table 17 **Petroleum product terminals in Brisbane**

Terminal location	Terminal owner(s)	Terminal operator	Supply arrangements
Lytton - refinery	Caltex	Caltex	Supply from Lytton refinery
Lytton - Tanker St.	Caltex	Caltex	Supplied from Lytton refinery
Pinkenba - refinery	BP	BP	Supplied from refinery
Whinstanes.	BP and Mobil Joint Venture	BP	Supplied from and Lytton and Bulwer Island refineries
Pinkenba	Shell	Shell	Supplied from and Lytton and Bulwer Island refineries
Eagle Farm	Neumann Petroleum	Neumann Petroleum	Supplied from and Lytton and Bulwer Island refineries and from imports from Maritime No1 wharf

Data source: BP, Mobil, Caltex, Shell, Neumann

The locations of the terminals, and the refineries and port facilities that supply them with products are shown in Figure 22.

Petroleum infrastructure network in Brisbane

The Port of Brisbane has 6 berths for petroleum imports, two crude oil berths and four products berths. Five of the berths are used solely for petroleum. One is used for multiple purposes, Maritime No. 1 Wharf at Hamilton.

The crude oil berths are located in deeper water than the products berths. Two of the products berths are used to load out products as well as discharge product imports.

The crude oil berths, the Luggage Point-Fisherman Islands swing basin and channel can accommodate Aframax tankers (in excess of 80,000 DWT). They can take Suezmax vessels (120,000 – 200,000 DWT) at the lower end of the range, but not fully laden. The channel and berths would have to be deepened by up to one metre to accommodate fully laden Suezmax tankers.[1]

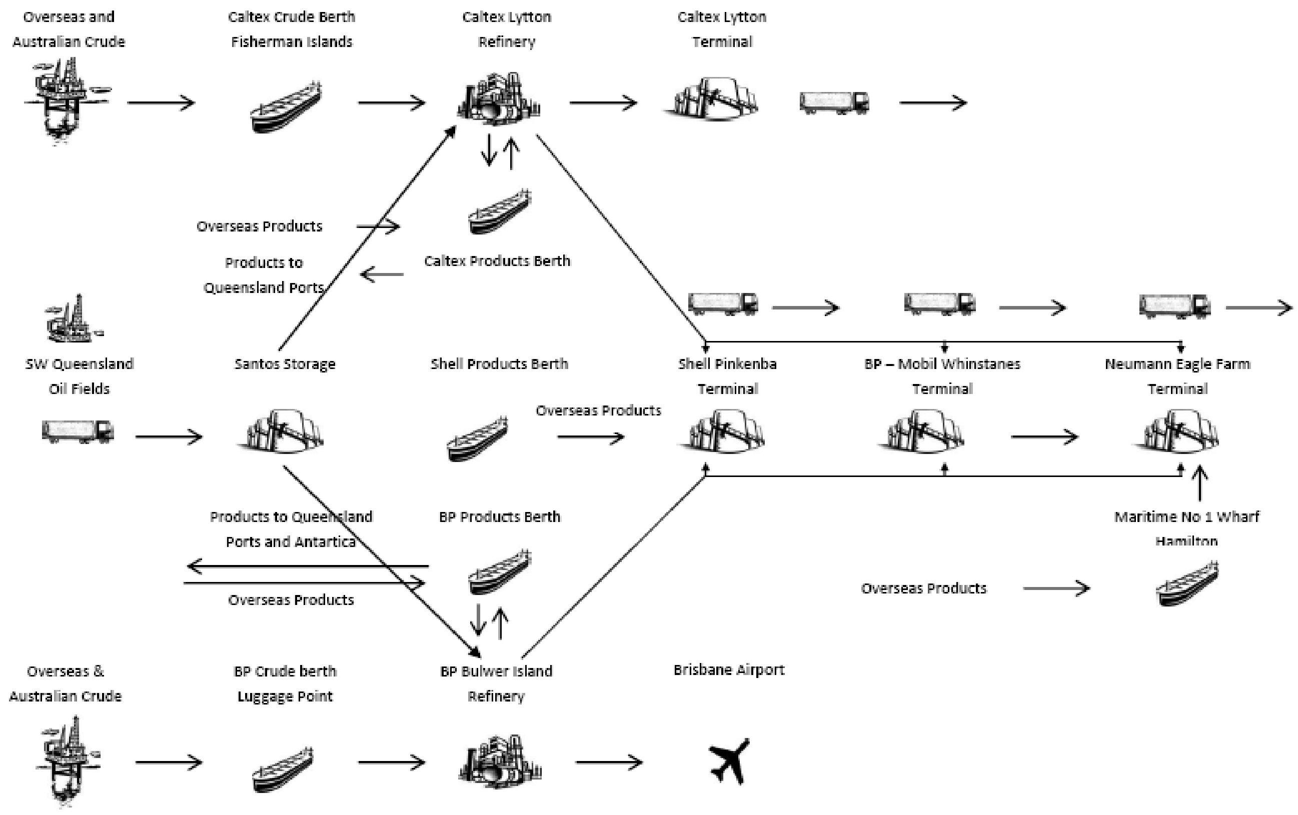
The petroleum infrastructure network in Brisbane is illustrated in Figure 23.

[1] Communication from Port of Brisbane Corporation.

Figure 22 **Port of Brisbane: refineries, petroleum berths, petroleum product terminals**

Data source: Port of Brisbane Corporation

Figure 23 **Brisbane petroleum infrastructure network**



Data source: ACIL Tasman

Caltex

Caltex imports crude oil for its Lytton refinery via its own facilities at Fisherman Islands, 3.1 km from the entrance beacons on the eastern side of the mouth of the Brisbane River, almost directly across the river from BP's Luggage Point berth. Crude oil is piped south from the Fisherman Islands berth to the refinery across a passage separating the Fisherman Islands port area from the mainland.

The depth of the Fisherman Islands berth is 14.3 metres below LAT. The shipping channel, the Fisherman Islands-Luggage Point swing basin, berth depth and berth pocket allow Caltex to bring in Aframax tankers and cargos up to a maximum of 127-135 ML, depending on tides.

The pipeline that carried crude oil from wells in south-west Queensland to the Lytton refinery has been taken out of service because of problems with corrosion and leaks. Crude oil is trucked to Santos' storage facility near the Lytton refinery and then piped to the refinery.

In 2007-08, Caltex's intake of crude oil to Lytton refinery was 5164 ML. The percentage sourced from Australian oil fields was 19 per cent. The other 81 per cent was shipped in from overseas. In the second half of 2008, the crude oil intake was 2090 ML, of which 80 per cent was sourced overseas.

The Lytton refinery supplies products to other locations by pipeline:

- Caltex's Lytton terminal (Tanker Street), which is located to the south-east of the refinery and adjacent to it
- Caltex's berth for shipment of products by sea to Queensland coastal terminals
- Shell's Pinkenba terminal to the south-west of the refinery on the other side of the Brisbane River
- BP-Mobil's Whinstanes terminal
- Neumann Petroleum's Eagle Farm terminal, which is located close to the Whinstanes terminal.

Shell's Pinkenba terminal, BP-Mobil's Whinstanes terminal and Neumann's Eagle Farm terminal are supplied by a single 10-inch, 9.5 km pipeline owned and operated by Caltex. There are tie-in (valving) points at BP's Bulwer Island refinery and the Shell, BP-Mobil, and Neumann terminals.

Caltex imports a range of products and sometimes refinery blendstocks through the berth it uses to ship products to terminals in ports in northern Queensland. The facilities are owned by Caltex and are adjacent to the Lytton refinery.

The most common imported products are regular and premium unleaded petrol and diesel. In the vast majority of cases, these imported products are stored at the refinery before being piped to terminals.

Caltex's products shipment (and imports) berth has a draught of 9.7 metres and berth pocket of 285x35 metres. The berth, the Pinkenba swing basin and the channel can accommodate ships in the middle of the MR tanker size range (25,000 to 45,000 DWT), with cargos up to 40 ML. The maximum ship size is less than for the Fisherman Islands crude oil berth because Brisbane Rocks prevents larger ships from berthing upstream from the Fishermans Island port area.

Caltex has ethanol storage and E10 blending facilities at its Tanker Street terminal.

BP

BP imports crude oil for its Bulwer Island refinery via a berth, wharf and discharge facilities to the north of the refinery on the western side of the Brisbane River mouth to the south-west of Luggage Point, 3.1 km from the entrance beacons. The facilities are owned by BP.

The berth is on the opposite side of the river to the Caltex crude oil berth in the Fisherman Islands area of the port. Crude is transported from BP's crude oil berth to the Bulwer Island refinery through a pipeline across the mouth of Boggy Creek.

The draught of the Luggage Point berth is 14.3 metres below LAT and the berth pocket is 329x50 metres. The berth, the Luggage Point-Fisherman Islands swing basin, and the channel depth allow Aframax vessels (in excess of 80,000 DWT) to access the berth. Typically, cargos of crude oil are 95-100 ML.

Although BP does not use its crude oil import berth to import products, it potentially could do so.

While the crude oil pipeline from south-west Queensland has been decommissioned, the Lytton-Bulwer Island segment under the Brisbane River remains in service for transportation of crude oil trucked to Santos' storage facility near Tanker Street, Lytton.

BP imports some products through its berth, wharf and discharge facilities upstream (south-west) of the refinery, and to the north-east of Yarra Street and Shell's berth. BP's product import (and export) facilities are located 8.1 km from the entrance beacons. Imported products are transported to refinery storage facilities initially.

Products are transported by pipeline from BP's refinery to other locations:

- the nearby Brisbane Airport to the west (jet fuel)
- Shell's Pinkenba terminal the BP-Mobil Whinstanes terminal
- Neumann's terminal at Eagle Farm, which is located close to BP's products berth for shipment to terminals at other Queensland ports and Antarctica.

Shell's Pinkenba terminal, BP-Mobil's Whinstanes terminal and Neumann's Eagle Farm terminal are supplied by a single 8-inch, 8.5 km pipeline.

BP's products shipment (and imports) berth has a draught of 11.3 metres. The berth, channel and Pinkenba swing basin can take ships in the middle of the MR tanker size range, with cargos up to 40 ML. The maximum ship size that can access the products berth is much smaller than for the Luggage Point crude oil berth. The riverbed obstacle created by Brisbane Rocks prevents larger ships from berthing upstream from the Bulwer Island refinery.

The BP-Mobil terminal at Whinstanes is supplied by pipelines from BP's Bulwer Island and Caltex's Lytton refineries. This terminal is not supplied directly with imported products. Ethanol stored at the terminal is blended with regular unleaded petrol by on-site blending facilities to produce E10. Diesel, regular unleaded petrol, premium petrol and E10 are loaded-out via track gantry for distribution by road transport.

Shell

Shell's Pinkenba terminal receives products by pipelines from the two Brisbane refineries.

Shell also owns a wharf and discharge facilities that it uses to import products. The facilities are located 8.6 km from the entrance beacons. They are adjacent to the terminal. The shipping channel, Pinkenba swing basin and berth can accommodate tankers in the middle of the MR tanker range, allowing cargos up to 40 ML.

Shell has ethanol storage and E10 blending facilities at Pinkenba.

Shell's Pinkenba terminal loads-out fuel via four gantry bays for distribution by road transport.

Neumann Petroleum

Neumann Petroleum's Eagle Farm terminal is supplied by:

- an 8-inch, 1.1 km pipeline (wharfline) from No. 1 Maritime Wharf, Hamilton (petrol and diesel)
- an 8-inch, 8.5km pipeline (owned by BP to Neumann's boundary) from the BP Bulwer Island refinery (petrol and diesel)
- a 10-inch, 9.5 km pipeline (owned by Caltex to Neumann's boundary) from the Caltex Lytton (petrol).

The BP and Caltex pipelines also deliver products to the Shell and BP-Mobil terminals

No. 1 Maritime Wharf is owned by the Port of Brisbane Corporation. It is located 14.8 km from the entrance beacons. The channel, Hamilton swing basin and berth limit ships to the lower part of the MR tanker range, around 28,000 DWT. So, cargoes are limited to 35 ML. Existing terminal tankage also has effectively imposed a limit.

Neumann Petroleum's Eagle Farm terminal has facilities for blending ethanol with regular and premium unleaded petrol to produce E10 products.

Fuel is distributed by road from the Neumann terminal, which has four Omega 3000 truck loading gantries.

BP-Mobil

The BP-Mobil Whinstanes joint venture also has additional tanks between Kingsford Smith Drive and Lavarack Avenue, in Meeandah, near the Meeandah railway station. They include a 15 ML diesel tank and a 15 ML petrol tank.

4.4.3 Gladstone

Gladstone has two petroleum product terminals (storage and road load-out facilities) supplied by petroleum product import facilities. They are listed in Table 18, which also shows ownership, operating and usage arrangements.

Table 18 **Type table title here**

Terminal location	Terminal owner(s)	Terminal operator	Supply arrangements
Gladstone	Caltex-Mobil	Caltex	Supplied from Auckland Point Wharf
Barney Point	BP-Shell	BP	Supplied from Auckland Point Wharf

Data source: BP, Caltex, Shell, Mobil

The terminals are located in close proximity to the Auckland Point Wharf Centre, which includes 4 wharves, Auckland Point Nos. 1-4. They are supplied with products from Auckland Point No. 3.

The terminals sit behind the stockpile and storage areas for Auckland Point No. 1 and No. 2 wharves (magnesia, calcite, break bulk for No. 1 and grain silos for No. 2). The locations of the terminals and wharf facilities are shown in Figure 24.

Petroleum infrastructure network in Gladstone

Products supplied to the Caltex-Mobil and BP-Shell terminals through Auckland Point No. 3 import facilities are sourced from the Lytton (Caltex) and Bulwer Island (BP) refineries in Brisbane and overseas refineries.

Auckland Point No. 3 wharf is a multi-user facility owned by Gladstone Ports Corporation Limited, which manages and operates port facilities in the Ports of Gladstone and Port Alma (62 km from Rockhampton). The wharf is used for general cargo as well as petroleum products.

Figure 24 **Gladstone Petroleum Products Berth and Terminals**

Data source: Google maps

The Auckland Point No. 3 facility has two wharf discharge pipelines for unloading petroleum products. The maximum vessel size is 55,000 DWT. This may be reduced depending on the presence and size of a vessel in an adjacent berth.[2]

Petroleum products are piped from the wharf to nearby terminals.

4.4.4 Mackay

Terminal location and ownership

In Mackay, there are three petroleum product terminals (storage and road load-out facilities) supplied by petroleum product import facilities. The terminals are listed in Table 19, which also shows ownership, operating and usage arrangements.

The locations of the terminals and Berth No. 1, at which products are discharged, are shown in Figure 25. BP has tank storage in Hamilton Drive as well as Graeme Heggie Street. The BP tanks in Hamilton Drive to the south of the Shell terminal were previously owned by Mobil, which is now hosted by BP.

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[2] Gladstone Ports Corporation Limited, *Port of Gladstone: Port Information Handbook 2008*, pp. 8. 29.

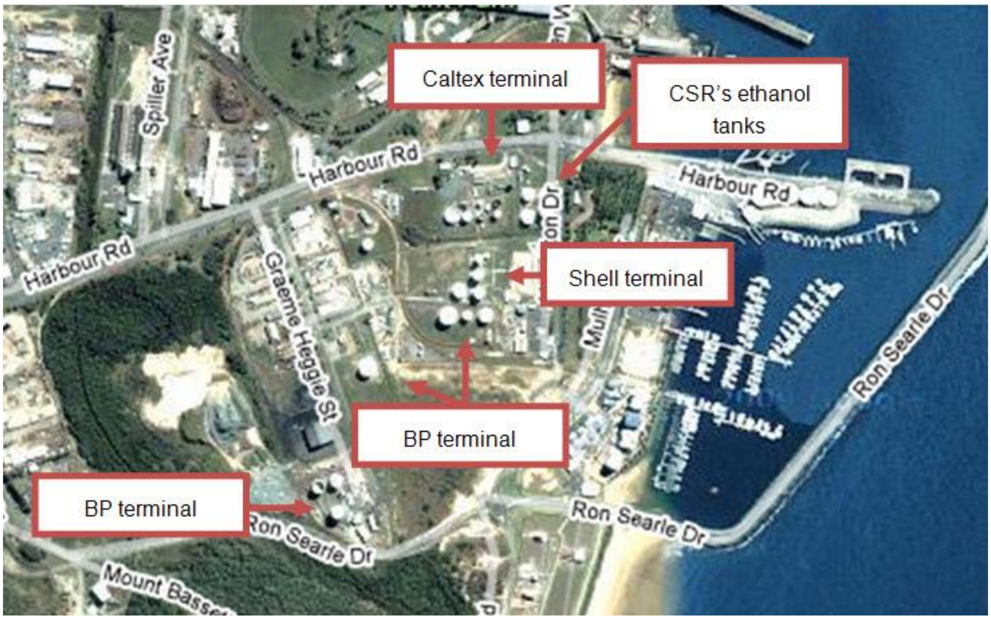
Table 19 **Petroleum product terminals in Mackay**

Terminal location	Terminal owner(s)	Terminal operator	Supply arrangements
Mackay	Caltex	Caltex	Port of Mackay
Mackay	BP	BP	Port of Mackay
Mackay	Shell	Shell	Port of Mackay

Data source: BP, Caltex, Shell, Mobil

CSR's ethanol storage tanks are also shown in Figure 25. The tank storage next to Berth No. 1 is used for molasses and tallow, not petroleum products.

Figure 25 **Port of Mackay and petroleum products berth and terminals**



Data source: Google maps

Petroleum infrastructure network in Mackay

Petroleum products are imported through Berth No. 1 in the Port of Mackay. Petroleum products imported through Berth No. 1 are sourced from the Lytton (Caltex) and Bulwer Island (BP) refineries in Brisbane and overseas refineries.

The depth of Berth No. 1 is 10.6 metres below LWD (low water datum, similar to LAT). The berth pocket is 210x33 metres.

The port and Berth No. 1 could accommodate fully laden MR tanker up to 45,000 DWT on a high tide (Mackay has a high tidal range). Typically, however, part loads are brought into Mackay from Brisbane and Singapore. Tanker loads are shared with other Queensland regional ports.

The berths in the Port of Mackay are shown in Figure 26. Berth No. 1 is in the background adjacent to molasses storage tanks (large tanks) and tallow (small, darker) tanks.

Figure 26 **Mackay Berths**

Data source: Mackay Ports Limited

Berth No. 1 handles molasses, tallow, and some ethanol exports, as well as imports of petroleum products. It also provides bunkering services.

Products are piped to the three terminals from Berth No. 1. From the terminals, products are loaded out by truck gantry for distribution by road tanker.

4.4.5 Townsville

Townsville has two petroleum product terminals (storage and road load-out facilities) supplied by petroleum product import facilities.

The terminals are listed in Table 20. Ownership, operating and usage arrangements are also summarised in the table.

Tropic Distributors, which distributes Caltex products, also has a depot near the terminals.

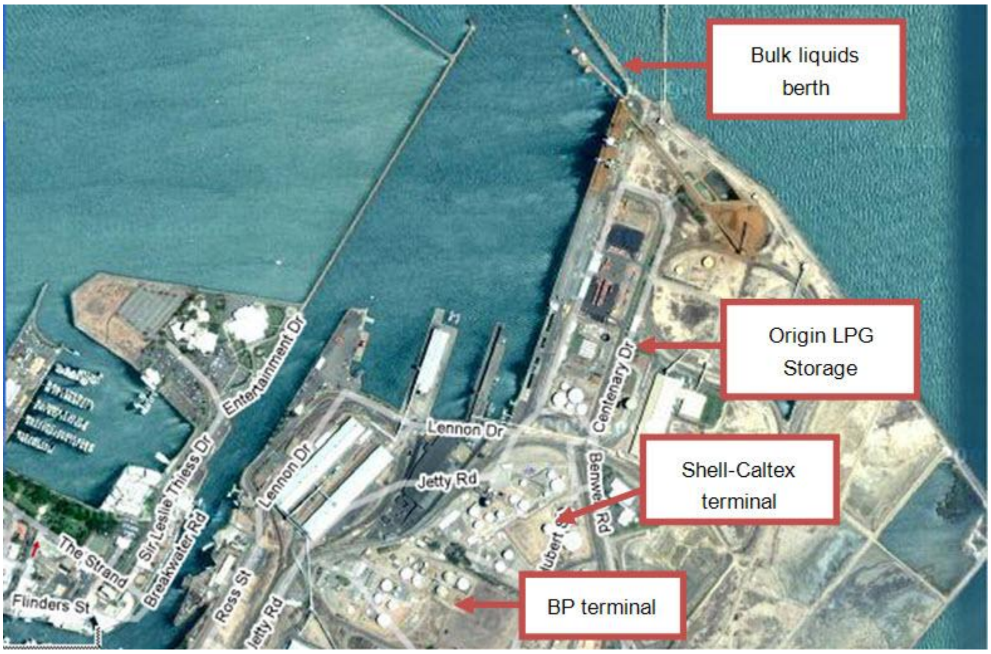
Table 20 **Petroleum product terminals in Townsville**

Terminal location	Terminal owner(s)	Terminal operator	Hosting / leasing arrangements
Townsville	BP	BP	Hosting
South Townsville	Shell-Caltex Joint Venture	Shell	None

Data source: BP, Caltex, Shell, Mobil

The locations of the bulk liquids berth and the Shell-Caltex and BP terminals are shown in Figure 27.

Figure 27 **Townsville port, petroleum products berth and terminals**



Data source: Google maps

Petroleum infrastructure network in Townsville

Petroleum products are imported through a dedicated bulk liquids wharf, Berth No. 1. It is a multi-user facility used exclusively by tankers discharging liquid petroleum products, LPG, and liquid petroleum products. The berth is also used for bunkering all types of vessels.

Petroleum products imported through Berth No. 1 are sourced from the Lytton (Caltex) and Bulwer Island (BP) refineries in Brisbane and overseas refineries.

Petroleum products are piped from the berth to the Shell-Caltex and BP terminals in Hubert Street. Products stored at the terminals are loaded out for transport by road and rail.

Caltex owns the former Ampol terminal at the corner of Archer and Hubert Streets. This terminal and the pipeline linking it to the petroleum products berth are currently unutilised and the products berth is currently decommissioned

Tropic Distributors, a locally owned entity that distributes Caltex products by road in north Queensland, is located at the site of the old Ampol terminal. However, Tropic fills its road tankers at the Shell-Caltex terminal.

The location of the former Ampol terminal and Tropic Distributors' depot are shown along with the Shell-Caltex and BP terminals in Figure 28.

Figure 28 **Shell-Caltex, BP, Tropic, former Ampol facilities**

Data source: Google maps, Townsville Port Corporation

4.4.6 Cairns

Terminal location and ownership

Three petroleum product terminals (storage and road load-out facilities) supplied by petroleum product import facilities have been established in Cairns. They are listed in Table 21, which also contains a summary of ownership, operating and usage arrangements.

Table 21 **Petroleum product terminals in Cairns**

Terminal location	Terminal owner(s)	Terminal operator	Hosting / leasing arrangements
Portsmith.	BP	BP	Hosting
Portsmith	Caltex	Caltex	Spot hosting
Portsmith	Shell	Shell	None

Data source: BP, Caltex, Shell, Mobil

The locations of the terminals and relevant ship berths are shown in Figure 29.

Figure 29 **Cairns petroleum product terminals and berth**

Data source: Google maps

Petroleum infrastructure network in Cairns

Petroleum products (liquids and LPG) are imported through Wharf No. 10 in the Port of Cairns. The wharf is also used for bunkering.

Petroleum products imported via Wharf No. 10 are sourced from the Lytton (Caltex) and Bulwer Island (BP) refineries in Brisbane and overseas refineries. The Wharf No. 10 berth has design depth of 9.3 metres below LAT. The maximum permissible vessel length for this berth is 189 metres. Access to the port is via a 13-km channel with a width of 90 metres and a depth of 8.3 metres below LAT.

As a result of the relatively small storage capacity at each terminal and draught restrictions in the port, tanker loads are shared between Cairns and petroleum product import ports to the south of Cairns. Typically, the final part of each cargo is discharged in Cairns before a tanker returns north to Singapore or south to Brisbane to take on another load. Petroleum products are usually brought into Cairns in partly loaded tankers, which can carry up to 45,000 DWT fully loaded. This is the maximum size that can be handled by the BP, Caltex and Shell products berths in Brisbane.

4.4.7 Cape Flattery

The Port of Cape Flattery is located north of Cooktown and more than 200 km north of Cairns on the east coast of Cape York Peninsula.

The port exports silica sand mined by Cape Flattery Silica Mines Pty Ltd and imports supplies for the mine and small township, including diesel fuel for mobile plant and electricity generation.

There is a 500-metre jetty, a conveyor and ship loader for silica sand. This facility can accommodate 80,000 DWT ships (Ports Corporation of Queensland, 2007-08).

In a separate location, there is a sheltered general purpose wharf for importing fuel and other supplies. It also is used to moor two line boats to assist with ship berthing (Ports Corporation of Queensland, 2007-08).

4.4.8 Torres Strait

The Port of Thursday Island is located in Torres Strait north of Cape York. Ports Corporation of Queensland owns wharf facilities on Thursday and Horn Islands.

Fuel is brought in weekly by small ships and barges. They discharge to a fixed bulk storage facility on Horn Island or to isotanks or isotainers[3] on Thursday Island. Fuel is transhipped from the Horn Island facilities to other islands.

4.4.9 Weipa

Rio Tinto owns a terminal at Weipa. BP operates the terminal, and has some hosting arrangements with others.

Ports Corporation of Queensland manages the Port of Weipa. There are four berths at the port. The Evans Landing berth is used to import petroleum products, and is managed by BP for Rio Tinto.

The shipping channel for vessels departing Weipa Harbour has a declared depth of 11.1 metres below LAT. The channel requires annual maintenance dredging to ensure the declared depth is maintained on a year round basis (Ports Corporation of Queensland, 2007-08).

4.4.10 Karumba

The Port of Karumba is located in the south-eastern corner of the Gulf of Carpentaria at the mouth of the Norman River.

Fuel is normally brought into Karumba by road. However, in flood periods, fuel is transported to Karumba by sea transport.

The fuel distributor is Gold Engineering and Construction

4.4.11 Commercial arrangements

The commercial arrangements discussed above are summarised in Table 22. There are four joint venture terminals of which one is in Brisbane, two are in Gladstone and one is in Townsville. There is one independent terminal operated by Neumann Petroleum in Brisbane.

Nine out of the seventeen terminals currently have hoisting arrangements. Such arrangements are available at all ports in Queensland. Around 37 per cent of total storage in Queensland terminals is currently subject to hosting arrangements.

Marstel advised that its charges were typically based on a tank rental fee and a throughput fee. The arrangements varied according to circumstances. Other hosting fees are similar to those discussed for the other states.

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3 Isotanks are skid mounted, container-like storage facilities with a tank inside steel framework.

Table 22 **Commercial arrangements for terminals in Queensland**

Arrangements	Terminal owner(s)	Terminal operator	Hosting / leasing arrangements
Terminals with hosting arrangements	BP - Mobil Joint Venture Whinstanes	BP operates	Hosting arrangements available
	Caltex Tanker Street Lytton	Caltex	Spot hosting
	Neumann Petroleum Eagle Farm	Neumann Petroleum	Hosts Glencore, Freedom, Choice and United
	Caltex-Mobil Joint Venture Gladstone	Caltex operator	Hosting by negotiation
	BP- Shell Joint Venture Gladstone	BP operator	Commercial hosting
	Shell Mackay	Shell	Hosts Mobil
	BP Townsville	BP	Hosts Mobil
	BP Cairns	BP	Hosts Mobil
	Caltex Cairns	Caltex	Some spot hosting
	BP Mackay	BP	Some commercial hosting
No current hosting arrangements	Caltex Lytton refinery	Caltex	No hosting (refinery)
	Shell Pinkenba Brisbane	Shell	No hosting
	BP Pinkenba (Bulwer Island)	BP	No hosting (refinery)
	Caltex Mackay	Caltex	No hosting
	Shell-Caltex Joint Venture Townsville	Shell	No hosting
	Shell Cairns	Shell	No hosting

Data source: ACIL Tasman survey

As discussed earlier, hosting arrangements are negotiated on a commercial basis and can be on a short term or long term arrangement. Port charges are set by the Port Corporations subject to Ministerial approval.

4.4.12 Capacity utilisation

Capacity

The total storage capacity for each Queensland port is summarised in Table 23. Total storage capacity for Queensland is 827 ML of which 240 ML or 29 per cent is located in Brisbane.

Table 23 **Storage capacity at Queensland ports 2007-08**

Port	Petrol	Diesel	Jet fuel	Lubes, Solvents, others	Total
	ML	ML	ML	ML	ML
Brisbane	90.0	82.2	21.0	47.3	240.5
Bundaberg	16.4	14.7	0.0	0.0	31.1
Gladstone	19.5	65.5	2.7	0.0	87.7
Port Alma	0.0	23.0	0.0	0.0	23.0
Mackay	19.3	74.0	2.2	0.0	95.6
Townsville	27.2	173.9	19.0	10.2	230.3
Cairns	29.1	31.5	31.1	0.0	91.8
Weipa	2.2	15.9	1.7	7.1	26.9
Total	203.8	480.7	77.8	64.6	826.9

Note: 1. Bundaberg and Port Alma terminal capacity is currently being established.
Note: 2 Lubes, solvents and others include some LPG.
Data source: ACIL Tasman Survey

Throughput

Total throughput by Queensland ports was 10,823 ML in 2007-08. Around 70 per cent of this throughput was through the Port of Brisbane. Overall this throughput was close to the maximum as at December 2008. Detailed comments by port are provided below.

There are emerging pipeline constraints in Brisbane and an emerging need to expand capacity at the margin. Neumann Petroleum is constructing new tanks and is to move its berth to a deeper water location. There is reported to be considerable interest from independents in building additional facilities to meet expected growth in demand for diesel.

The regional ports are in most cases adequate to meet current demand. Shipping cycles and berth depth were reported to be constraints in most regional ports. There is reported to be some interest from independents in investing in further import infrastructure and incumbents are investing in some areas where demand growth warrants.

Brisbane

There was little spare capacity in the Brisbane import supply chain as at December 2008. The presence of Brisbane Rocks on the bed of the Brisbane River limits products tankers above the top of the MR range (45,000 DWT) moving beyond the Fisherman Island port area. All of the petroleum products berths are upstream from Brisbane Rocks. The crude oil berths are downstream of this obstruction.

Caltex's product berth has some spare capacity that can be utilised to import products during refinery shutdowns. Pipeline capacity from the Lytton refinery to terminals north of the Brisbane River (Pinkenba, Whinstanes, and Eagle Farm) is a current bottleneck. Loading rack capacity at the Caltex's Lytton Tanker Street terminal is a current bottleneck.

The pipeline from the Bulwer Island refinery to Neumann's terminal is operating at close to full capacity, and the pipeline from Lytton to terminals north of the river is also a bottleneck.

The throughput and capacity of Shell's Pinkenba terminal was close to capacity as at December 2008.

Neumann Petroleum's Eagle Farm terminal is also constrained by the draught at Maritime No. 1 wharf (that limits cargoes to 35 ML), by storage capacity for diesel and ULP and by loading facilities.

Gladstone

Both terminals are operating at close to capacity with loading congestion, storage capacity and shipping rotations creating constraints from time to time.

Berth restrictions and storage capacity constrain use of larger ships to import larger cargos.

Townsville

Draught restrictions and shipping schedules create some bottlenecks. There is also some storage capacity constraints in one of the Townsville terminals.

Mackay

There are no constraints affecting BP's Mackay terminal.

Caltex advised that storage capacity, shipping cycles and draught limitations were impediments to greater petroleum product imports through Mackay by Caltex. Also, Caltex described truck loading rack capacity as an emerging bottleneck at its Mackay terminal.

The throughput of the Shell facility in Mackay is constrained by the current shipping rotation and scheduling. More frequent scheduling of ships would increase throughput capacity.

Townsville

BP advised it was unaware of any current or emerging bottlenecks affecting its Townsville terminal. Throughput at the joint Shell-Caltex facility in Townsville is constrained by the current shipping rotation and scheduling. More frequent scheduling of ships would increase throughput capacity.

Overall there was little spare capacity in Queensland as at December 2008 (Table 24).

Table 24 **Capacity utilisation**

Port	Capacity utilisation as at December 2008	Bottlenecks
Brisbane	Throughput through Brisbane was close to full capacity with a number of constraints in storage, pipelines and berth capacity for importing products.	Pipelines from refineries to terminals are close to full capacity Product berth depth limits tanker size
Bundaberg	No capacity	Berth and channel depth will be a constraint
Gladstone	Throughput is reaching capacity limits	Some gantry congestion and shipping cycle issues
Port Alma	No capacity	
Mackay	Little spare capacity	Shipping cycles and draught limitations reported to be a constraint on increasing throughput
Townsville	Little spare capacity	Shipping cycles and draught limitations reported to be a constraint on increasing throughput
Cairns	Little spare capacity	Shipping cycles and draught limitations reported to be a constraint on increasing throughput

Note: ACIL Tasman assessment
Data source: ACIL Tasman audit

4.4.13 Committed and planned developments

There is an active program of current and planned investments in new capacity in Queensland. The current and planned projects are summarised in Table 25.

Total additional capacity committed in Queensland is around 88 ML which represents around 10 per cent of current storage capacity for the state. There is also considerable interest from independent fuel importers and from Queensland port corporations in increasing investment in petroleum import infrastructure. More detail of these current and potential expansions is provided below.

Brisbane

Caltex is increasing its capacity for diesel production at the Lytton refinery which will supply north Queensland.

Table 25 **Expansions and developments**

Port	Committed expansion	Planned expansion
Brisbane	Neumann Petroleum is relocating its berth to Pinkenba Grain Berth and constructing a new pipeline and an additional 15 ML storage. Planned commissioning for 2010 subject to some planning delays. Further capacity being added at Brisbane terminals.	Port of Brisbane medium term strategy to develop new petroleum berths and storage facilities over the longer term.
Bundaberg	Marstel is recommissioning a 30 ML storage terminal	
Gladstone	Loading capacity is being increased at terminals	Interest from independents in further diesel import capacity in Gladstone
Port Alma	Marstel is recommissioning a 23 ML storage terminal due for completion in August 2009	Longer term prospects for developing a deeper port for coal exports from Port Alma which would provide an opportunity for more efficient shipping arrangements.
Mackay	Expansion of terminal capacity	Mackay Ports investigating further investment in diesel import capacity
Townsville	No current expansion plans	Independent fuel supplier investigating further import capacity in Townsville
Cairns	No current expansion plans	

Data source: ACIL Tasman audit

Neumann Petroleum plans to relocate its discharge facilities from No. 1 Maritime Wharf at Hamilton to the Pinkenba Grain Berth closer to the mouth of Brisbane River. Mobil used this berth in the past. Neumann's relocation to this berth will be accompanied by construction of a new 14-inch, 4.5 km pipeline from Neumann's Eagle Farm terminal to the grain berth. Neumann Petroleum will also construct a new 15 ML diesel tank at Eagle Farm. The estimated cost of the tank is $4.2 million. The cost of the pipeline and relocation is estimated to be $9.3 million.

Neumann could convert 10.6 ML of tank capacity currently used for diesel storage to unleaded petrol storage following construction of the new diesel tank.

The Pinkenba berth draught is 10.4 metres. The berth and channel will accommodate MR (medium range) tankers to the top of the MR range of 25,000 to 45,000 DWT. This allows cargoes of 40 ML.

The wharf draught of 9.1 metres at Hamilton limits ships to the lower part of the MR range, around 28,000 DWT. So, cargoes are limited to 35 ML. Existing terminal tankage also has effectively imposed such a limit.

Neumann Petroleum had planned to decommission the existing wharfline (pipeline) from Maritime No. 1 Wharf at Hamilton to the company's Eagle Farm Terminal by December 2010 and to commission the new wharfline from the Pinkenba Grain Berth to Eagle Farm by the same date. However time frames may be extended due to delays in obtaining approvals and licences described above.

There is further additional capacity being added at other Brisbane terminals.

The Port of Brisbane Land Use Plan 2007 stated, "An area at the north-eastern extension of the main reclamation area may be investigated for the potential future development of an oil terminal, or alternatively, other port operational services, depending on capacity demands and port operational requirements."[1] However, under the current reclamation plan, this area may not be available for 20-30 years.

In the meantime, the Port of Brisbane Corporation has been developing a medium term strategy focused on the potential provision of new petroleum product berths and storage facilities on the north-western side (Pinkenba) side of the Brisbane River.

Gladstone

Marstel's Port Alma facility near Rockhampton may be an alternate conduit for imports to supplement those through Gladstone. Caltex has plans to add a second loading bay at their Gladstone terminal.

It is also understood that an independent product trader not currently participating in the Australian market is investigating establishment of a diesel terminal in Gladstone.

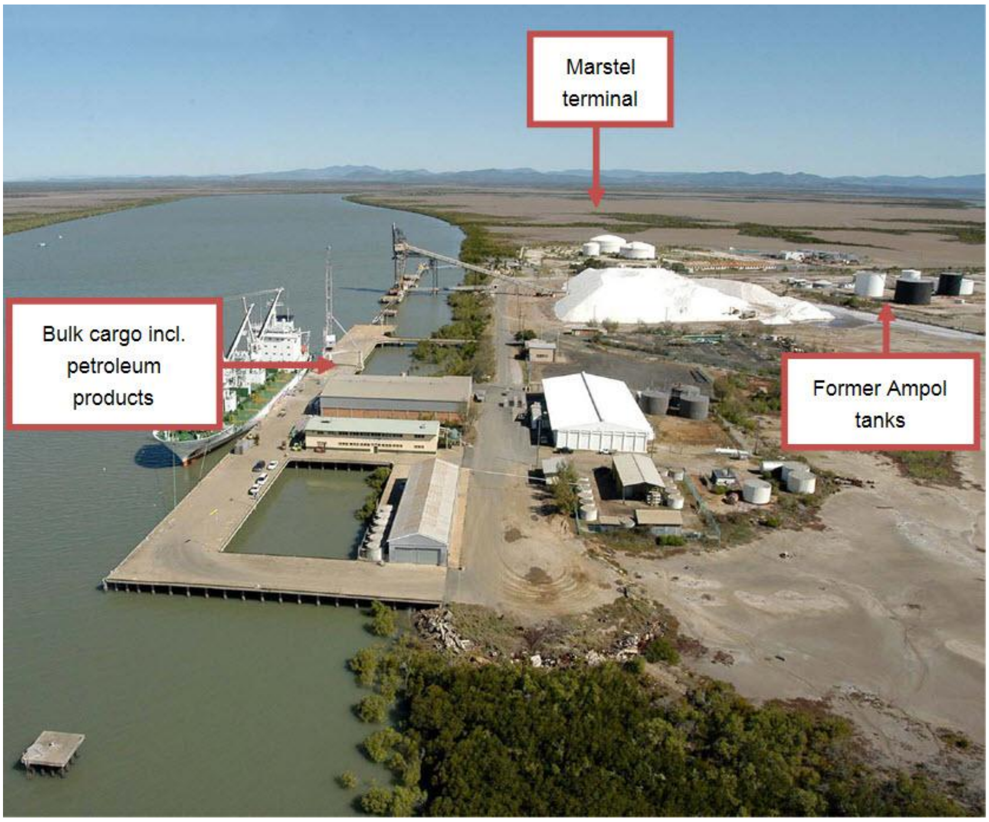
Port Alma

Marstel has acquired and is recommissioning the former Mobil terminal at Port Alma Road, Port Alma, about 62 km by road to the south-east of Rockhampton on the southern tip of the Fitzroy River Delta, close to the mouth of Raglan Creek. It is expected that the terminal will be ready to receive product by sea in mid- to late-2009.

Marstel is an independent terminal company that does not own petroleum products. It normally levies a tank rental charge and/or a bulk throughput fee on terminal users.

The three tanks that Marstel has taken over are located to the south of the bulk salt storage area, on the southern side of the access road. The tanks are close to the southern end of berth 3 (see Figure 30).

Figure 30 **Port Alma berths and storage**



Data source: Gladstone Ports Corporation Limited, *Port Alma Port Information Handbook 2006*

The view in the photograph (Figure 31) is from north to south. The Marstel tanks are the three white tanks south of the salt stockpile.

Petroleum infrastructure network in Port Alma and Rockhampton

Berth depths at the Port Alma No. 1-3 wharves are 9.2 metres below LAT. The channel depth is 5-6 metres below LAT, but the tidal range is high. The port and berths can accept ships up to about 35,000 DWT. Maximum cargo size would be about 35-40 ML.

This cargo size is significantly larger than current storage. Marstel anticipates cargos being split between its Port Alma and Bundaberg terminals.

The pipe work between the wharf and storage tanks is still in place and serviceable. However, pipe work on the outlet side of the tanks and truck gantries were removed. Marstel is installing new pipes and a truck gantry. It is also undertaking some tank repairs.

The above photograph of the port from the *Port Alma Port Information Handbook 2006* also shows bulk tank storage tanks immediately to the west of the bulk salt storage area (Figure 31). These storage tanks were part of a former Mobil terminal. They are currently being used to store tallow.

The Gladstone Ports Corporation and Xstrata have been investigating use of Port Alma for coal exports. Commencement of coal exports would be preceded by provision of a deeper shipping channel and berths, although the berths would be located in the middle harbour (south-east of Berth No. 3) to avoid proximity to handling of ammonium nitrate and explosives. Port Alma is a significant import point for these commodities.

Bundaberg

Marstel is planning to recommission the former Mobil terminal at Wharf Drive in the Port of Bundaberg. It is expected that the terminal will be ready to receive products by sea in 2010.

Marstel has acquired the group of tanks and the necessary land. The location of the terminal and berth are shown in Figure 31.

Marstel will import petroleum products via the 240-metre long John T Fisher bulk liquids wharf. The wharf is currently used to load and unload bulk molasses. Prior to 2002, the facility was used to import petroleum products.

The berth depth is 9.7 metres below LAT. The channel depth is 9.5 metres below LAT. The berth, shipping channel, and swing basin are able to accommodate vessels up to Handimax class. This means that ships up to 50,000 DWT can use the port.[4]

The cargo of such ships is significantly larger than current storage. Marstel anticipates cargos being split between its Port Alma and Bundaberg terminals and carried in smaller ships that can access Port Alma.

Mackay

Caltex is expanding its terminal in Mackay. It is expanding diesel storage, installing ethanol storage and blending facilities, and adding a new loading rack. The investment program is scheduled to be completed by the end of 2009.

There was some interest reported from independent entities in establishing a bulk diesel terminal at Mackay. Berth number 1 is currently at around 35 per cent to 40 per cent utilised.

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[4] Port of Brisbane Corporation, *Draft Port of Bundaberg Land Use Plan 2009*, pp. 7, 9.

Figure 31 **Port of Bundaberg**

Data source: Port of Brisbane Corporation, *Port of Bundaberg Draught Land Use Plan 2009*

Townsville

The currently unused former Ampol terminal in Archer Street has been decommissioned and requires investment. Caltex has retained the facility.

It is known that an independent product trader not currently participating in the Australian market is investigating establishment of a diesel terminal in Townsville.

Abbot Point

The Port of Abbot Point, north of Bowen, exports coal from the far northern end of the Bowen Basin coal province in Queensland. An expansion of facilities at the Abbot Point Coal Terminal is scheduled to be completed in mid-2009.

Abbot Point is one of very few locations along Queensland's eastern seaboard where deep water is close in-shore. This is one reason why the Queensland Government and Ports Corporation of Queensland have been investigating the concept of transforming Abbot Point into a multi-cargo import/export port, involving provision of a sheltered harbour capable of handling Cape-class ships.

Abbot Point is therefore a potential location for petroleum import infrastructure with deep water access.

4.5 Western Australia

4.5.1 Location and supply arrangements

There are nine major ports in Western Australia of which eight are located in regional areas while the Kwinana Bulk Berths and the BP Jetty are located at Fremantle Outer Harbour at Kwinana in the southern part of the Perth Metropolitan Area. The only port not capable of importing petroleum products in Western Australia is the Port of Bunbury which ceased petroleum imports a number of years ago when the land used to house storage tanks was sold off for real estate.

The only refinery in Western Australia is the BP Refinery at Kwinana. It is the largest refinery in Australia with a capacity of 137,000 barrels of crude oil per day supplying most the fuel needs of regional and metropolitan Western Australia. In 2007-08 the throughput at the refinery was 7,300 ML.

All ports import diesel and most import ULP. A select number of ports import PULP while Port Hedland and the BP Kwinana Refinery Jetty import aviation and jet fuel. See Table 26 for a summary of the major petroleum importing ports in Western Australia and the fuel companies operating at those ports.

BP is the most widely represented fuel major at ports in Western Australia with terminals at all ports except Albany that has arrangements with Caltex and Wyndham that imports its own fuel supplies (operating as CGL Fuels) from a refinery in Korea.

Table 26 **Summary of major petroleum importing ports: Western Australia**

Port	Fuels	Terminals
Fremantle Berth 3 and 4	• ULP • PULP • Diesel	• Access to: – BP refinery – BP Kewdale – North Fremantle terminals –BP and Caltex/Shell – Gull terminal – Coogee Chemicals Verve Energy
BP Refinery Jetty	• ULP • PULP • Diesel • Avgas • Jet fuel	• BP refinery • BP Kewdale • North Fremantle terminals – BP and Caltex/Shell • Gull terminal • Coogee Chemicals - Exxon Mobil
Albany	• ULP • Diesel	• Caltex
Broome	• ULP • PULP • Diesel	• BP • Shell
Bunbury	• Nil	• Nil
Dampier	• ULP • Diesel	• BP through Rio Tinto • Shell
Cape Lambert	• Diesel	• BP through Rio Tinto • Shell
Esperance	• ULP • Diesel	• BP • Shell
Geraldton	• ULP • Diesel	• BP • Caltex • Shell
Port Hedland	• ULP • PULP • Diesel • Avgas • Jet fuel	• BP • Shell • Caltex
Wyndham	• Diesel	• CGL Fuels

Supply arrangements in Western Australia

The terminal supply arrangements in Western Australia are summarised in Table 27 and discussed below.

Table 27 **Fuel terminals in Western Australia**

Terminal location	Terminal owner(s)	Terminal operator	Supply arrangements
North Fremantle	BP	BP	Kwinana refinery
North Fremantle	Shell-Caltex Joint Venture	Shell	Kwinana refinery
Kewdale	BP	BP	Kwinana refinery
Kwinana	Gull Petroleum	Terminals West	Kwinana refinery with imports from Kwinana Bulk Berth possible
Kwinana	Coogee Chemicals	Coogee Chemicals	Kwinana refinery with imports from Kwinana Bulk Berth possible.
Albany	Caltex	Caltex	Albany Port
Broome	BP	BP	Port of Broome
Broome	Shell	Shell	Broome Port
Dampier	Rio Tinto	BP	Dampier Port
Cape Lambert	Rio Tinto	BP	Rio Tinto Port
Esperance	Shell	Shell	Esperance Port
Esperance	BP	BP	Esperance Port
Geraldton	BP	BP	Geraldton Port
Geraldton	Shell	Shell	Geraldton Port
Port Hedland	BP BHP also owns some storage	BP	Port Hedland Port
Port Hedland	Caltex	Caltex	Port Hedland Port
Wyndham	CGL Fuels	CGL Fuels	Wyndham Port

Note: JV = joint venture
Data source: ACIL Tasman Survey

BP

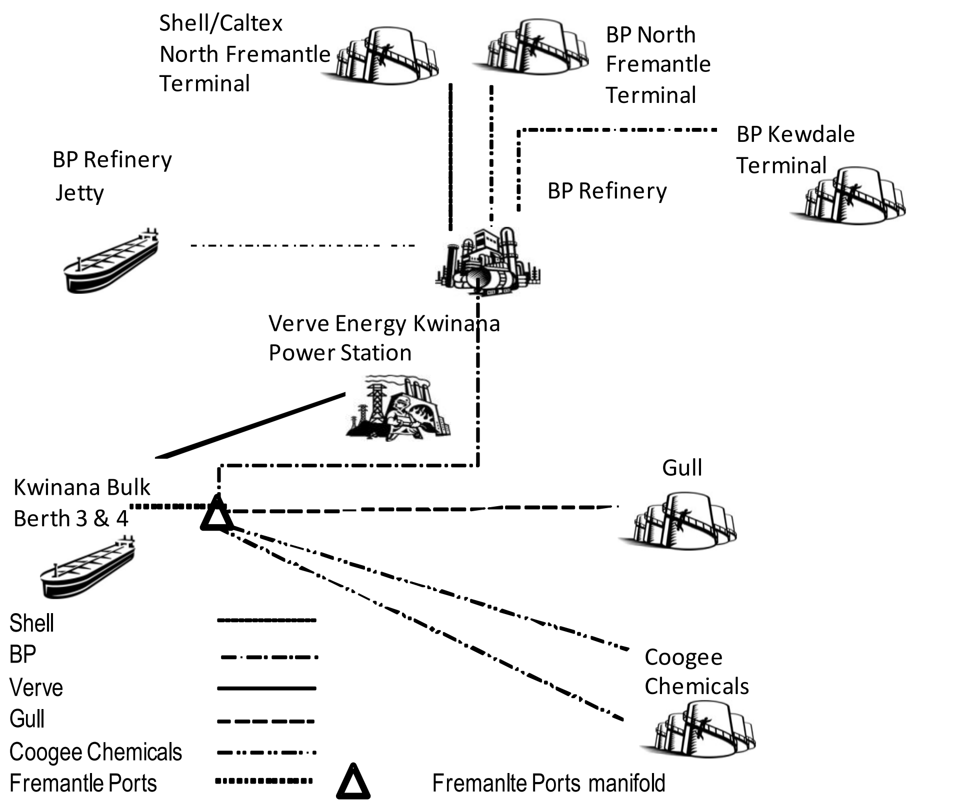
BP imports fuel through its jetty at Kwinana which is adjacent to the BP Refinery. The Refinery produces a number of fuels for distribution throughout Western Australia and Australia. The company has direct arrangements with a number of large customers including Shell, Mobil, Coogee Chemicals and Gull Petroleum. It also sells and distributes products through local distributors from terminals located at North Fremantle and Kewdale.

Figure 32 shows the petroleum import network at the Port of Fremantle and highlights BP's import and distribution network. Note that BP accesses Gull and Coogee Chemicals through a pipeline to the Fremantle Ports manifold located at the jetty neck of Kwinana Bulk Berth (KBB) 3 and 4. While Coogee Chemicals and Gull Petroleum have a pipeline to the manifold, they are currently only using the manifold to access the BP Refinery pipeline. The only imports currently through KBB3 and 4 are therefore to Verve Energy (whose pipeline bypasses the manifold) with all other imports through the BP Refinery Jetty. Importantly, the pipeline connecting KBB3 and 4 to the BP Refinery allows the option of importing fuel through these jetties should the BP Refinery Jetty become unavailable.

The Kewdale terminal is supplied by a pipeline that runs from the Kwinana Refinery. The Terminal services road tankers and also supplies fuel to Kalgoorlie via rail.

The North Fremantle terminal is supplied by the Kwinana Refinery via a pipeline and primarily services the metro area. The terminal supports tanks across three grades of product including fuel oil, aviation fuel and kerosene.

Figure 32 **Petroleum import network: Port of Fremantle**



BP also operates terminals at the ports of Broome, Dampier, Esperance, Geraldton and Port Hedland.

Shell

Shell operates at terminal at North Fremantle under a 50:50 joint terminal arrangement between Shell and Caltex. It handles a range of products including PULP, ULP and diesel.

It receives petroleum products via its own pipeline from the BP Kwinana refinery and distributes its products from the terminal throughout Western Australia by truck.

Caltex

Caltex operates out of the Caltex/Shell joint terminal at North Fremantle, which is operated by Shell and handles a range of products including PULP, ULP and Diesel. The company makes use of its own and Shell's tanks at the site as part of the joint terminal arrangements. Approximately 60 per cent of the total throughput is Caltex volume. Fuel is delivered to the terminal via a pipeline owned by BP from the Kwinana Refinery to the BP North Fremantle terminal and then via pipeline owned by Shell through to the Caltex/Shell joint terminal.

Gull Petroleum

Gull Petroleum is the largest independent fuel company in Western Australia. It owns a terminal facility at Kwinana close to the BP Refinery. The terminal is operated by Terminals West Pty Ltd which is a subsidiary of Gull Petroleum. Fuel is split almost evenly between petrol and diesel.

Gull has an agreement with Fuel Distributors of Western Australia, a Western Australian fuel distributor who mainly supplies the Perth area and the wheat belt region. It also has an agreement with Eagle Petroleum which services the Goldfields region.

Gull receives fuel from the BP Refinery and can also receive fuel from KBB3 or KBB4. Fremantle Ports own a pipeline to KBB3, while Coogee Chemicals and Gull have pipelines to KBB4.

Coogee Chemicals

The other independent is Coogee Chemicals which is also located close to the BP Refinery. Coogee Chemicals is a Western Australian company that produces a wide range of industrial, agricultural and mineral processing chemicals for supply to both the Australian and International markets. It operates the Kwinana Tank Terminal, the largest multi-purpose Bulk Liquid Dangerous Goods Terminal in Western Australia. The terminal caters for a number of products including diesel, unleaded fuel and premium unleaded fuel. Note that Coogee Chemicals does not import any petroleum products in its own right but does so on behalf of other companies such as Mobil.

Coogee Chemicals has two pipelines. Both are owned by the company and connect KBB4 to its premises. Each line has connection at the Fremantle Ports manifold to the BP Refinery pipeline which is owned by BP. Each Coogee

Chemicals pipeline has a capacity of 60,000 litres each and a flow rate capacity of approx $250m^3$ per hour directly from the ship. Coogee Chemicals is not currently using the pipeline to KBB3 for petroleum products and is receiving all products through the line to the BP Refinery. The company is building six new 4 million litre tanks.

Arrangements at regional ports

Broome

There are two terminals at Broome operated by BP and Shell. The BP Broome terminal is the largest and has some commercial hosting. Ninety per cent of total imports are diesel however small amounts of ULP and PULP are also imported. The Shell Broome terminal caters for diesel and is a sole Shell terminal.

Dampier

Facilities at Dampier are operated by BP under a contractual agreement associated with supply arrangements to Rio Tinto. The Rio Tinto wharf is the only facility currently importing petroleum products at the Port of Dampier. Fuel is imported under arrangement with BP and BP supplies Shell, Woodside and Mermaid Marine. Ninety eight per cent of imports are diesel.

There are no pipeline facilities at this port with all product unloaded directly into road tankers.

Esperance

BP owns and operates a terminal at Esperance supplying petrol and diesel. It has some commercial hosting.

Shell also owns storage facilities at Esperance that cater for petrol and diesel – most of the product however is diesel. Shell also has hosting arrangements for others.

Geraldton

BP owns and operates a terminal at the Port of Geraldton. Eighty four percent of the storage is for diesel. BP has hosting arrangements with Caltex at this port.

Port Hedland

BP owns and operates a terminal at Port Hedland. In addition BP also uses a tank owned by BHP. However the future use of this tank is not certain. BP also hosts another small storage facility.

BP plans to build 50ML of additional storage that is likely to be staged with demand growth. The first tank should be completed by end 2009.

Caltex also operates a dedicated terminal at Port Hedland where fuel is supplied by BP. Caltex has plans to expand its diesel storage at Port Hedland by the end of 2010 due to current constraints caused by lack of storage capacity.

Albany

Caltex operates a dedicated terminal at the Port of Albany where it owns tanks as well as a pipeline that runs from the berth to the tank farm.

Cape Lambert

Cape Lambert is a private port facility in the Pilbara region which is owned by Rio Tinto and operated by BP to supply Rio Tinto's operations with diesel.

Wyndham

CGL Fuels is owned by the Wyndham Port Authority. It sources fuel from a refinery in Korea off the open market and supplies the local towns and resources industry with diesel. A major customer is the nickel mine which accounts for around one third of its total throughput.

CGL owns two storage tanks of various sizes as well as two pipelines that connect the berth to the tanks.

4.5.2 Ownership and commercial arrangements

Ownership

The ownership arrangements for terminals in Western Australia are summarised in Table 28.

Four ports (Albany, Cape Lambert, Dampier and Wyndham) are served by a single company and two (Esperance and Port Hedland) operate on a hosting basis. At the remaining three ports more than one fuel company is in operation.

Most ports in Western Australia own the berth infrastructure with fuel companies owning petroleum infrastructure connecting the berth to their storage facilities. The exception is the Port of Esperance which also owns the pipeline infrastructure that connects the berth to the fuel storage facilities. All ports lease port land to the fuel companies when that infrastructure is located on port land.

Table 28 **Commercial arrangements for terminals in Western Australia**

Arrangements	Terminal owner(s)	Terminal operator	Hosting / leasing arrangements
Terminals with current hosting arrangements	BP North Fremantle	BP	Yes
	BP Kewdale	BP	Yes
	Gull Kwinana	Terminals West	Yes
	Coogee Chemicals Kwinana	Coogee Chemicals	Yes
	BP Broome	BP	Some commercial hosting
	Rio Tinto Dampier	BP	Yes
	BP Esperance	BP	Yes
	BP Geraldton	BP	Yes
	BP Port Hedland	BP	Yes
	Shell Esperance	Shell	Yes
	Shell Geraldton	Shell	Yes
	Rio Tinto Cape Lambert	BP	Yes
Terminals with no current hosting arrangements	Shell-Caltex Joint Venture North Fremantle	Shell	Generally no
	Shell Broome	Shell	No
	Caltex Albany	Caltex	No
	Caltex Port Hedland	Caltex	No
	GGL Fuels Wyndham Port Wyndham	CGL Fuels	

Table 29 summarises the ownership arrangements for petroleum import infrastructure at major ports in Western Australia.

Petroleum import infrastructure in Western Australia has a strong presence from BP with the company owning the only refinery in Western Australia, the major fuel import and export jetty, the majority of pipelines used for transporting petroleum products in Western Australia, as well as significant and strategic terminal infrastructure at North Fremantle, Kewdale and most regional ports. In addition BP has strategic agreements in place with major resources companies in the major resources ports of Dampier (Rio Tinto) and Port Hedland (BHP) from which it supplies the resources companies and other fuel majors (mainly Shell).

The only other major infrastructure owners are the other fuel majors whose infrastructure is minor in comparison. Shell owns a pipeline and tank farm at North Fremantle as well as small tank farms at the regional ports of Broome, Esperance, Geraldton and Port Hedland.

Table 29 **Petroleum import infrastructure ownership arrangements at ports in Western Australia**

Port	Port owned import infrastructure	Other import infrastructure ownership
Fremantle Berth 3 and 4	Berth 3 and 4	Pipelines from berth to businesses owned by Coogee Chemicals and Verve Energy
BP Refinery Jetty	Nil	BP Jetty and BP pipelines from jetty to refinerty and from refinerty to some customers. Some private ownership from BP Refinery to own premises including Shell, and Coogee Chemicals.
Albany	Berth 2	Caltex storage tanks Caltex pipeline from berth to tanks
Broome	Berth	BP terminal Shell terminal BP pipeline
Bunbury	Nil	Nil
Dampier	Nil	Rio Tinto Wharf BP terminal
Esperance	Berth 2 Pipeline from Berth to Shell	BP terminal Shell terminal with hosting
Geraldton	Berth 6	BP terminal Shell terminal BP Pipeline
Port Hedland	Berth 1 and 3	BP terminal – hosts shell Tanks BHP tank BP pipeline from berths to BP and BHP
Wyndham	Berth, pipeline and tank farm	

Caltex owns very little petroleum import infrastructure with tanks at North Fremantle and Port Hedland and a terminal and associated pipelines at Albany.

There are several independently owned pieces of petroleum importing infrastructure in Western Australia including:

- pipelines owned by Verve Energy and Coogee Chemicals linking the Kwinana Bulk Berths to their premises
- pipelines owned by Coogee Chemicals and Gull linking their premises to the BP Refinery at Kwinana

- BHP tank at Port Hedland
- The Rio Tinto wharf and tanks at Dampier
- The pipeline linking the berth to the fuel tank farm at Esperance which is owned by the port
- The pipeline and tanks at Wyndham which are owned by CGL Fuels
- Apart from Dampier and the BP Refinery Jetty, all berths are owned by the respective ports.

Commercial arrangements

Around 61 per cent of the storage reported in Western Australia was reported to be subject to some hosting arrangement. While there are a range of hosting parties in Western Australia, BP is the dominant supplier of services to other companies. BP reported that there were two types of hosting arrangements in WA. Long term hosting is available if there is spare capacity and no operational or quality impacts on the operation of the terminal. Short term hosting is also available on request to meet short term shortage on the part of other suppliers.

Terms and conditions for hosting contracts are negotiated on a commercial basis and take into account terminal operating costs, depreciation and volumes.

Port charges in Western Australia are determined on a commercial basis by each port operator. Port charges are however subject to Ministerial approval.

4.5.3 Capacity utilisation

Capacity

The total storage capacity and throughput of each port in Western Australia is summarised in Table 30.

Total capacity at the various Perth/Fremantle terminals is 205.6 ML which represents 39 per cent of all tank capacity in Western Australia.

Regional ports included in this study have a combined capacity of around 316 ML if all tanks are in commission. Note that around 34 ML of capacity, primarily in the ports of Dampier and Geraldton is currently out of commission. Nearly all storage capacity is for diesel (as illustrated in Figure 33), which reflects the role of most regional ports in servicing the nearby resources industry.

Throughput

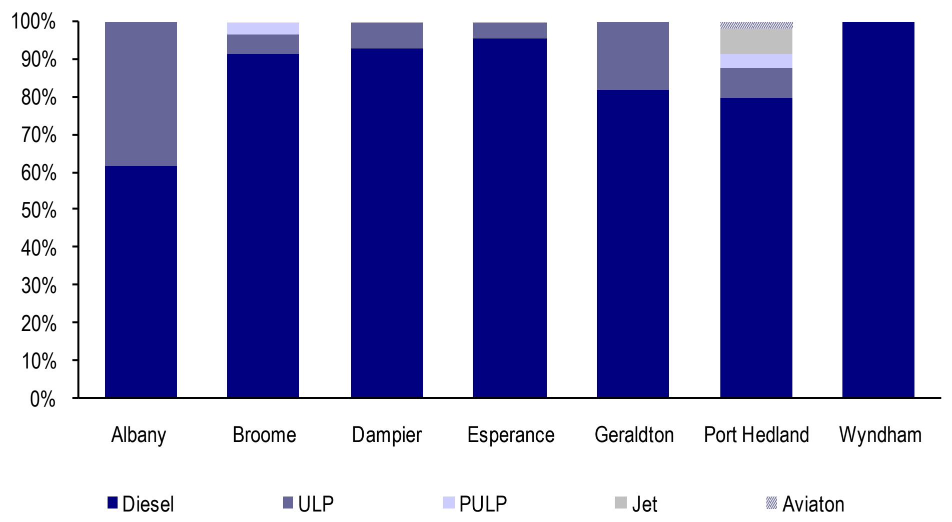
Total throughput in Western Australian importing terminals in 2007-08 was 7,013 ML.

Table 30 **Tank capacity - Western Australia**

Port	Petrol	Diesel	Jet fuel	Lubes, Solvents, others	Total
	ML	ML	ML	ML	ML
Fremantle	89.0	77.4	12.6	26.6	205.6
Albany	8.1	13.0	0.0	0.2	21.3
Broome	3.0	34.2	0.0	2.3	39.5
Cape Lambert	0.0	49.0	0.0	0.0	49.0
Dampier	3.3	42.0	0.0	0.0	45.3
Esperance	2.3	50.8	0.0	0.0	53.1
Geraldton	7.3	32.6	0.0	0.0	39.9
Port Hedland	8.2	56.4	6.0	0.0	70.6
Wyndham	0.0	16.0	0.0	0.0	16.0
Total	121.2	371.5	18.6	29.1	540.4

Data source: ACIL Tasman Survey

Figure 33 **Storage capacity by type of fuel imported: regional ports Western Australia**



Data source: ACIL Tasman from various sources

The major petroleum importing port in Western Australia is the Port of Fremantle with the BP Jetty importing nearly all volumes apart from some small imports by Verve Energy and Coogee Chemicals. There are also small amounts imported through regional ports such as by CGL Fuels through Wyndham and Caltex through Albany.

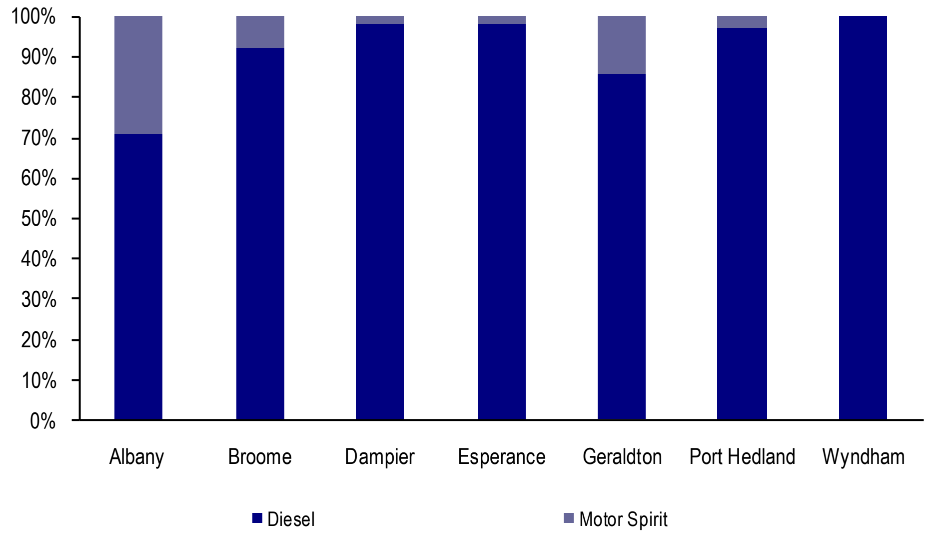
The ACCC found that over 80 per cent of petrol throughput in Western Australia was by refiner–marketers using their own or jointly owned terminals, with the remainder going through independently owned terminals in 2007–08 (ACCC, 2008, p. 35).

Throughput through terminals located at or near the Fremantle Port was just over 4,775 ML in 2007-08. Regional ports and their terminals had a combined throughput of around 2,238 ML in 2007-08 which is expected to remain roughly the same into the near future.

Petroleum imports at regional ports are dominated by those associated with the resources industry. The ports of Dampier, Esperance and Port Hedland all have reasonably small storage capacity. Nearly all throughput is diesel to supply the major resources companies such as BHP, Rio Tinto, FMG and Woodside. The Port of Esperance supplies the resources sector in the Goldfields region.

Figure 34 shows the type of fuel imported through regional ports in Western Australia. It clearly shows the dominance of diesel as the most common form of import in regional ports. This is particularly so in those ports servicing the resources industry. Note the ports of Albany, Broome and Geraldton where the resources industry is not as significant have a higher share of non diesel imports.

Figure 34 **Type of fuel imported: regional ports Western Australia**



Data source: ACIL Tasman from various sources

Capacity utilisation

All ports in Western Australia are currently meeting the demand requirements of petroleum product importers. There is capacity to increase throughput in Kwinana increasing imports through the Gull terminal and potentially the

Coogee terminal. However, at the present time supply is adequate to meet demand.

Facilities at Broome, Dampier, Esperance and Port Headland are constrained. Other Ports are adequate for supply. A summary of the current situation is provided in Table 31.

Table 31 **Current utilisation of Western Australian import facilities**

Port	Capacity utilisation as at December 2008	Current bottlenecks
Albany	Capacity is adequate to meet demand with little spare capacity	Nil
Broome	Spare capacity	Draught/tide restrictions at berth
Dampier	Adequate to meet demand but constraints exist	Draught restrictions at berth Volume limitations associated with rail movements, can move by truck at higher cost Rating issues with diesel imports
Esperance	At close to full capacity with some constraints	Berth congestion
Geraldton	Spare capacity	Nil
Port Hedland	Adequate however congestion becoming an issue	Some berth congestion
Wyndham	Adequate	Nil
Kwinana	Considerable spare capacity	Nil

Gull has considerable spare capacity at its Kwinana terminal. If it were to be fully utilised it would be possible to increase throughput through the Fremantle/Kwinana system by around 50 per cent.

There are several ports where congestion is becoming an issue. While congestion is seen as an issue at the Port of Esperance by importers, it was not considered as an issue by the Port.

Port Hedland has experienced a rapid increase in shipping movements due to expansion in the nearby iron ore industry from the major resource companies FMG and BHP. The Port and fuel importers reported that congestion is an issue. This is expected to be eased in the near future as a new dry bulk export berth is under construction. This will allow some shipping movements to be diverted from Berth 1 where petroleum imports are catered for.

The northern ports of Broome and Dampier were affected by draught restrictions.

4.5.4 Committed and planned developments

Current capacity expansions and planned expansions are summarised in Table 32.

Table 32 **Capacity expansions**

Port	Committed expansion	Planned expansion
Fremantle	Coogee Chemicals currently constructing an additional 24 ML of storage at Kwinana	Nil
Albany	Nil	Nil
Broome	None necessary	Nil
Dampier	Nil	RTIO plans to build new petroleum import facilities. Plans to import diesel through Bulk Liquids Berth and store in Woodside tanks for bunkering
Esperance	Nil	Possible additional berths in 5-10 years if demand growth continues
Geraldton		Nil
Port Hedland	BP is installing an additional 50 ML storage for completion in 2011	
Wyndham	Nil	Nil
Cape Lambert	Nil	Nil

Additional storage capacity totalling 74 ML in total is currently under construction. Coogee Chemicals is currently constructing 24 ML capacity at its Kwinana terminal and BP has commenced construction of what will ultimately be an additional 50 ML at Port Hedland.

This will represent an additional 14 per cent of the total storage capacity in Western Australia.

As discussed above it is possible that petroleum imports could be increased at all ports however congestion issues would be a problem at Port Hedland and to a lesser extent at the Port of Esperance. There is a possibility for developments at both these ports which would alleviate congestion. The Port of Esperance has plans for the possible development of additional wharves in 5 to 10 years time.

Apart from plans to ease congestion through the construction of a new bulk goods berth (thus freeing up wharf space for petroleum imports), Port Hedland noted that it would prefer the construction of a dedicated bulk liquids berth for several reasons, including safety management. It believed that this development should be driven by the fuel importers.

The only other port with plans for development is the Port of Dampier where both the Port and Rio Tinto intend to construct new facilities. Rio Tinto plans to downgrade the current wharf where petroleum is imported and construct a new service wharf to cater for, amongst other things, petroleum imports. It is not yet clear whether the existing storage capacity will be retained. This development is expected as early as 2010.

The Port also intends to upgrade the existing bulk liquids berth to allow diesel imports. Diesel will be trucked to the Woodside 18,000 tonne storage tanks where a bunker line will run from there to Bulk Cargo Wharf to service ships. This development is expected as early as late 2009 and will alleviate concerns regarding the issues associated with the rating of the Rio Tinto wharf for diesel imports.

The Dampier Port Authority has completed a study on options for common user fuel facilities in the King Bay area. It outlines options to build additional fuel storage facilities and possibly integrate the North West Shelf Venture and Mermaid Marine fuel storage facilities into the common user framework. The Port Authority will let industry lead a common user fuel facility and will consider commercial proposals from industry.

All companies indicated they would consider third party hosting if their own capacity constraints would allow it. In addition there are a number of privately owned ports in Western Australia that currently import petroleum products or are capable of doing so which could possibly absorb additional imports if required. This includes the Cape Lambert Port in the Pilbara region, which is a major importer of diesel and services the nearby resources industry.

4.6 South Australia

4.6.1 Overview

Terminals

There are a total of six import terminals in South Australia: four in Adelaide and two at Port Lincoln on the Eyre Peninsula. These are summarised in Table 33.

Table 33 **Summary of major petroleum importing ports: South Australia**

Port	Fuels	Terminals
Adelaide	ULP PULP Diesel Avgas Jet fuel	Caltex Mobil/Shell JV BP Terminals Pty Ltd
Port Lincoln	ULP PULP Diesel	Caltex Shell

Note: Does not include LPG storage

Data source: ACIL Tasman

Berths

There is a specialised bulk liquids berth for petroleum products (tanker berth) at Port Adelaide's Inner Harbour with a draught of 10.7 metres. At Port Lincoln, the oil berth at Kirton Point has a draught of 9.9 metres.

Port Stanvac

ExxonMobil owns a former refinery complex at Port Stanvac. This refinery was closed in 2003 and mothballed pending a final decision on its future. In June 2009, ExxonMobil announced that it did not plan to restart the refinery.

The mothballed facilities include a berth and pipeline to the Adelaide terminals. The berth is in a weather exposed area which requires offshore loading of crude cargoes when operational.

4.6.2 Adelaide

Terminal location and ownership

There are four terminals in Adelaide, of which three are owned and operated by refiner-marketers and one is owned and operated by an independent bulk logistics company (see Table 34).

Table 34 **Fuel terminals in Adelaide**

Terminal location	Terminal owner(s)	Terminal operator	Supply arrangements
Birkenhead	Caltex	Caltex	Bulk liquids berth
Birkenhead	Shell-Mobil	Mobil	Bulk liquids berth
Largs North	BP	BP	Bulk liquids berth
Port Adelaide	Terminals Pty Ltd	Terminals Pty Ltd	Bulk liquids berth

Data source: BP, Caltex, Mobil, Shell and Terminals Pty Ltd

Caltex owns and operates a terminal at Birkenhead, and offers spot hosting arrangements with third parties. Mobil and Shell have a joint terminal at Birkenhead which Mobil operates on behalf of the joint venture. BP owns and operates a terminal at Largs North, and offers some hosting capacity at the terminal.

Petroleum infrastructure network in Adelaide

The Caltex and Mobil terminals at Birkenhead mainly receive petroleum products by ship from Singapore. The latter terminal has also on occasion received product from the Altona refinery.

The BP terminal at Largs North receives products by ship, mainly from BP's Kwinana refinery in Western Australia. The location of the bulk liquids berth for petroleum products is shown in Figure 35.

Figure 35 **Port of Adelaide**

Data source: Google Maps

Fuel is distributed by truck from Caltex's Birkenhead and BP's Largs North terminals and by truck and rail from the Mobil's Birkenhead terminal.

4.6.3 Port Lincoln

Terminal location and ownership

There are two terminals in Port Lincoln. Both are owned and operated by refiner-marketers (see Table 35). The Shell terminal has hosting arrangements with Mobil. Both terminals are supplied by ship and distribute by truck.

Table 35 **Fuel terminals in Port Lincoln**

Terminal owner(s)	Terminal operator	Supply arrangements
Caltex	Caltex	Port Lincoln
Shell	Shell	Port Lincoln

Data source: Caltex and Shell

4.6.4 Commercial arrangements

Commercial arrangements for South Australian terminals are summarised in Table 36.

Table 36 **Fuel terminals in Adelaide**

Arrangements	Terminal owner(s)	Terminal operator	Hosting / leasing arrangements
Terminals with Hosting arrangements	Caltex Birkenhead	Caltex	Spot hosting to third parties
	Shell-Mobil Birkenhead	Mobil	Hosting
	BP – Largs North	BP	Spot hosting
	Shell – Port Lincoln	Shell	Hosts another
Terminals with leasing arrangements	Terminals Pty Ltd Port Adelaide	Terminals Pty Ltd	Leasing arrangements
Terminals with no current hosting arrangements	Caltex Port Lincoln	Caltex	No current hosting. (Some spot hosting)

Data source: BP, Caltex, Mobil, Shell and Terminals Pty Ltd

The Mobil – Shell Birkenhead terminal is the only joint venture terminal operating in South Australia. This terminal is dedicated to the joint venture partners.

Four of the six terminals currently host others either on a short or long term basis, one leases terminal facilities and one currently does not host others.

Spot hosting is offered at the Caltex Birkenhead terminal and the BP Largs north terminal. Terminals Pty Ltd offer leasing arrangements.

Charges for hosting and leasing are comparable to practices in other States.

4.6.5 Capacity utilisation

Capacity

Total storage capacity in South Australia is 198 ML as shown in Table 37. Around 53 per cent of storage in Adelaide terminals is petrol and 34 per percent is diesel. By comparison only 19 per cent of storage is for petrol in Port Lincoln and 82 per cent is for diesel.

Table 37 **Storage capacity in South Australia in 2007-08**

Port	Petrol	Diesel	Jet fuel	Lubes, Solvents, others	Total
Port	ML	ML	ML	ML	ML
Adelaide	94.6	60.4	19.8	1.3	176.1
Port Lincoln	4.1	17.4	0.0	0.0	21.5
Total	98.7	77.8	19.8	1.3	197.6

Data source: ACIL Tasman survey

Throughput

Total throughput in 2007-08 in South Australia was around 2,944 ML per annum. Throughput in Adelaide represented 95 per cent of this amount.

There are currently storage capacity and draught limitations for the Birkenhead terminals and emerging bottleneck in loading rack capacity. The balance between tankage and shipping patterns is expected to become a concern as mining volumes grow, as well as potential issues with having a berth only capable of handling Medium Range (MR) tankers.

There are some shipping constraints at Port Lincoln. However there is some spare capacity depending on product balance.

The utilisation of terminals in South Australia is summarised in Table 38.

Table 38 **Current utilisation in South Australia**

Port	Capacity utilisation as at December 2008	Current bottlenecks
Adelaide	Little spare capacity	Storage capacity and draught limitations Shipping patterns
Port Lincoln	Some spare capacity depending on product balance	

Data source: ACIL Tasman audit

4.6.6 Committed and planned developments

A summary of committed and planned expansions is provided in Table 39.

Table 39 **Committed and planned expansions**

Port	Committed expansion	Planned expansion
Adelaide	Some expansion in storage and equipment capacity is planned to commence in 2010-11	Nil
Port Lincoln	Nil	Nil
Port Bonython		Potential 80 ML storage terminal is in the planning stage for completion by 2011,

Data source: ACIL Tasman audit

BP is converting some tanks for diesel storage to deal with increasing demand for the fuel.

Caltex is planning to expand storage capacity and upgrade equipment and systems at the Birkenhead Terminal. The project is due for completion in late 2010 or early 2011.

Stuart Petroleum and the Scott Group of Companies have established a joint venture to build a new terminal at Port Bonython. The initial phase of the project will see the construction of two 40 ML tanks, with plans to double tankage later. The terminal is expected to commence operations in 2011.

4.7 Tasmania

4.7.1 Terminal location

There are five terminals in Tasmania located in Hobart, Bell Bay, Devonport and Burnie (Table 40)

Table 40 **Summary of major petroleum importing ports: Tasmania**

Port	Fuels	Terminals
Hobart	ULP PULP Diesel Avgas Jet fuel	BP Caltex
Bell Bay	ULP PULP Diesel	Marstel
Devonport	ULP PULP Diesel	Shell
Burnie	ULP PULP Diesel	BP

Note: Does not include LPG storage
Data source: ACIL Tasman

Of the five petroleum product terminals, all except one are owned and operated by refiner-marketers (see Table 41). The exception is a terminal owned by a Marstel at Bell Bay.

Table 41 **Fuel terminals in Tasmania**

Terminal location	Terminal owner(s)	Terminal operator	Supply source
Hobart	BP	BP	Port of Hobart
Hobart	Caltex	Caltex	Port of Hobart
Bell Bay	Marstel	Marstel	Terminal berth at Bell Bay
Burnie	BP	BP	Port of Burnie
Devonport	Shell	Shell	Port of Devonport

Data source: BP, Caltex, Shell and Marstel

4.7.2 Commercial arrangements

Four terminals in Tasmania are currently engaged in hosting arrangements and one offers leasing access (Table 36).

Table 42 **Fuel terminals in Tasmania**

Arrangements	Terminal owner(s)	Terminal operator	Hosting / leasing arrangements
Terminals with Hosting arrangements	BP Hobart	BP	Hosts another party
	Caltex Hobart	Caltex	Long term and spot hosting
	BP Burnie	BP	Hosts other parties
	Shell - Devonport	Shell	Long term hosting
Terminals with leasing arrangements	Marstel Bell Bay	Marstel	Leasing arrangements

Data source: BP, Caltex, Mobil, Shell and Terminals Pty Ltd

The refiner-marketers have various cross-hosting arrangements. Marstel's terminal at Bell Bay near Launceston has leasing arrangements with an independent importer. The terminal has direct pipeline access to a dedicated bulk liquids berth at Bell Bay.

4.7.3 Capacity utilisation

Storage capacity

The petroleum product storage capacity in Tasmania is shown in Table 43. Around 58 per cent of the storage in Tasmania is reserved for petrol and 39 per cent for diesel.

Table 43 **Capacity in Tasmania in 2007-08**

Port	Petrol	Diesel	Jet fuel	Lubes, Solvents, others	Total
	ML/a	ML/a	ML/a	ML/a	ML/a
Hobart	39.3	13.9	3.5	3.2	59.9
North coast	54.4	50.6	0.0	0.0	105.1
Total	93.7	64.5	3.5	3.2	165.0

Note: Does not include LPG
Data source: ACIL Tasman

Throughput

Throughput for Tasmania in 2007-08 was 842 ML.

There are capacity constraints in some Tasmanian ports caused by shipping frequencies. However overall there is currently spare capacity as a result of Marstel's entry into the terminal market at Bell Bay.

4.7.4 Capacity Expansions

There are currently no capacity expansions occurring in Tasmania and no known longer term plans for expansion.

4.8 Northern Territory

4.8.1 Terminal location and ownership

There are four petroleum import terminals in the Northern Territory: a Vopak terminal at Darwin and three small import terminals at McArthur River Mine, Gove and Groote Eylandt that store imported fuel for mining and other uses in the immediate local areas (see Table 44).

Table 44 **Summary of major petroleum importing ports: Tasmania**

Port	Fuels	Terminals
Darwin	ULP PULP Diesel Avgas Jet fuel	Vopak
Gove	ULP PULP Diesel	Rio Tinto Alcan
Groote Eylandt	ULP PULP Diesel	BHP Billiton
McArthur River Mine	Petrol Diesel	McArthur River

Note: Does not include LPG storage
Data source: ACIL Tasman

The ownership and supply arrangements are shown in Table 45.

The Vopak Darwin terminal (shown in Figure 36) is used by the four refiner marketers. The terminal, a co-mingled facility where the fuels imported by different operators are stored in the same tanks, is connected to a single berth with 11.5 m draught. The Northern Territory is the only State/Territory where no refiner-marketer has its own major import terminal.

Table 45 **Fuel terminals in the Northern Territory**

Terminal location	Terminal owner(s)	Terminal operator	Supply source
Darwin	Vopak	Vopak	Darwin Port – East Arm
Gove	Rio Tinto/Alcan	Rio Tinto Alcan	Local port
Groote Eylandt	GEMCO (BHP Billiton)	BHP Billiton	Local port
McArthur River Mine		McArthur River Mine	Local port

Data source: Shell and Vopak

Figure 36 **Vopak Darwin terminal**

Source: Vopak

4.8.2 Capacity utilisation

Capacity

Table 46 **Total tank capacity at NT terminals (ML)**

Terminal	Petrol (ULP, PULP)	Diesel	Aviation (jet fuel and Avgas)	Other fuels	All fuels
Vopak Darwin terminal	33.2	55.8	34.8		123.8
Other		17.4	1.4	138.1	156.9
Total	**33.2**	**55.8**	**34.8**	**0.0**	**123.8**

Note: Other fuels include lubes, solvents, fuel oil, marine diesel, heating oil etc
Data source: Shell and Vopak

Throughput

The throughput in the Northern Territory for 2007-08 was 1,388 ML per annum.

4.8.3 Commercial arrangements

The Vopak terminal is available for lease to all importers. The main requirement is for long term agreements and users must have distribution contracts to market. The parties must meet quality specifications for Australian standards.

The terminals at Gove, Groote Eylandt and McArthur River are primarily for supplying the mining operations.

4.8.4 Committed and planned developments

The Darwin Port bulk liquids berth envelope is shared with cattle ships, off-shore supply vessels etc. They argue that dedicated space is critical to maintain an ongoing energy supply surety.

Vopak plans a modest increase in the capacity of its Darwin terminal by 2010. The Port of Darwin is also reviewing its longer term development strategies which may impact on bulk import berths. However this had not been released at the time of writing.

4.9 Summary of capacity utilisation and planned investments

The overview of current capacity utilisation, capacity expansions committed and those planned are summarised in Table 47 below.

The table shows that as at December 2008 there was little spare capacity for petroleum imports in New South Wales, Queensland and the Northern Territory. However there was spare capacity in Victoria, Western Australia, South Australia and Tasmania. Considerable new investment is currently committed or planned that is changing this outlook.

There is a total of 270 ML of additional storage capacity in Australia currently under construction or committed, which is around 9 per cent of total storage capacity in Australia. Of this, 64 per cent is being installed by independent terminal operators.

Storage capacity in New South Wales, Queensland and Western Australia will be increased by 15 per cent, 10 per cent and 14 per cent respectively. With these investments all states will have surplus capacity over throughput reported for 2007-08. The Northern Territory will have only a small surplus capacity.

Table 47 **Investment in new capacity at product import terminals**

State	Region	Capacity utilisation As at December 2008	Committed investment	Planned and potential investment
New South Wales	Sydney	Constrained	Additional 75 ML storage under construction. .	Second bulk liquids berth at Botany approved in principle Expansion of JUHI pipeline under consideration
	Newcastle	Constrained by Sydney –Newcastle pipeline	Additional 40 ML and connection to berth completed in April 2009	A further 60 ML new terminal in the final planning stages
Victoria	Melbourne	Small spare capacity Constraints on JUHI pipeline	Tank conversion to ULP at one terminal	Tank conversion to ULP at a west Melbourne terminal
	Hastings	Spare capacity around 20%		Expansion of ethanol storage. Potential for further investment subject to market conditions
Queensland	Brisbane	Constrained by pipelines and product berths	Additional 26 ML product storage under construction. Now investment in product berth arrangements by independent.	Interest in development of bulk liquids berths by Port of Brisbane
	Regional	Constraints in Mackay and Gladstone	Additional 53 ML capacity underway in Bundaberg and Port Alma. Storage and gantry expansion in Mackay. Additional investment in Gladstone and Mackay terminals	Potential interest from independents in Mackay and Gladstone
Western Australia	Perth	Considerable spare capacity at Kwinana	Coogee Chemicals is currently constructing 24 ML of additional storage capacity at Fremantle.	
	Regional	Constraints at Port Hedland, Dampier and Esperance Spare capacity at Broome and Geraldton	Additional 50 ML being constructed at Port Hedland	
South Australia	Adelaide	Full capacity	Some conversions of storage to increase diesel throughput	
	Regional	Up to 20% spare capacity at Port Lincoln		ULP storage expansion at Port Lincoln Stuart Petroleum and the Scott Group investigating construction of 80ML storages at Port Bonython (around 40% of current state capacity)
Tasmania	Hobart	Little spare capacity	No expansion underway	No expansion plans
	North	Spare capacity at Bell Bay	No expansions underway	No further investment at the present time
Northern Territory	Darwin	Close to full capacity	Small expansion underway for 2010	No longer term plans
	Mining	At capacity	No known expansion	
Australia total			Around 9 % additional capacity	Potentially around 13% additional capacity if all plans realised

5 LPG

LPG is sourced from petroleum production fields in Gippsland, the Otway and Bass Basins, the Cooper Basin and from the Carnarvon Basin in the north west of Western Australia. It is also manufactured at Australia's seven petroleum refineries. Australia is a net exporter of LPG.

In 2007-08 Australia produced 2,886,000 tonnes of LPG either from producing fields or refineries. In the same year 388,000 tonnes were imported and 1,454,000 tonnes were exported. LPG consumption in Australia in 2007-08 was 1,798,000 tonnes including an increase in stocks of 22,000 tonnes. In general terms there is a surplus of LPG production in Western Australia, South Australia and Victoria. LPG is imported into the other States and Territories either by ship or road transport.

There are eighteen dedicated LPG storages around the country. This includes the 65,000 tonne LPG cavern owned by Elgas at Botany in Sydney, seven LPG import facilities owned and operated by Origin and other storages owned by producers (see Table 48).

Table 48 **LPG storages in Australia**

Port	Operator	Capacity	Use
Botany	Origin	4,710 tonnes	LPG distribution
Botany	Elgas	65,000 tonnes	Importing and storing propane for distribution
Botany	Qenos	14,400 tonnes	Propane (petrochemicals)
Darwin	Kleenheat	1,000 tonnes	LPG distribution
Brisbane	Origin Energy	1,700 tonnes	LPG distribution
Brisbane	BP	2,100 tonnes	LPG distribution
Brisbane	Shell		LPG distribution
Cairns	Origin Energy	2,500 tonnes	LPG distribution
Townsville	Origin Energy	1,200 tonnes	LPG distribution
Gladstone	Origin Energy	1,000 tonnes	LPG distribution
Port Bonython	Santos	70,000 tonnes	LPG distribution
Devonport	Origin Energy	2,000 tonnes	LPG distribution
Hobart	Origin Energy	1,800 tonnes	LPG distribution
Dandenong	Elgas	2,000 tonnes	LPG distribution
Westernport	Esso/BHP	85,120 tonnes	LPG storage and export
Lang Lang (Victoria)	Origin Energy	2,125 tonnes	LPG storage and distribution
Otway	Woodside Petroleum	800 tonnes	LPG storage and export
Dampier (WA)	Woodside Petroleum	62,000 tonnes	LPG storage and export
Kwinana	Kleenheat	40,000 tonnes	LPG storage and export

Data source: ALPGA Supply and Demand Study 2008 *(ALPGA, 2008)* and ACIL Tasman survey

Kleenheat operates a 40,000 tonne LPG storage facility at Kwinana that has a production capacity of 360,000 tonne per annum for LPG and is primarily used for export. It has import capacity in the event of disruption in supply from domestic sources.

The Kleenheat LPG facility at Darwin has a storage capacity of 1,000 tonnes, through which Kleenheat imports about 12,000 tonnes of the fuel annually.

Elgas imports propane for distribution in eastern Australia and re-export. Shipments of LPG to the Botany caverns are made in Very Large Gas Carriers of approximately 44,000 million tonne capacity, requiring a deep wharf at Botany bulk liquids berth. Shipments around the coast are made in smaller vessels between 1,000 to 2,500 tonnes.

Deliveries of domestically produced propane and butane are often determined by shipping logistics and by the Australian heating specification which requires 95 per cent propane for commercial heating applications. LPG Australia is currently reviewing the heating specification to see if the butane content can be increased.

The audit found that LPG import facilities were adequate to meet current demand. Some operators reported plans for expansion to meet emerging demand but did not identify any obstacles to doing so, other than the increasing cost of land rental in port areas and increasing port charges.

Industry reported some constraints in Sydney, Brisbane and Devonport from berth congestion and other issues. While imports are not constrained in Sydney, there is limited capacity for re-export of LPG from the Sydney Cavern due to the congestion of the Botany Bulk Liquids Berth. The in-principle decision to proceed with construction of a second common user bulk liquids berth at Botany should alleviate these constraints.

No significant expansions of LPG import terminals were reported by the industry.

6 Projections of supply and demand

The terms of reference require projections of petroleum product by state in order to assess the adequacy of existing and planned petroleum import infrastructure. Unfortunately there are no specific published forecasts by product by state of demand for petrol, diesel, jet fuel and LPG. ACIL Tasman has prepared its own projections of demand by state by product. These have been prepared from an analysis of recent trends in consumption of petroleum products, a review of ABARE and other projections, and an econometric (multivariate regression) analysis of consumption patterns by state.

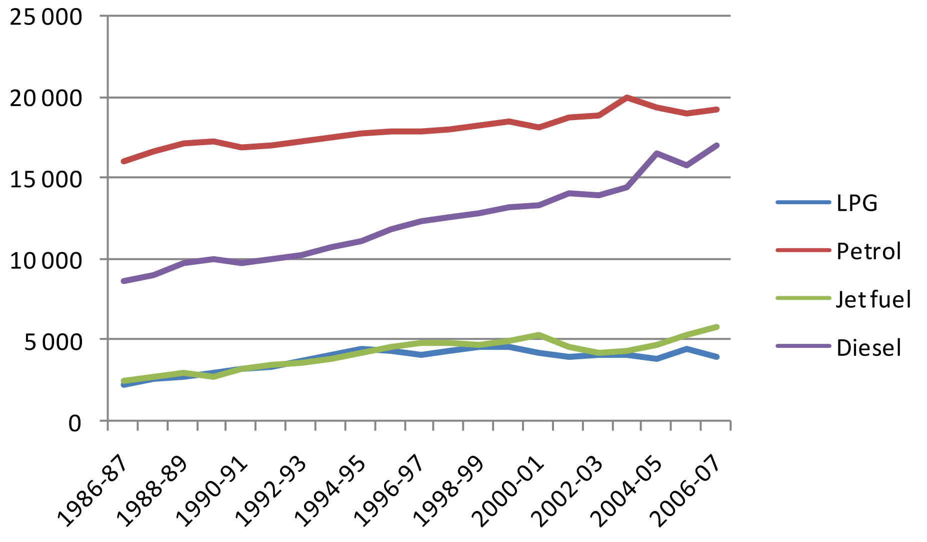
6.1 Recent trends in consumption of petroleum products

This section discusses trends in the consumption of petrol (ULP and PULP), diesel, jet fuel and LPG in Australia and across the various States and Territories.

6.1.1 Australia

The volumes of petroleum products consumed in Australia between 1986-87 and 2006-07 are shown in Figure 37.

Figure 37 **Australian consumption of petroleum products, 1986-97 to 2006-07 (ML/a)**



Data source: ABARE

In the two decades, petrol consumption rose by an average of 0.9 per cent per annum while diesel consumption rose by an average of 3.4 per cent per annum.

Since 2000-01, the average annual growth rates in the consumption of petrol and diesel have been 1.0 per cent and 4.2 per cent respectively.

The relatively slow increase in petrol consumption is due partly to continued increases in the fuel efficiency of cars, while the much higher growth in diesel consumption is largely due to increased commercial transport activities as a result of sustained economic growth. In the last several years, increased diesel consumption has been driven primarily by the boom in the resource sector.

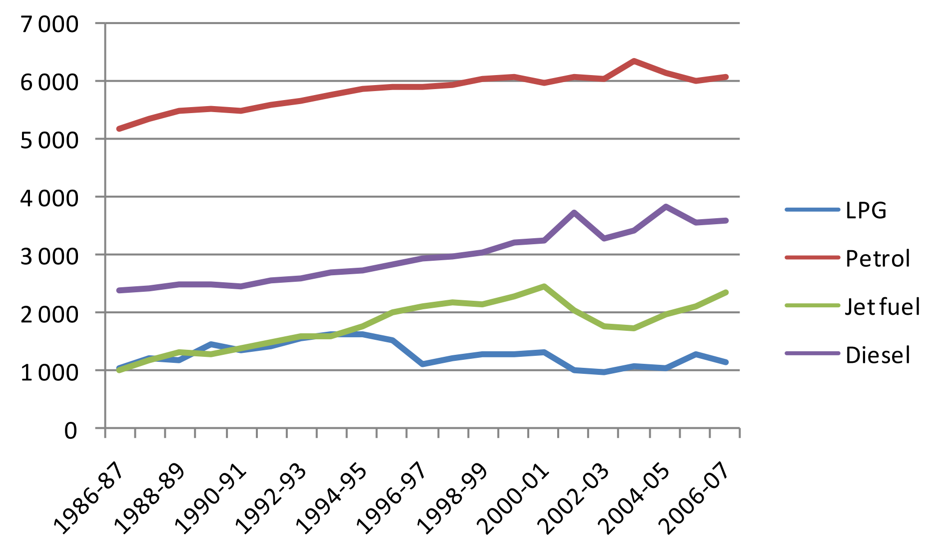
In the two decades to 2006-07, consumption of jet fuel in Australia has risen by an average of 4.3 per cent a year, although the average growth rate between 2000-01 and 2006-07 has been only 1.6 per cent per annum caused in part by the slump in international aviation and tourism following the terrorist attacks in New York and Bali and by the SARS epidemic in Asia.

LPG consumption in Australia rose quite rapidly between the mid-1980s and the mid-1990s but has remained relatively steady since then. Annual growth rates in LPG consumption averaged 7.9 per cent between 1986-87 and 1995-96 and minus 0.7 per cent between 2000-01 and 2006-07.

6.1.2 New South Wales

Trends in the consumption of petrol, diesel, jet fuel and LPG in New South Wales over the last two decades are shown in Figure 38.

Figure 38 **NSW consumption of petroleum products, 1986-97 to 2006-07 (ML/a)**



Data source: ABARE

Between 1986-87 and 2006-07, petrol and diesel consumption in the state rose by an average of 0.8 per cent and 2.1 per cent per annum respectively. Between

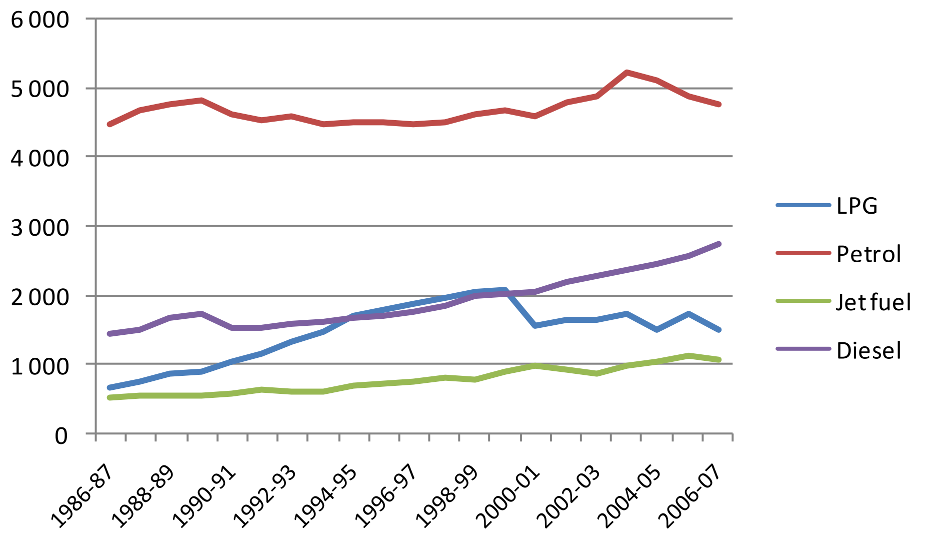
2000-01 and 2006-07, the corresponding annual growth rates were 0.3 per cent and 1.8 per cent respectively.

Jet fuel consumption in New South Wales rose rapidly between the mid-1980s and 2001. Jet fuel consumption then declined rapidly due to the fall in international travel referred to above, averaging -0.7 per cent between 2000-01 and 2006-07.

6.1.3 Victoria

The volumes of petrol, diesel, jet fuel and LPG consumption in Victoria over the last two decades are shown in Figure 39.

Figure 39 **Victorian consumption of petroleum products, 1986-97 to 2006-07 (ML/a)**



Data source: ABARE

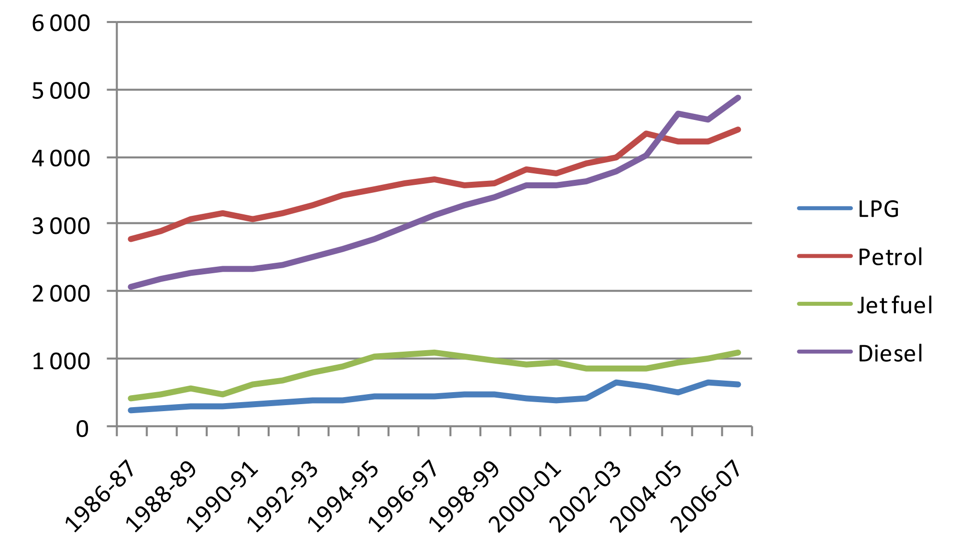
While the demand for petrol in Victoria has been relatively static (averaging 0.3 per cent a year between 1986-87 and 2006-07 and 0.7 per cent a year between 2000-01 and 2006-07), diesel demand has grown steadily at the average rate of 3.2 per cent a year between 1986-87 and 2006-07 and 5.0 per cent a year between 2000-01 and 2006-07.

Unlike New South Wales, demand for jet fuel has continued to grow in a relatively stable fashion since 2000-01, averaging 1.5 per cent a year between 2000-01 and 2006-07 (compared with 3.7 per cent between 1986-87 and 2006-07). This is primarily because Victoria is not as reliant on international tourism and aviation as New South Wales.

6.1.4 Queensland

Trends in the consumption of petrol, diesel, jet fuel and LPG in Queensland over the last two decades are shown in Figure 40.

Figure 40 **Queensland consumption of petroleum products, 1986-97 to 2006-07 (ML/a)**



Data source: ABARE

Between 1986-87 and 2006-07, petrol and diesel consumption in Queensland rose by an average of 2.3 per cent and 4.4 per cent per annum respectively. Between 2000-01 and 2006-07, the corresponding annual growth rates were 2.7 per cent and 5.3 per cent respectively. Petrol consumption has increased more rapidly than in Sydney and Melbourne due to greater population growth, while diesel consumption has been underpinned by both population growth and the recent resource boom.

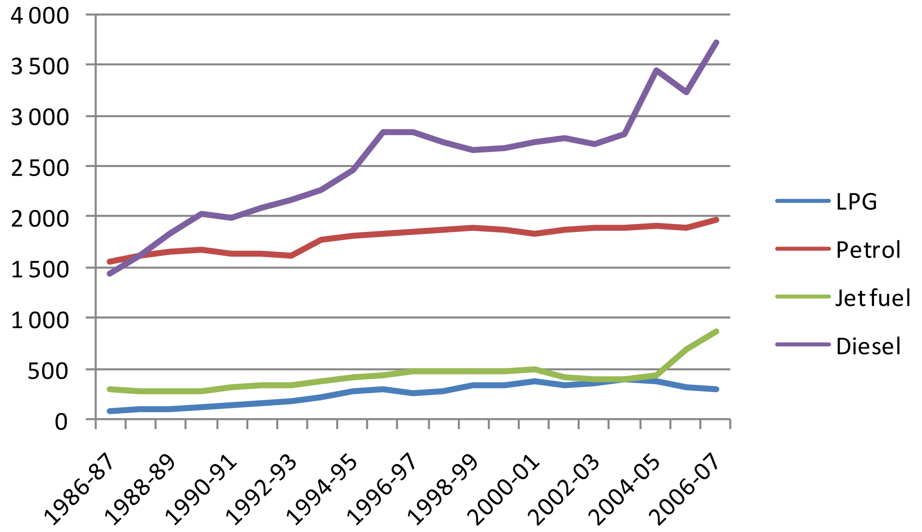
Jet fuel consumption in Queensland rose sharply between the mid-1980s and mid-1990s, declined steadily till about 2001-02, and has since risen again (averaging an annual growth rate of 2.4 per cent between 2000-01 and 2006-07).

In Queensland, LPG consumption increased by an average of 5.0 per cent per annum between 2000-01 and 2006-07, and by an average of 7.7 per cent between 2000-01 and 2006-07.

6.1.5 Western Australia

The volumes of petrol, diesel, jet fuel and LPG consumption in Western Australia over the last two decades are shown in Figure 41.

Figure 41 **Western Australia consumption of petroleum products, 1986-97 to 2006-07 (ML/a)**



Data source: ABARE

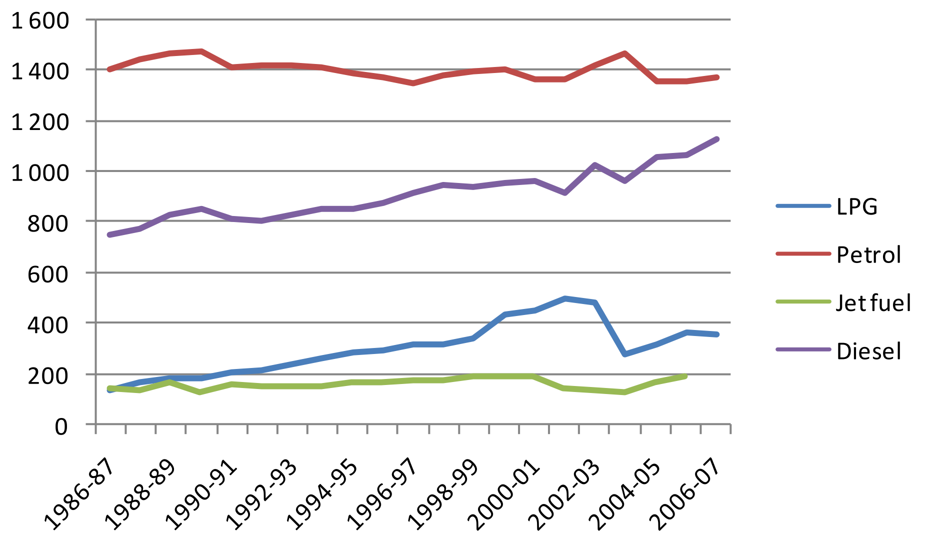
While petrol consumption in Western Australia has grown relatively slowly (averaging 1.2 per cent per annum between 1986-87 and 2006-07), diesel consumption has increased much more quickly, growing by an average of 4.9 per cent a year in the same time period. This increased to 5.2 per cent between 2000-01 and 2006-07 due, to a large extent, to the resource boom in the state.

Jet fuel consumption in Western Australia also rose rapidly in the two decades to 2006-07, averaging 5.5 per cent per annum. Growth in jet fuel consumption has accelerated in the last several years, averaging 9.8 per cent a year between 2000-01 and 2006-07. This has been due to a rapid increase in the number of flights to remote mining sites as a result of the resource boom. On the other hand, LPG consumption in Western Australia has declined by an average of 3.2 per cent a year between 2000-01 and 2006-07.

6.1.6 South Australia

As can be seen in Figure 42, there has been considerable growth in the demand for diesel in South Australia over the last five years. This growth has averaged 2.1 per cent per annum between 1986-87 and 2006-07 and 2.7 per cent per annum between 2000-01 and 2006-07. By comparison, demand for petrol and jet fuel has remained relatively stable, with growth averaging 0.1 per cent for both fuels between 2000-01 and 2006-07. LPG consumption in South Australia rose rapidly between the mid-1980s and 2001. It has since declined considerably at the rate of minus 3.9 per cent between 2000-01 and 2006-07.

Figure 42 **South Australian consumption of petroleum products, 1986-97 to 2006-07 (ML/a)**

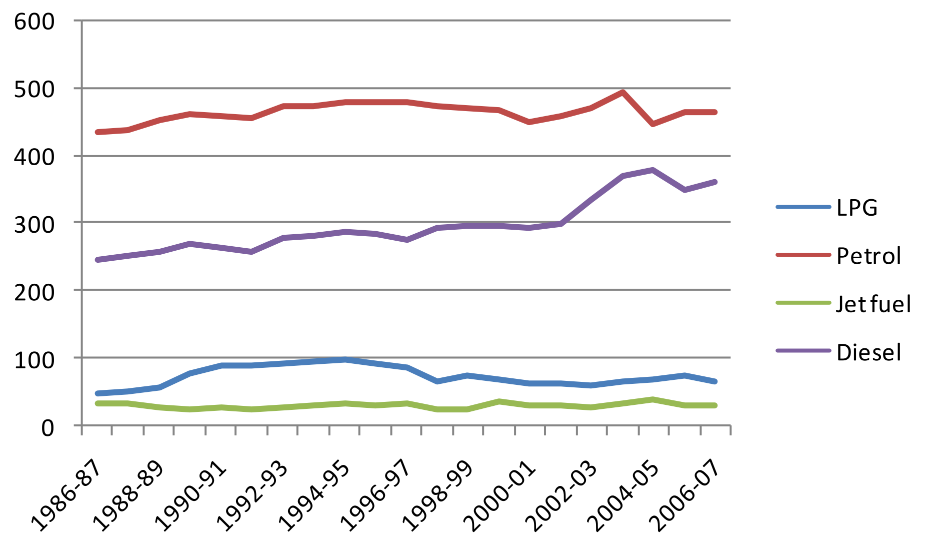


Data source: ABARE

6.1.7 Tasmania

Like South Australia, petrol consumption in Tasmania has remained relatively flat over time, increasing by an average of 1.7 per cent per year between 1986-87 and 2006-07 (see Figure 43). Diesel consumption has risen at a faster rate, averaging 1.9 per cent per annum between 1986-87 and 2006-07 and accelerating to 3.6 per cent per annum between 2000-01 and 2006-07.

Figure 43 **Tasmanian consumption of petroleum products, 1986-97 to 2006-07 (ML)**



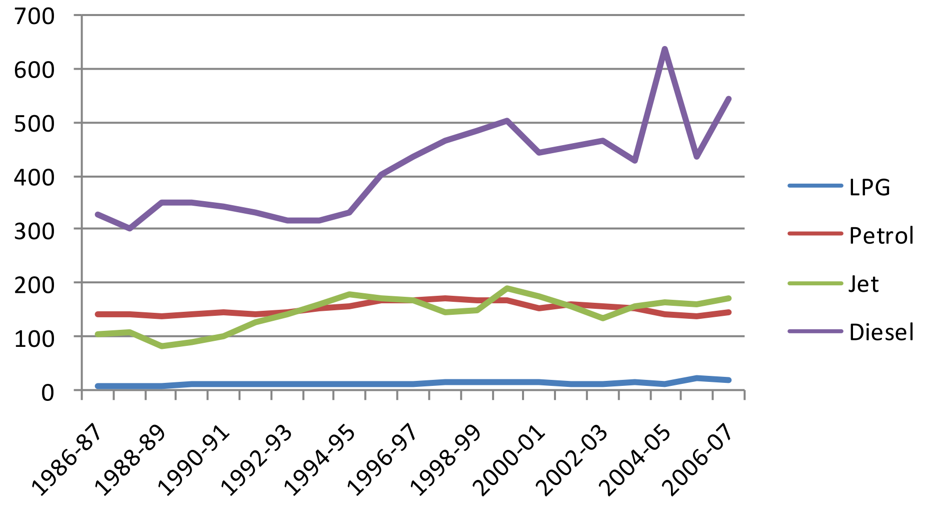
Data source: ABARE

Over the past two decades, Tasmania has experienced little growth in LPG consumption and virtually no growth in jet fuel consumption.

6.1.8 Northern Territory

The volumes of petrol, diesel, jet fuel and LPG consumption in the Northern Territory over the last two decades are shown in Figure 44.

Figure 44 **Northern Territory consumption of petroleum products, 1986-97 to 2006-07 (ML/a)**



Data source: ABARE

While petrol consumption in the Territory has remained largely unchanged over time, diesel consumption has increased by an average of 3.6 per cent a year between 1986-87 and 2006-07. Annual growth in diesel consumption accelerated to an average of 3.5 per cent a year between 2000-01 and 2006-07. Diesel consumption in the Territory, however, has exhibited considerable volatility compared with that in other states.

LPG consumption has increased by an average of 4.9 per cent a year between 1986-87 and 2006-07 (off a relatively low base), and by an average of 7.0 per cent a year between 2000-01 and 2006-07.

While jet fuel consumption increased by an average of 2.4 per cent a year between 1986-87 and 2006-07, it consumption has flattened in the latter part of this period.

6.1.9 Demand trends in mining and transport sectors

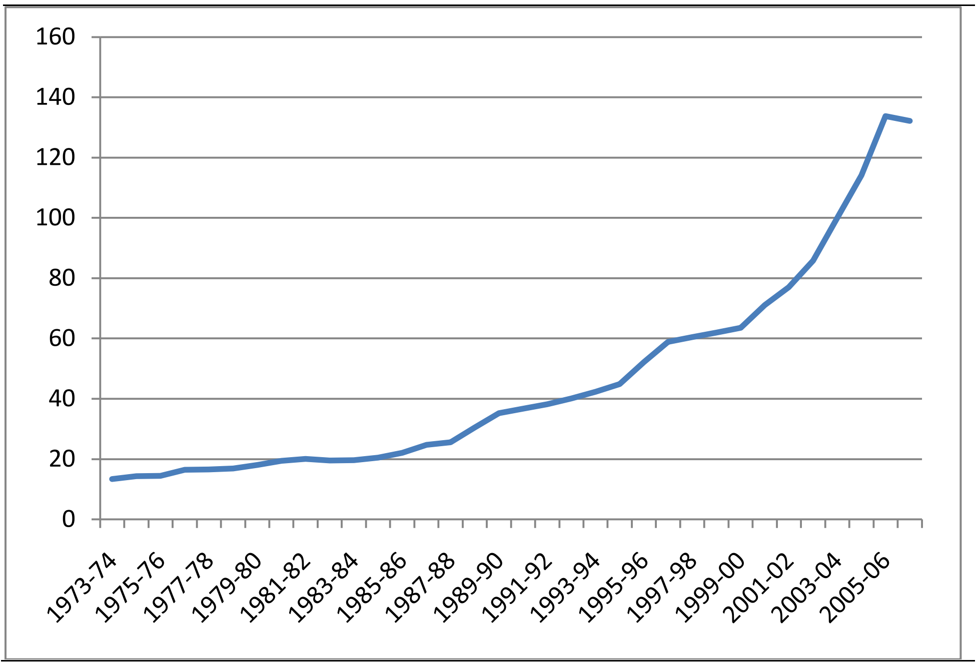
The mining and transport sectors are important factors in determination of future demand for petroleum fuels. Recent demand trends provide further insights into possible future demand trends.

The mining sector

Figure 45 depicts trends in petroleum and petroleum product consumption for the mining sector in Australia from 1973 to 2007, the latest available figures. Petroleum products are calculated as the sum of LPG, petrol, aviation fuel and diesel.

The figure depicts a strong upward trend in fuel consumption in the mining sector. Moreover, this trend does not seem to be greatly affected by the recession of the early 1980s as well as the 1997 Asian Crisis.

Figure 45 **Petroleum & petroleum products consumption, mining, energy units 1973-2007**



Notes: Petroleum and petroleum products are calculated as the sum of LPG, auto-gasoline leaded and unleaded, aviation gasoline, aviation turbine fuel and diesel.

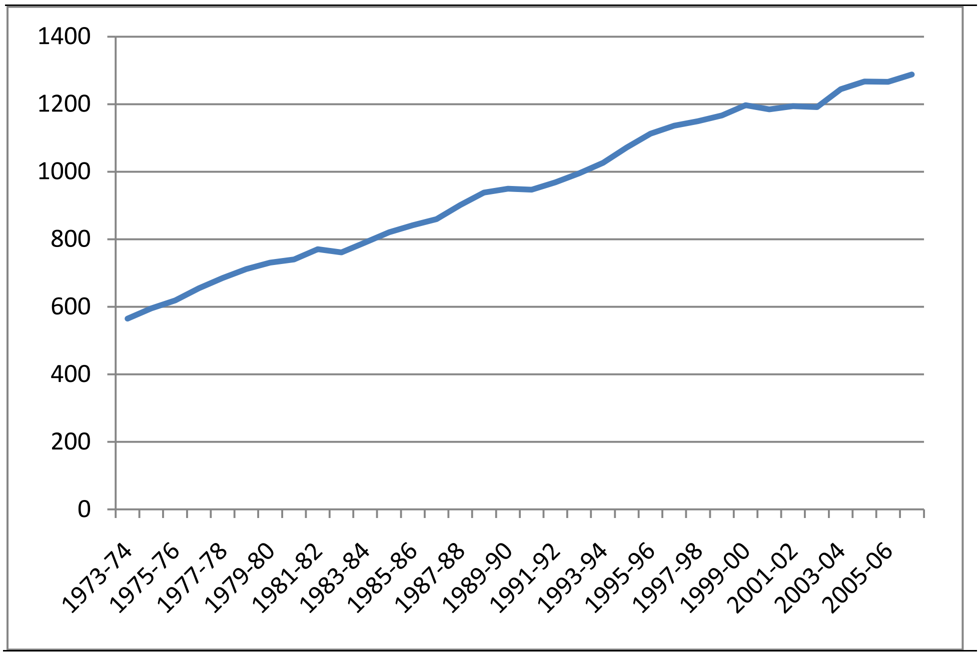
Data source: ABARE (2008) energy statistics, Table F: Australian energy consumption, by industry and fuel type - energy units.

However consultations with petroleum companies and importers have indicated that the current downturn in world demand for minerals and energy has resulted in lower growth expectations for diesel than before the onset of the financial crisis. It appears likely that the downturn will result in lower growth in demand for petroleum products in the mining and resources sector in the short to medium term. However longer term demand could return to trend should global recovery occur over the longer term.

The transport sector

The transport sector may also follow a similar path. Figure 46 shows a strong upward trend in petroleum and petroleum products consumption in the transport industry over the past 30 years. The upward trend is robust to the two aforementioned international crises. As a result it is possible to conclude that both the mining and transport sector are unlikely to be truly affected by the financial crisis.

Figure 46 **Petroleum & petroleum products consumption, transport, energy units 1973-2007**



Notes: Petroleum and petroleum products are calculated as the sum of LPG, auto-gasoline leaded and unleaded, aviation gasoline, aviation turbine fuel and diesel.

Data source: ABARE (2008) energy statistics, Table F: Australian energy consumption, by industry and fuel type - energy units

While increasing vehicle fuel efficiency might moderate this trend in future, further economic growth and lower cost fuel efficient vehicles could result in more travel which could counteract this trend in the medium to longer term.

The above historical patterns have been used to develop medium term scenarios of possible projections of petrol, diesel, LPG and jet fuel in Australia to 2029-30.

6.2 Recent projections of petroleum supply and demand

Until relatively recently the outlook for petroleum supply and demand in Australia has been characterised by strong growth in diesel and jet fuel and ongoing demand in growth for petrol and LPG. The impact of the global financial crisis and the uncertainty over the impact of the Carbon Pollution Reduction Scheme (CPRS) has, however, changed to attitude of analysts and forecasters both in government and in industry.

The most recent forecasts by ABARE were released in December 2007 (Syed, Wilson, Sandu, Cuevas-Cubria, & Clarke, 2007). Revised forecasts for the next five years were revised in the March 2008 edition of Australian Commodities (ABARE, March 2008). ABARE provided further commentary on the global economic outlook in December 2008(ABARE, December 2008).

The existing forecasts also do not provide projections by product or by state. They therefore can only provide broad guidance to an analysis of the adequacy of import infrastructure. For the purposes of this report, we have reviewed the existing forecasts in the light of recent developments for overview purposes. We have drawn on recent work by Treasury on the implications of the CPRS for projections of economic growth to 2030 (Treasury, 2008).

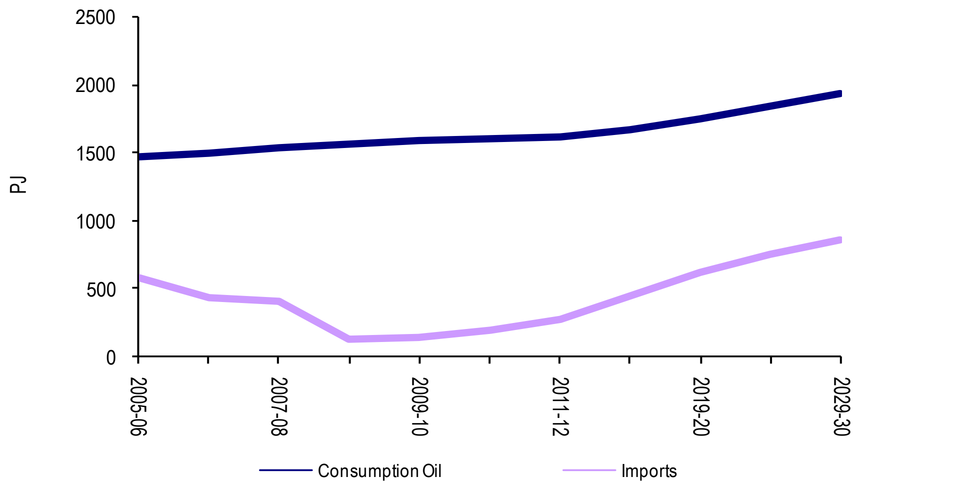
We have also undertaken econometric studies of consumption of petrol, diesel, jet fuel and LPG by state and used the results of the regressions, plus the overview to develop plausible projections of demand for these products to 2030.

6.2.1 ABARE projections

Domestic petroleum supply

ABARE projections assume that the Port Stanvac refinery remains mothballed and there is a one per cent a year growth in overall refinery output through efficiency improvements. On the whole, these assumptions project that refinery output will increase to 1,937 petajoules by 2029-30 (ABARE, 2007). ABARE's projections of crude oil consumption and imports are shown in Figure 47.

Figure 47 **ABARE projections of crude oil consumption and imports**



Note: Projections are in energy terms

Data source: ABARE Australian Commodities, several years

Imports initially fall from around 576 PJ as increased domestic production reduces the consumption of imported crude oil in refineries. However, after 2009-10 imports rise from around 200 PJ to 858PJ by 2029-30.

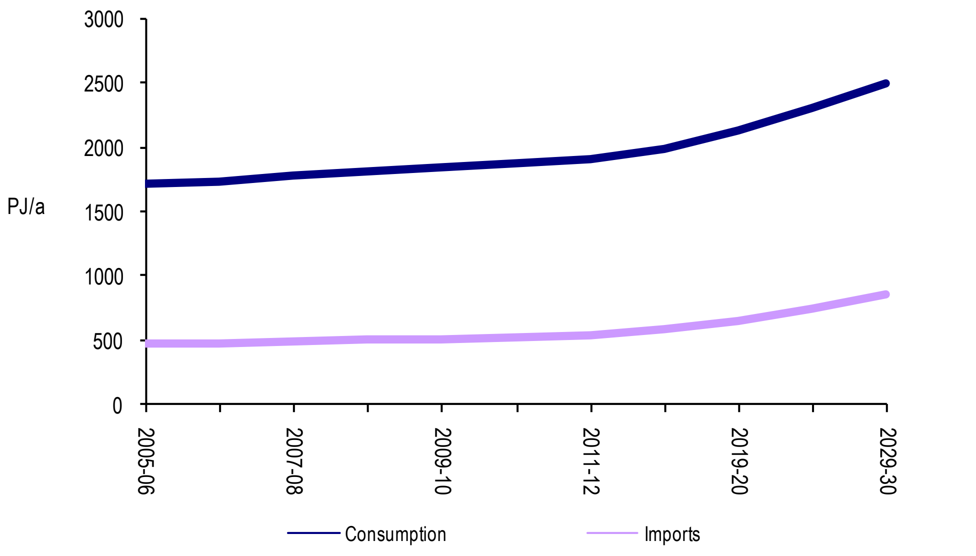
Domestic petroleum product consumption

The growth in consumption of petroleum products is projected to outpace the growth in refinery output over the longer term (Figure 48). As a result, the proportion of petroleum products consumption sourced from domestic refineries is projected to fall over the projection period (ABARE, 2007).

According to ABARE, the projected supply-demand gap for liquid fuels in Australia is expected to widen because a significant proportion of the growth in domestic production of crude oil and naturally occurring LPG will be concentrated in the Carnarvon Basin, in the north west of the country. Therefore, it is assumed that this supply of crude oil and naturally occurring LPG will largely be exported to Asia for processing, as opposed to supplied to the domestic market (ABARE, 2007). As this gap widens, imports will have to increase.

The corresponding projections of imports of petroleum products not including LPG are provided in Figure 48.

Figure 48 **ABARE projections of consumption and imports of petroleum products**



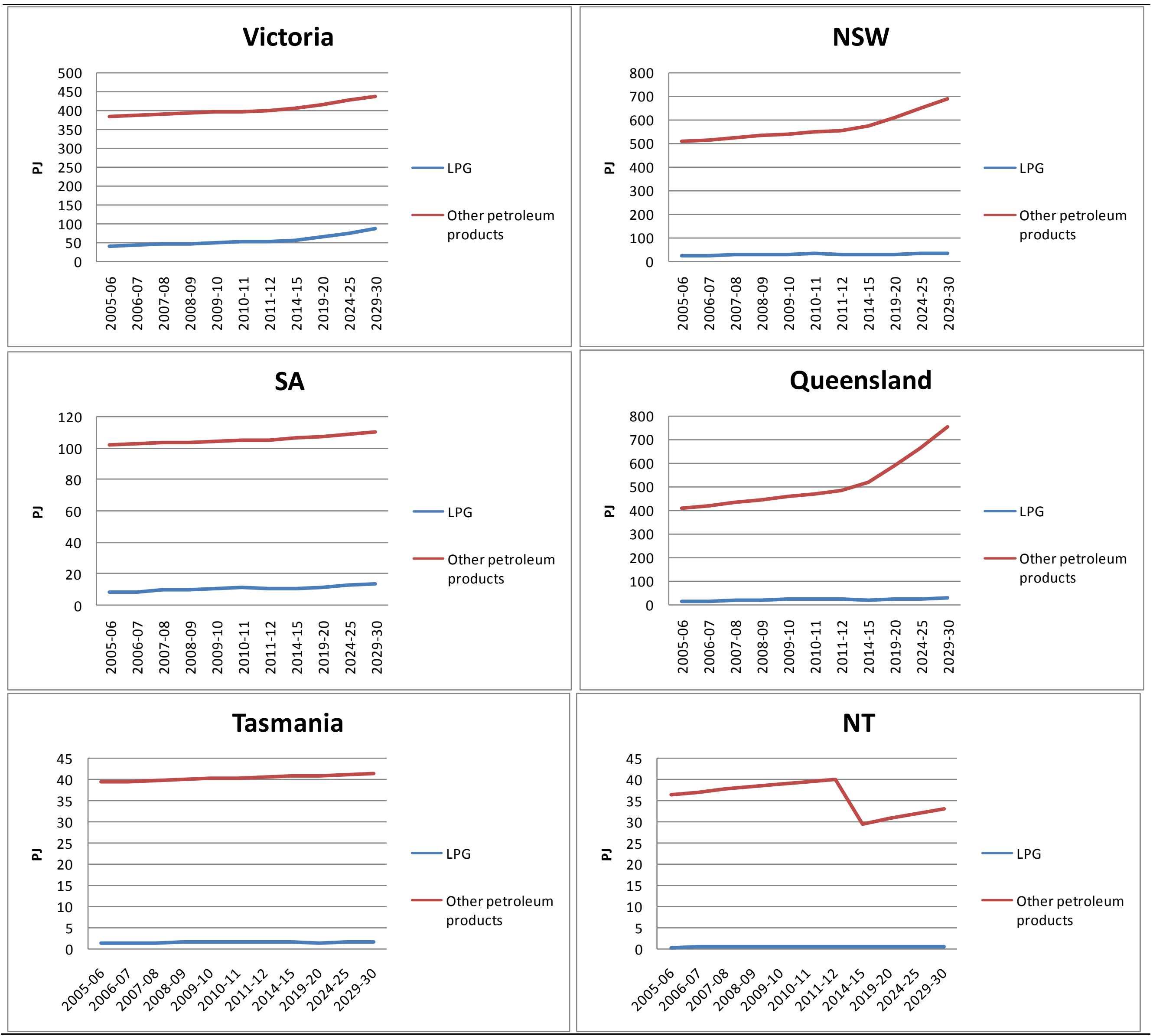
Data source: ABARE 2007

This will essentially depend on whether Asia is able to overcome the economic crisis swiftly. It is important to note that Asia is only expected to recover as quickly as the developed world. This is because the two region's growth prospects are intrinsically tied to the import-absorption capacity of the developed world. In what follows we discuss how the role of the financial crisis is affecting these predictions.

6.2.2 Demand projections by State and Territory

The demand projections for petroleum products and LPG by State are summarised in Figure 49.

Figure 49 **Projections of consumption of other petroleum products and LPG – ABARE December 2007**



Data source: Syed, Wilson, Sandu, Cuevas-Cubria, & Clarke, 2007

The forecasts show that over the 25 year period to 2029-30, consumption of petroleum products increases by 35 per cent in NSW, 89 per cent in

Queensland, 110 per cent in Western Australia, and 66 per cent in South Australia.

Total increase in consumption of petroleum products in Tasmania is 5 per cent and the Northern Territory declines by around 9 per cent at the end of the period after having risen by around 10 per cent by 2011-12.

LPG consumption increases by 124 per cent in NSW by 2029-30, 90 per cent in Queensland, 76 per cent in WA and 67 per cent in SA. LPG consumption in Victoria increases by 14 per cent by 2029-30 and Tasmania 25 per cent.

The compound annual growth rate for petroleum products and LPG by State are shown in Table 49. The annual growth rate in petroleum products is highest in Queensland and Western Australia at around 2.5 per cent. New South Wales' growth rate for petroleum product is 1.2 per cent. Annual growth rates for South Australia and Tasmania are below 0.3 per cent and the annual growth rate for the Northern Territory is zero.

Table 49 **Projected annual growth rate to 2029-30**

State	Petroleum products	LPG
Queensland	2.6%	2.7%
New South Wales	1.2%	3.4%
Victoria	0.5%	3.4%
South Australia	0.3%	2.2%
Western Australia	2.4%	3.1%
Tasmania	0.2%	0.9%
Northern Territory	0.0%	2.2%

Note: Growth rates are annual compound growth rate over 25 years
Data source: *Syed, Wilson, Sandu, Cuevas-Cubria, & Clarke, 2007*

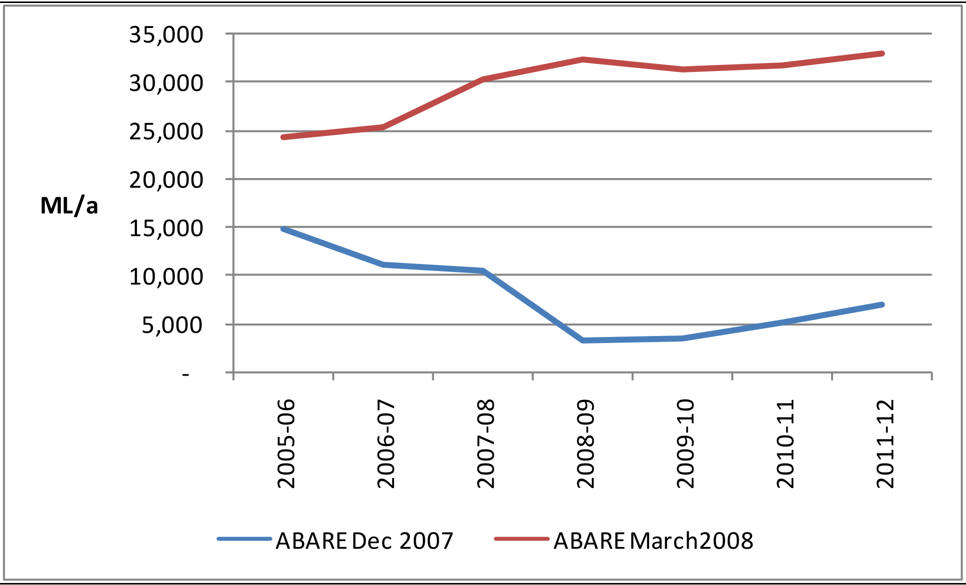
6.2.3 Revised projections

The latest projection from ABARE (Australian Commodities, March 2008) shows an increasing demand for crude oil imports in 2008-2009 as a result in the reduction in domestic production. This spike in imports ceases by 2009 when domestic production recovers and enter a cyclic pattern afterwards.

The reduction in domestic production reflects technical difficulties in several fields, namely Mutineer-Exeter and Corallina. But the further increase in 2009 is due to increasing production capacity in the Angel, Skua/Swift and Vincent oil fields. ABARE argues that the future behaviour of domestic production will be driven by the fall in production from mature fields.

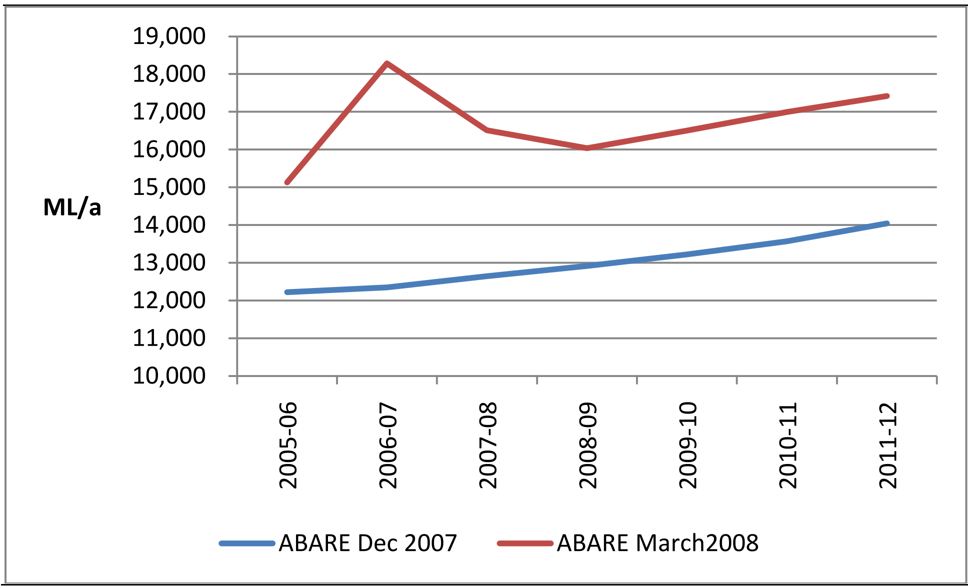
The March 2008 projections are compared with the December 2007 projections for crude oil and other refinery feedstock and for petroleum products in Figure 50 and Figure 51 respectively.

Figure 50 **ABARE medium term projections of crude oil imports**



Data source: Syed, Wilson, Sandu, Cuevas-Cubria, & Clarke, 2007) (ABARE, March 2008

Figure 51 **ABARE medium term projections of petroleum product imports**



Data source: Syed, Wilson, Sandu, Cuevas-Cubria, & Clarke, 2007) (ABARE, March 2008

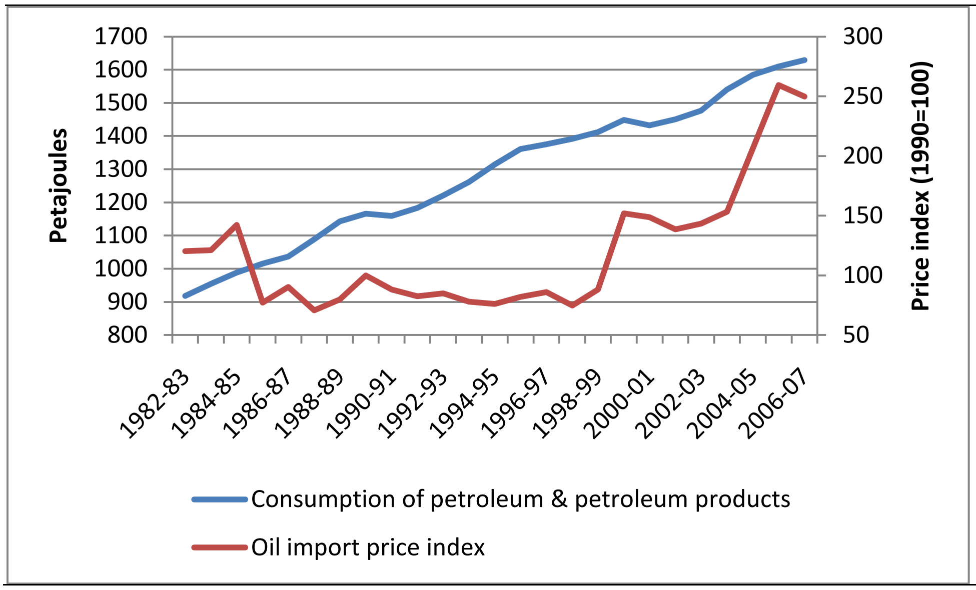
6.2.4 Key uncertainties

Syed et al (2007) indicate that the ABARE projections presented in December 2007 do not take into account policies that have been announced but not implemented. The most important policy change is the governments announcements of the introduction of the proposed CPRS commencing in 2011 (Australian Government, 2008). Moreover that report does not take account of the financial crisis that arose in 2008. Both raise uncertainties about demand for petrleum products in Australia and world oil prices as lower growth expectations flow through to demand and supply for crude oil and ultimately to crude oil prices.

There is a body of evidence that indicates that oil consumption is inelastic with respect to price (Small & van Dender, 2007). This is likely to be true within the range of oil prices that have been experienced in the past ten years. However it is also possible that if oil prices rose to well in excess of historical peak prices, oil consumption could show increased elasticity as alternative technologies and other policy interventions lead to reduced demand for liquid petroleum products at very high prices.

Figure 52 shows the consumption of petroleum and petroleum products compared with the import price index for oil for the past twenty five years.

Figure 52 **Australian consumption of petroleum & petroleum products (PJ) versus the oil import price index (1990=100), 1982-2007**



Note: Petroleum and petroleum products are calculated as the sum of LPG, auto-gasoline leaded and unleaded, aviation gasoline, aviation turbine fuel and diesel.

Data source: Energy consumption data comes from ABARE (2008) energy statistics, Table F: Australian energy consumption, by industry and fuel type - energy units. Import price index comes from ABS Import price Index 2008 for Petroleum products and related material SITC 33.

The figure shows that while the price of oil has been relatively volatile, consumption maintained an consistent upward trend throughout the period. Moreover, from the mid- to late-1980s the price of imported oil maintained a constant trend, while consumption maintained its strong upward trend. Therefore, it is possible that movements in the price of oil that are within the ranges experienced over the past twenty years or so will not have a strong influence on the consumption of petroleum and petroleum products.

On the basis of recent experience, consumption of petroleum products appears to be more related to changes in income.

Impact of the global financial crisis

According to the December 2007 ABARE forecast, oil prices were expected to remain high in the short run and subsequently fall in the long run (ABARE, 2007). These assumptions are likely to require revision at least in the short- to medium-term. In its December 2008 analysis, ABARE described the relationship between oil prices and the global financial crisis:

> In early December 2008, oil prices in West Texas Intermediate (WTI) terms, traded just above US$40 a barrel, the lowest prices observed since late 2004. This compares with an average of US$112 a barrel in the first half of 2008 when prices were supported by growing world oil demand, weak non-OPEC output growth and strong investment demand for commodities. Since oil prices peaked at US$147 a barrel in July 2008, they have fallen by 72 per cent and are estimated to have averaged US$87 a barrel in the second half of 2008 and around US$60 a barrel in the December quarter. The rapid fall in oil prices has been caused by falling demand; firstly as consumers around the world responded to record high prices and; secondly, in response to the global financial crisis which has led to slower economic growth in most developing economies and economic contractions in the United States, the euro area and Japan in the September quarter. For 2008 as a whole, oil prices are estimated to average around US$99 a barrel, an increase of 37 per cent compared with 2007 (Copeland, 2008 p. 694).

The review adds that, in 2009, WTI prices are projected to be 40 per cent lower than in 2008[5]. Moreover, the weak economic outlook for 2009 is expected to result in falling oil consumption in OECD countries and slower growth in demand in non-OECD economies. ABARE assumes that economic conditions will improve during the second half of 2009 and oil consumption growth will gradually increase during this period. However, a number of uncertainties remain.

On the demand side, uncertainties include unexpected changes in world economic growth and seasonal oil consumption. ABARE assumes that in 2009 world economic growth will be around 2.5 per cent. This is a significantly slower rate of growth than in 2008, which is expected to result in world oil demand growing at a lower rate leading potentially to lower oil prices. Conversely, the ABARE report notes that if world economic output grows

[5] WTI is widely used as a proxy for world oil prices.

faster than 2.5 per cent, this could result in oil prices averaging higher than the forecast (Copeland, 2008).

According to the International Monetary Fund (IMF) World Economic Outlook, released in October 2008, world growth is expected to be at 3 per cent in 2009 (IMF, 2008). However, more recent reports in the media suggest that the growth forecast will be substantially cut once the Fund's latest report comes to light (FOREX News, 2009). Overall, a slower growth rate will be coupled with depressed oil consumption and prices throughout the year.

Impact of climate change policies

Forecasting the economic impact of climate change policy is very difficult given the surrounding uncertainty about the direction policy will take in future years. The Government's recent White Paper on climate change policy notes that by 2020, Australia is committed to reduce its carbon pollution by between 5 to 15 per cent on 2000 levels if major economies agree to substantially restrain carbon pollution and advanced economies take on reductions comparable to Australia (Australian Government, 2008). The Government recently committed to reduce Australia's carbon pollution to 25 per cent below 2000 levels by 2020 if the world agrees to a global deal to stabilise levels of greenhouse gases in the atmosphere at 450 parts per million of CO_2-e or lower by mid century (Department of Climate Change, 2009).

It is difficult to ascertain how much the price of oil and domestic demand will change in light of climate change policies both at home and abroad. McKibbin & Wilcoxen review a number of studies that have tried to asses the economic consequences of climate change policy. The authors note that these studies typically determine the marginal cost of reducing emissions by calculating the carbon tax—a tax levied on fossil fuels in proportion to their carbon content—that would be needed to drive emissions down to a specified level. They note that the results vary significantly between the types of models employed(McKibbin & Wilcoxen, 2002).

Australian demand for petroleum fuels will be affected through the impact on demand for petroleum products from major consuming groups, including agriculture, resources, transport and tourism.

Supply-side uncertainties

ABARE also notes that there is uncertainty regarding the supply of oil in 2009. At the Meeting of the Conference of the Organization of the Petroleum Exporting Countries (OPEC) convened in Oran, Algeria on 17 December 2008, member countries agreed to cut 4.2 million barrels a day from the

September 2008 OPEC production of 29 million barrels per day. This decision was mandated to take effect from 1 January 2009 (OPEC, 2008).

According to a recent report by the US Energy Information Agency, changes in OPEC's oil supply decisions will determine the price of oil in the long run (Energy Information Agency, 2008). The Agency indicates that if OPEC decides to increase its conventional oil production to obtain around 44 per cent of the share of total world oil production, then the price of oil could be around $69 per barrel in 2030. On the other hand, if OPEC maintains its production at October 2008 levels, then the price of oil could increase to around $180 per barrel in 2030. The agency notes that both scenarios are plausible.

Copeland (2008) adds that potential delays to the start up of new production facilities and faster than expected depletion rates in oil fields in the North Sea and Mexico can lead to further disruptions. He indicates that the price forecast in 2009 is based on the premise that non-OPEC supply will increase by around 2 per cent. However, many of these projects have already been delayed as a result of a worldwide shortage of equipment and labour. Further delays to projects or difficulties in ramping up production to full capacity could reduce non- OPEC supply growth which may place upward pressure on prices (ABARE, December 2008).

Uncertainty with respect to Australian refineries

Australia has seven petroleum refineries producing a total amount of 44,086ML of refined petroleum products in 2007-08 (ABARE, 2008). In 2007-08, Australian refineries consumed 38,346 ML of crude oil and other refinery feedstock.

If one or more of the Australian refineries closed over the period to 2029-30, the consumption and imports of refined petroleum feedstock would fall significantly. At the same time the import of refined petroleum products would rise to replace the lost domestic supply.

There is a non-zero chance that poor economic conditions or the consequences of an emissions trading scheme could cause one of the Australian refineries to close.

It is not feasible to include such events in the forecasts for this report. However the impact of such an event is discussed at the end of this report.

6.3 Projections of imports of crude oil

ABARE's most recent projections for crude oil demand and imports are somewhat higher than the December 2007 projections (ABARE, March 2008). The two projections are compared in Table 50.

Table 50 **Comparison of ABARE forecasts for crude oil consumption and imports**

	ABARE 2007		ABARE 2008	
	Crude oil consumption PJ/a	Crude oil imports PJ/a	Crude oil consumption PJ/a	Crude oil imports PJ/a
2005-06	1,476	576	1,845	945
2006-07	1,500	432	2,086	981
2007-08	1,538	411	2,181	1,169
2008-09	1,564	128	2,331	1,249
2009-10	1,589	138	2,368	1,210
2010-11	1,611	200	2,375	1,227
2011-12	1,627	276	2,384	1,273
2014-15	1,675	452		
2019-20	1,758	619		
2024-25	1,845	759		
2029-30	1,937	859		

Data source: Syed, Wilson, Sandu, Cuevas-Cubria, & Clarke, 2007, ABARE, March 2008

Both projections assume that total consumption of crude oil and other refinery feedstock will increase as improvements in refinery processes and operations increase production at the existing refineries.

For the purposes of this report, it would seem prudent to assume that crude oil imports could increase to around 1,300ML per year by 2011-12. Following that time further declines in domestic production could result in higher imports. The level of imports that ultimately are required will depend on a wide range of factors including oil price, suitability of north-west shelf crudes for Australian refineries, and the potential for enhanced oil recovery from existing fields.

The consequences for these outcomes are discussed later in this report.

6.4 Outlook for consumption of refined petroleum product and imports

The ABARE projections and the qualifications and uncertainties discussed above provide a framework within which more specific product forecasts can be made. For this purpose econometric estimates were made of factors that have influenced consumption in each State and Territory. These were used to provide projections over the period to 2029-30.

6.4.1 Econometric approach

Econometric estimation and econometric-based forecast of domestic consumption for petrol, diesel and LPG were undertaken for each State and Territory. Estimation for jet fuel was done only for Australia as a whole because of data constraints. Assumptions were made of aircraft departures and available seats by kilometre.

Details of the econometric estimation are presented in Appendix F and Appendix G. For the sake of simplicity and robustness, the estimation carried out was a simple formulation of a demand function on which income and prices are the basic exogenous variables. It is expected that income has a positive effect on demand and price has negative impact. Substitution effects between products such as LPG and petrol have also been incorporated into the model.

The data used for the estimation was a time series of petroleum product consumption, the corresponding series for product price and private income. For the case of petrol and diesel a time series of automobiles and trucks efficiency was obtained. Although times series of consumption exist back to 1960s, appropriate data on the explanatory variables by state were available only from 1985. This is not the case for Australia as a whole, where the data dates back to 1975.

A simple least squares approach was taken. The primary reason for not using a more sophisticated methodology such as vector auto regression (VAR) and vector error correction was the time available for the analysis. ACIL Tasman considers that the approach taken is sufficient for the purposes of this exercise.

Reference case assumptions

Projections of economic growth

Economic growth projections are driven by productivity, population and participation. Treasury has prepared projections of gross domestic product (GDP) and gross state product (GSP) for its reference case in modelling the impacts of the CPRS (Treasury, 2008). Using this as a guide ACIL Tasman has made estimates of productivity, population and participation and entered these into its computable general equilibrium model, Tasman Global. The methodology for this is included in Appendix E at the end of this report.

The assumed future annual rates of economic growth that underpin the income variables used in the econometric estimation and forecasts are based on historical growth rates over the last two decades (Table 51).

Table 51 **GDP and GSP growth trends and assumptions**

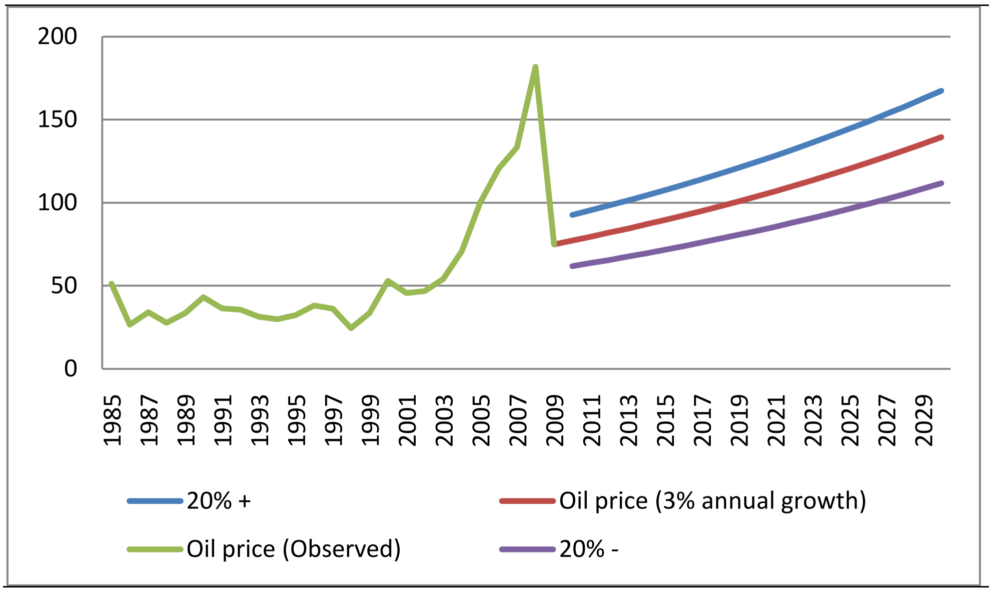
	AUS	NSW	VIC	QLD	WA	SA	TAS	NT
	%	%	%	%	%	%	%	%
2002	3.80	2.20	3.20	5.80	7.10	4.00	4.20	1.70
2003	3.20	2.90	3.00	4.80	3.60	1.20	2.70	0.00
2004	4.00	2.10	4.50	6.40	5.90	4.20	4.30	2.30
2005	2.80	1.70	2.40	5.00	3.80	0.90	3.40	5.60
2006	3.00	2.00	2.60	3.60	5.10	2.30	2.10	6.50
2007	3.30	1.90	2.70	4.80	7.10	0.60	2.20	5.20
2008	3.70	2.80	3.20	5.30	5.20	3.80	3.40	3.90
2009	0.50	-0.87	-0.86	2.51	2.80	1.56	0.16	2.36
2010	1.76	1.12	1.60	2.64	2.63	1.08	1.02	2.53
2011	2.72	2.08	2.49	3.69	3.58	2.02	1.95	3.38
2012	3.35	2.72	3.09	4.36	4.19	2.64	2.53	3.80
2013	3.46	2.85	3.19	4.42	4.28	2.73	2.63	3.90
2014	3.38	2.78	3.13	4.31	4.17	2.67	2.56	3.83
2015	3.31	2.73	3.06	4.19	4.06	2.62	2.51	3.76
2016	3.19	2.62	2.95	4.04	3.92	2.51	2.40	3.65
2017	3.12	2.57	2.89	3.93	3.82	2.46	2.35	3.58
2018	3.04	2.51	2.82	3.82	3.71	2.40	2.28	3.50
2019	2.98	2.46	2.77	3.73	3.62	2.35	2.23	3.45
2020	2.93	2.43	2.73	3.64	3.54	2.32	2.20	3.40
2021	2.91	2.42	2.72	3.60	3.50	2.32	2.19	3.39
2022	2.87	2.39	2.68	3.53	3.44	2.28	2.15	3.35
2023	2.83	2.36	2.64	3.46	3.37	2.25	2.12	3.31
2024	2.79	2.33	2.61	3.40	3.31	2.22	2.08	3.27
2025	2.75	2.31	2.58	3.35	3.26	2.20	2.05	3.24
2026	2.72	2.28	2.55	3.29	3.20	2.17	2.02	3.21
2027	2.68	2.26	2.53	3.24	3.15	2.15	1.99	3.18
2028	2.66	2.25	2.51	3.19	3.11	2.14	1.97	3.16
2029	2.65	2.25	2.51	3.17	3.09	2.14	1.97	3.17
2030	2.61	2.22	2.47	3.11	3.02	2.11	1.94	3.13

Note: GDP and GSP projections are real projections
Data source: ACIL Tasman

Oil price movements

For this analysis it has been assumed that the price of crude oil will grow at an average annual rate of three per cent (see Figure 53).

Figure 53 **World Oil price (index) – Assumption for econometric estimation and forecast**



a 3% annual growth projection.

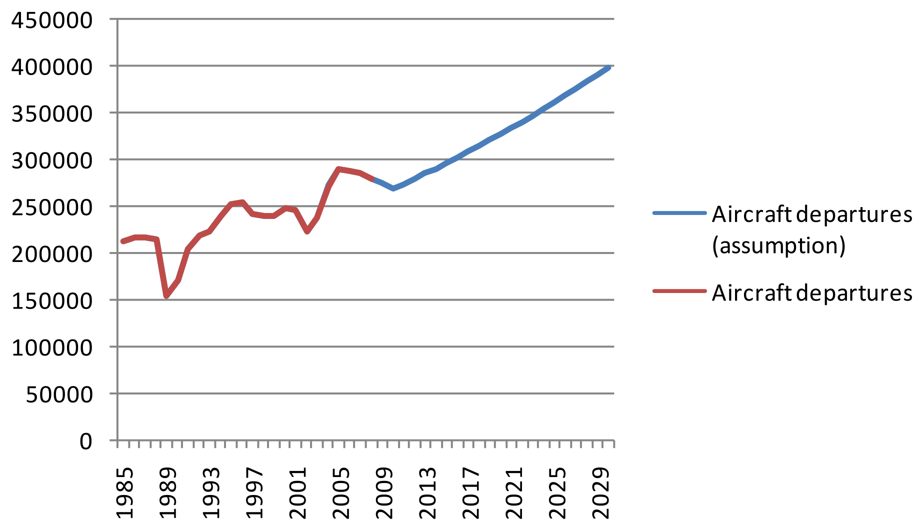
Note: Crude Oil (petroleum), Price index, 2005 = 100, simple average of three spot prices; Dated Brent, West Texas Intermediate, and the Dubai Fatah

Data source: IMF commodities prices

Air travel assumptions

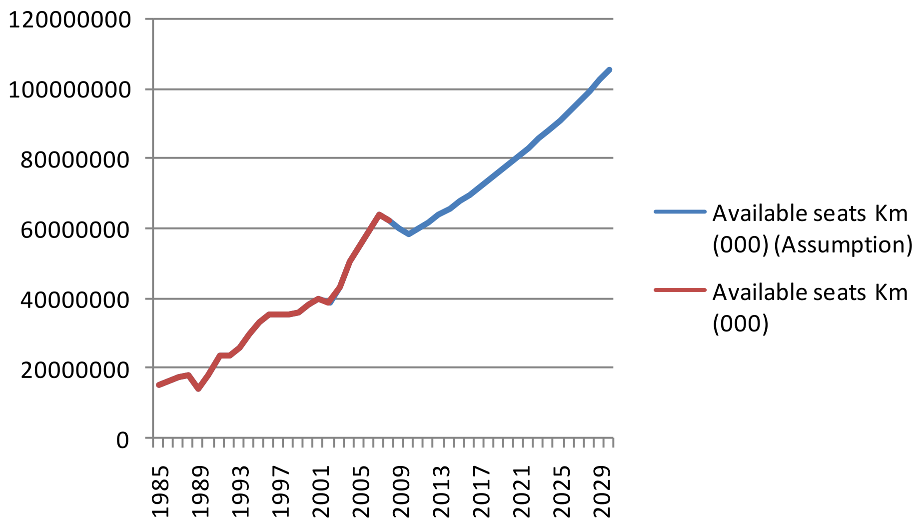
In the case of jet fuel, the forecasting model included the following additional variables: aircraft departures and available seat-kilometres (this latter variable represents the aircraft seating capacity multiplied by the number of kilometers the seats are flown). Future annual growth rates are assumed to be two per cent annually for aircraft departures and three per cent for available seats per kilometre (see Figure 54 and Figure 55).

Figure 54 **Aircraft departure – Assumption for econometric estimation and forecast**



Data source: ACIL Tasman

Figure 55 **Available seats KM (000) – Assumption for econometric estimation and forecast**



Data source: ACIL Tasman

Sensitivity analysis

A reference case was established based on assumptions outlined below. Sensitivity analysis was undertaken for a high and a low case. The adjustments made for the high and the low case were as follows:

- High case
  - GDP increased by 25 per cent
  - Oil price increased by 25 per cent

  - Fuel efficiency improvements reduced by 25 per cent
- Low case
  - GDP decreased by 25 per cent
  - Oil prices lower by 25 per cent
  - Fuel efficiency improvements increased by 25 per cent

6.4.2 Results and discussion

The results of forecast by fuel type are presented in the following sections.

The models and forecast for petrol and diesel are satisfactory. Price, income and the lag structure offer an appropriate description of demand and scenarios that are plausible within the broad limits suggested for future oil price behavior.

Finally, the jet fuel estimation was only carried out for Australia as a whole. Data for the air transport industry back to the 1980s is only available at the aggregate, not State/Territory, level. In the jet fuel estimation and forecast, the income variable was dropped. The estimation shows that jet fuel demand is not responsive to price changes. Instead, the upward trends assumed for aircraft departures and available seats by kilometre, a measure of capacity, suggest a constant increase in the demand.

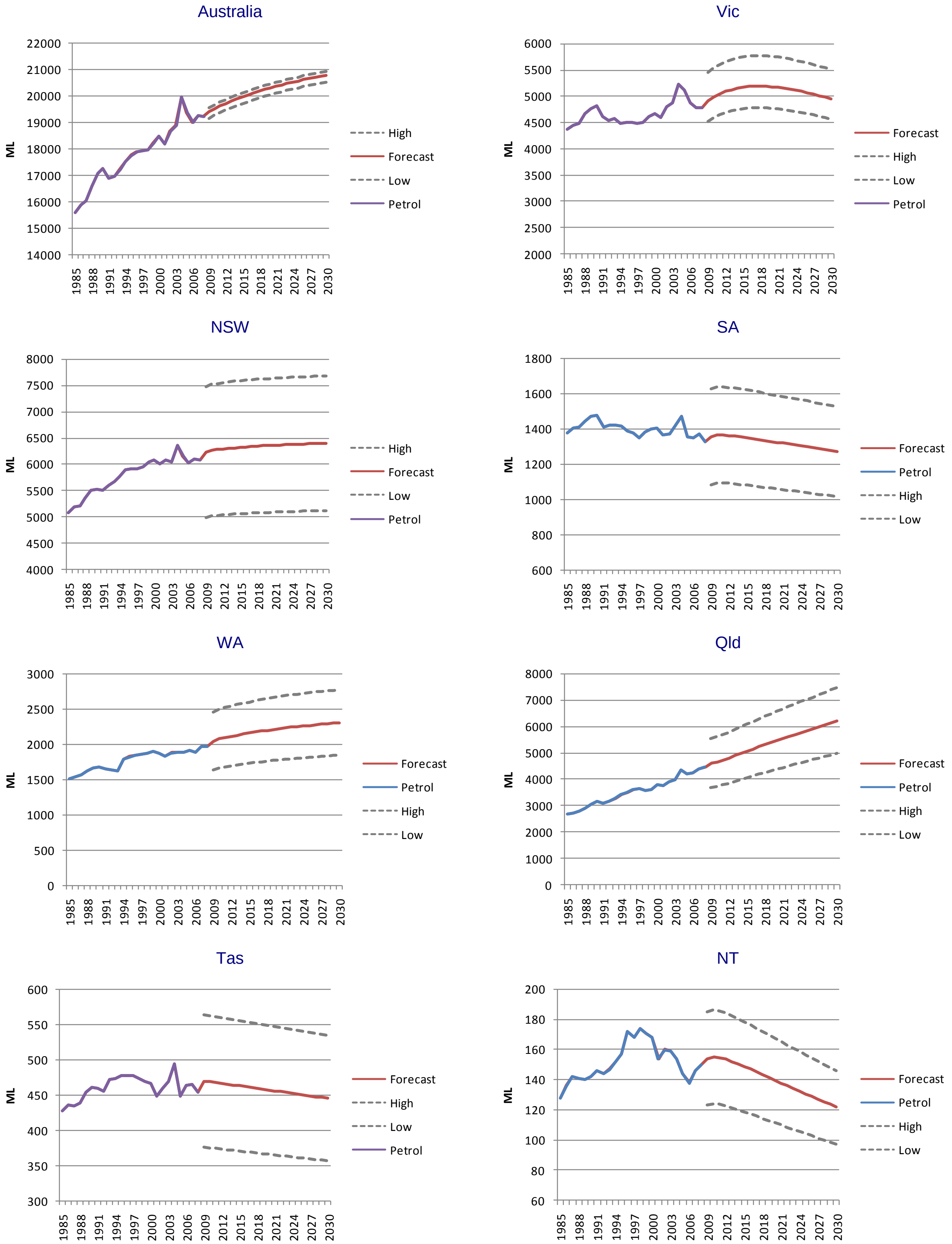
6.4.3 Petrol

The results for petrol consumption for Australia and by State and Territory are shown in Figure 56. Most of the forecast results presented in the figures below correspond to a plausible scenario given the assumptions on the determinants of petrol demand by State and Territory. In most of the cases, the future trends are not dissimilar to the observed trends in the last 25 years. This is the case for Australia, New South Wales, Queensland and Western Australia, where the increasing trend in petrol demand is well captured by the econometric estimation. On the other hand, South Australia, Tasmania and Northern Territory have shown a decreasing trend, which is also well captured by the parameters of the estimation and the forecast.

Petrol forecast in Victoria decreases after 2020. This is because the coefficient associated with prices is larger than the one for Australia as a whole, and also because of the negative association between passenger vehicle efficiency and petrol consumption in the state.

The estimations and forecasts for South Australia and Northern Territory also suggest a long reduction in demand, but this reduction is in line with the recent historical behavior of petrol demand in the state. Petrol demand in both states has been decreasing in the last 5 to 10 years.

Figure 56 **Petrol – Forecast Australia and by State and Territory**



Data source: ACIL Tasman

6.4.4 Diesel

The projections for diesel consumption for Australia and by State and Territory are shown in Figure 57. The estimation and forecast for diesel is also quite satisfactory in terms of the scenarios provided. The forecast provided for all States/Territories reflects to some extent the previous behavior of diesel demand and the values adjust quickly to the variation observed from the recession scenario of 2009.

An important feature of the forecast is the quick adjustment (after two or three years) from the current shock in economic growth. As can be seen in the figures below, the previous trends continue until the end of the forecast period.

In the case of Australia, the increasing trend of diesel consumption in the last 25 years continues in the forecast. This is also true for all the States and Territories – Tasmania and the Northern Territory are the only ones that do not show a very strong increase in future consumption.

It should be noted that Queensland, Western Australia and South Australia are expected to experience the highest growth rates in diesel consumption.

6.4.5 LPG

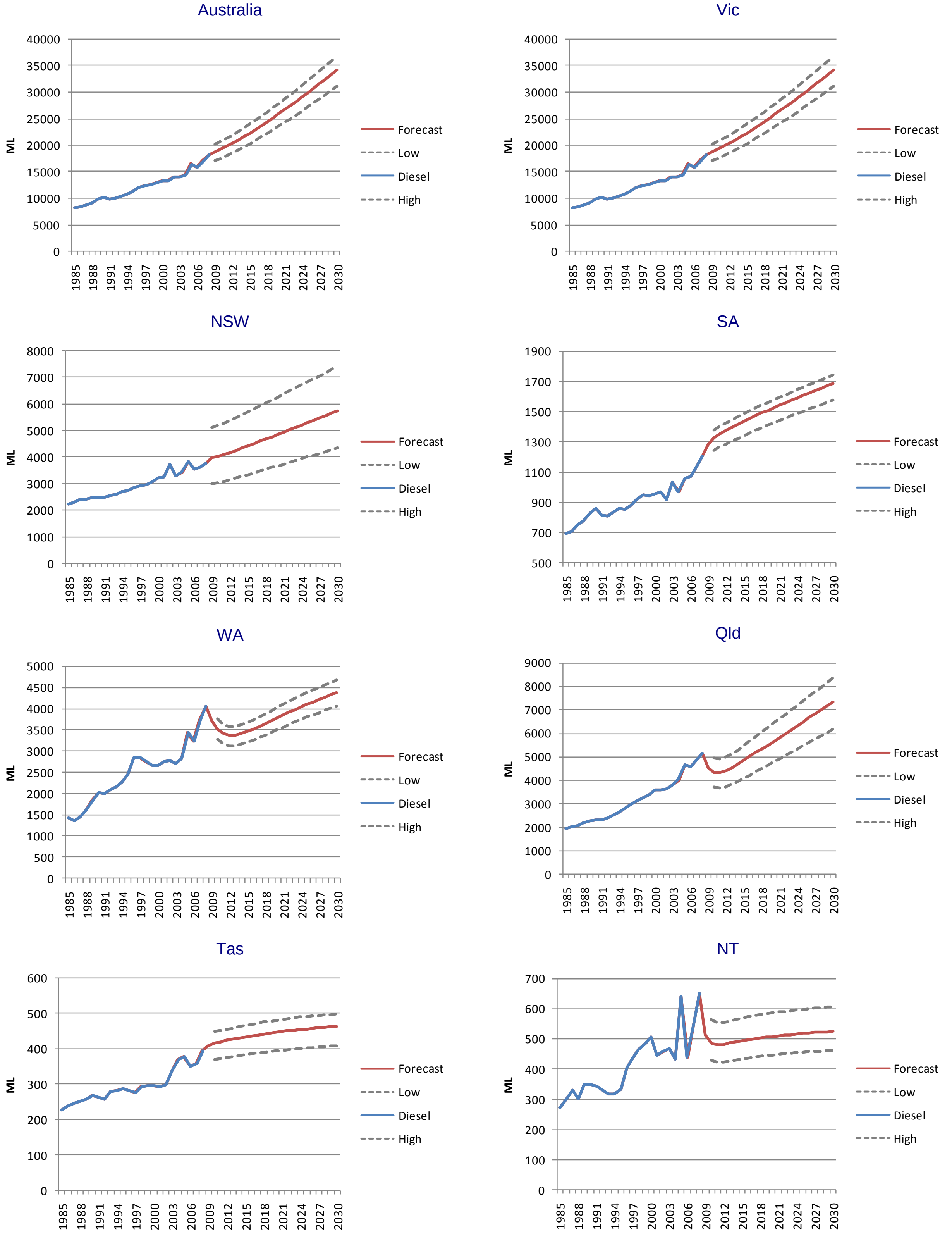
It was not feasible to apply an econometric analysis to projections of LPG demand to 2030. LPG demand in the past has been influenced by policy instruments, including the LPG Vehicle Scheme that provides a subsidy for conversion of vehicles to LPG and excise-free status for LPG used in vehicles. The excise-free status will be phased out from 2011 to half of that for petrol by 2015. Automotive use of LPG comprised around 56 per cent of total consumption in 2007-08, with the remainder being traditional use (home use, commercial use) and petrochemical use.

The LGPA has prepared forecasts of LPG demand to 2018 in 2008. In these forecasts, it was assumed that automotive use would decline from 4 per cent in 2011 to 2 per cent by 2015 and that traditional use would grow at around 2 per cent for the period. Petrochemical use was not included in the analysis.

ACIL Tasman adopted these growth projections and extended them out to 2030. Sensitivity testing was undertaken by assuming a 25 per cent greater growth rate and a 25 per cent lower growth rate for these sectors. The results are summarised in Figure 58.

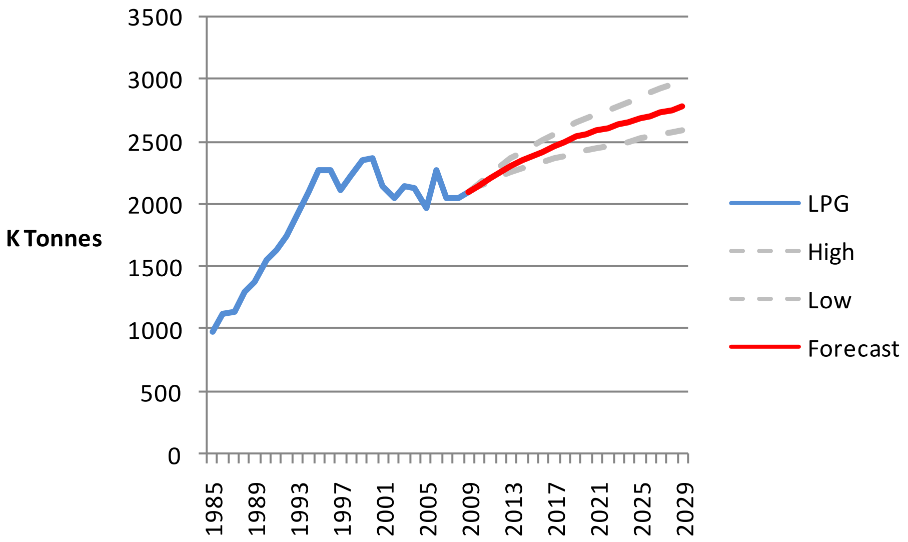
The projections show an increase in demand for LPG over the period to 2030. Consumption levels are slightly higher than the peak levels achieved in the mid 1990s when the adoption of LPG by motorists reached its peak.

Figure 57 **Diesel – Forecast Australia and by State and Territory**



Data source: ACIL Tasman

Figure 58 **Forecast for LPG**



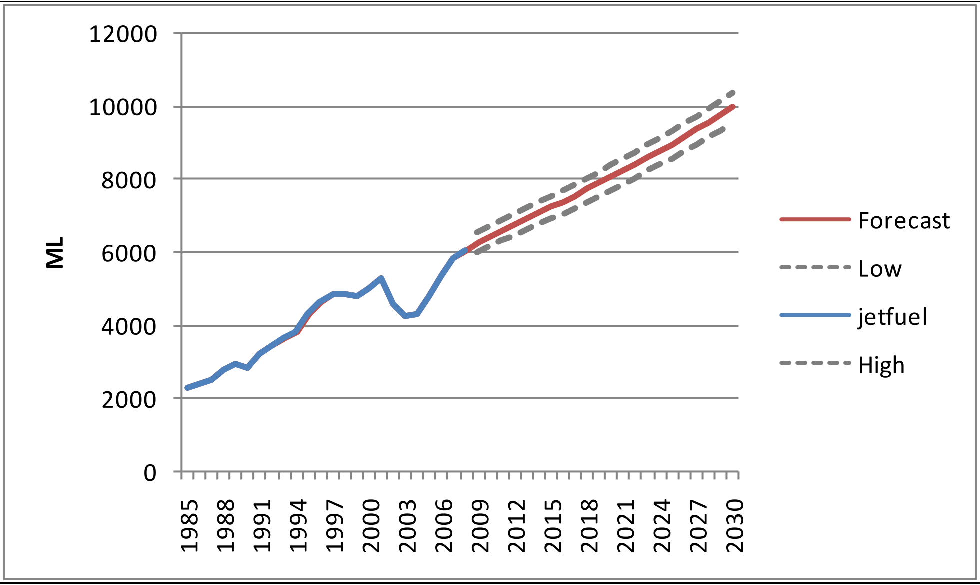
Note: Based on assumptions adopted by the ALGPA supply and demand study (ALPGA, 2008)
Data source: ACIL Tasman and ALPGA

These are broad estimates only and provide a general framework for considering the LPG import requirements in each State/Territory in the following chapter.

6.4.6 Jet fuel

The projection for jet fuel for Australia is shown in Figure 59.

Figure 59 **Jet fuel– Forecast Australia**



Data source: ACIL Tasman

The behavior of jet fuel demand in the past has been of constant growth and the forecast does not suggest anything different, given the assumptions on prices and other demand determinants.

As is well known, the September 11 attacks in 2001 and SARS outbreak in 2003 created a reduction in the demand for international air travel (and therefore the demand for jet fuel). These shocks are projected to fade away, leading to a resumption of demand growth in our forecast.

7 Adequacy to meet future demand

This chapter presents a discussion on the likely ability of current petroleum import infrastructure around Australia and planned expansions to meet anticipated future demand for petroleum products in each State and Territory (according to the demand projections shown in the preceding chapter).

7.1 Australia

The current annual throughput and ACIL Tasman's projection of future demand for petrol and diesel in Australia are shown in Table 52. Annual demand for petrol is projected to reach 20,780 ML in 2029-30, compared with the annual throughput of 19,234 ML in 2007-08, an increase of about 1,550 ML. Annual demand for diesel is projected to reach 34,290 ML in 2029-30, compared with 18,244 ML in 2007-08, an increase of approximately 16,050 ML. Annual demand for jet fuel is estimated to be 10,010 ML in 2029-30 compared with 6,0 ML in 2007-08.

Table 52 **Current and projected demand for petroleum products in Australia**70

Year	Petrol (ULP, PULP)	Diesel	Jet fuel	LPG
	ML/a	ML/a	ML/a	K Tonnes/a
2007-08	19,234	18,244	6,069	1850
2014-15	19,965	22,284	7,251	2197
2019-20	20,304	25,974	8,083	2365
2024-25	20,566	29,973	8,996	2486
2029-30	20,776	34,285	10,006	2613

Note: Jet fuel projections have been calculated using Australia wide growth rates. LPG excludes *petrochemical use*

Data source: ACIL Tasman

These projections are just one scenario for the path of future demand. The sensitivity analysis provided in chapter 6 shows that the possible outcomes could vary in a range of plus or minus 20 per cent.

The projections are compared with the projections of total consumption of petroleum products from the ABARE 2007 projections in Table 53. ACIL Tasman's projections are around 12 per cent lower than the ABARE projections in 2009-10. However by 2029-30 the projections are only 6 per cent lower.

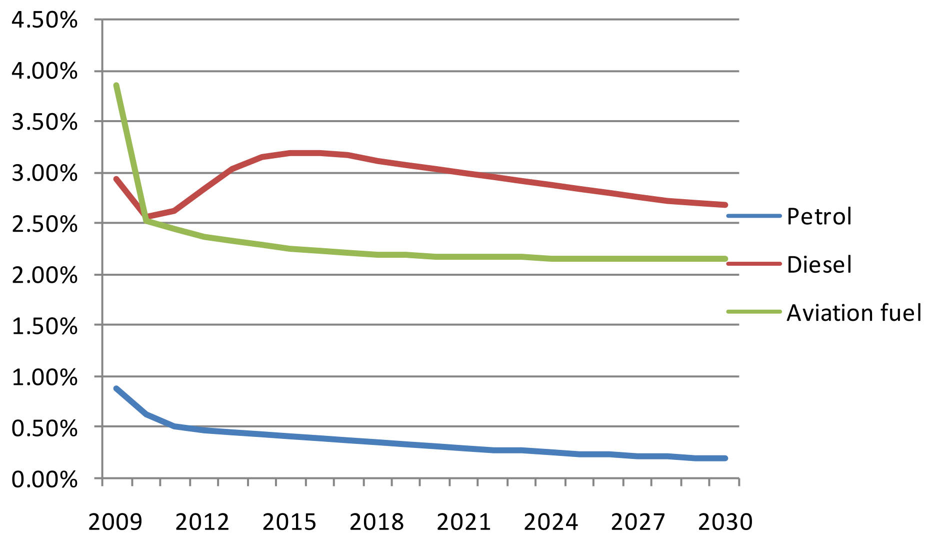
Table 53 **Comparison of ACIL Tasman and ABARE projections**

	ACIL Tasman	ABARE 2007
	Consumption of petroleum products (ML per annum)	Consumption of petroleum products (ML per annum)
2009-10	45,242	51,525
2014-15	49,499	55,350
2019 -20	54,361	59,481
2024-25	59,535	64,172
2029-30	65,067	69,419

Note: ACIL Tasman projections do not include other petroleum products such as fuel oil or LPG
Data source: ACIL Tasman, *(Syed, Wilson, Sandu, Cuevas-Cubria, & Clarke, 2007)*

The annual growth rates associated with ACIL Tasman's projection of demand for petrol and diesel in Australia over the next twenty years are shown in Figure 60. While the annual growth rate for diesel demand is projected to lie between 2.5 and 3.2 per cent, annual demand growth for petrol is expected to decline from one per cent in 2009 to less than 0.5 per cent by 2030. Aviation fuel annual growth declines from over 3.5 per cent to 2 per cent over the longer term.

Figure 60 **Projected growth rate of demand for petrol and diesel in Australia, 2009 to 2030**



Data source: ACIL Tasman

The following sections discuss the adequacy of petroleum import infrastructure in each State and Territory to meet projected future demands for petrol, diesel and jet fuel.

7.2 New South Wales

7.2.1 Current throughput and projected future demand

The current annual throughput and ACIL Tasman's projection of future demand for petrol and diesel in New South Wales are shown in Table 54.

Table 54 **Current and projected demand for petroleum products in NSW (ML)**

Year	Petrol (ULP, PULP)	Diesel	Jet fuel	LPG
	ML/a	ML/a	ML/a	K Tonnes/a
2007-08	6,197	3,958	2,995	457
2014-15	6,321	4,433	3,252	479
2019-20	6,358	4,864	3,625	551
2024-25	6,382	5,302	4,034	624
2029-30	6,398	5,753	4,487	656

Note: Jet fuel projections have been calculated using Australia wide growth rates. LPG excludes petrochemical use.
Data source: ACIL Tasman

Annual demand for petrol is projected to reach 6,400 ML in 2029-30, compared with the current annual throughput of 6,197 ML, an increase of about 330 ML. Annual demand for diesel is projected to reach 5,750 ML in 2029-30, compared with 3,958 ML today, an increase of approximately 1,790 ML. Annual demand for jet fuel is estimated to be 4,490 ML in 2029-30 compared with 2,995 ML today.

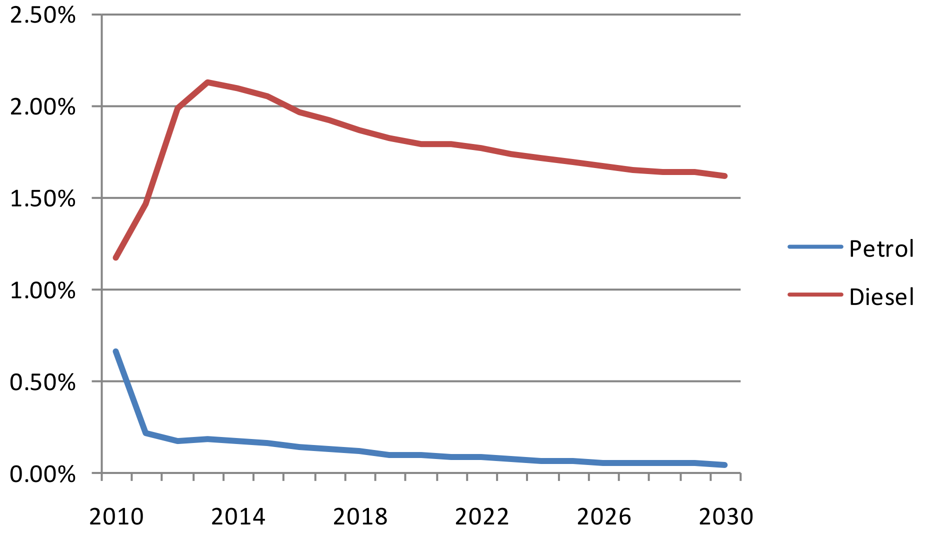
The annual growth rates associated with ACIL Tasman's projection of demand for petrol and diesel in New South Wales over the next twenty years are shown in Figure 61.

Following a predicted rebound in petrol demand in 2009 for New South Wales, demand growth for the fuel is expected to decline to about 0.05 per cent in the 2020s. Annual growth in diesel demand is expected to reach about 2.1 per cent in 2013, before declining to about 1.6 per cent by 2030.

7.2.2 Adequacy to meet future demand

The refineries in Sydney currently produce around 4,633 ML of petrol, 2,500 ML of diesel and 1,280 ML of jet fuel annually. While it is possible that refinery throughput could be increased marginally, significant increases in demand would by and large have to be met from increased imports.

Figure 61 **Projected growth rate of demand for petrol and diesel in New South Wales, 2010 to 2030**



Data source: ACIL Tasman

These forecasts indicate that the import capacity for petrol, diesel and jet fuel in Sydney and Newcastle as at December 2008 is not likely to be adequate to meet growth in demand. Further investment in capacity is required in the medium and longer term. This has been reflected in the responses to the survey. The lack of a second bulk liquids berth at Port Botany was identified as a major constraint to increased importation of petroleum products into Sydney. As noted previously, Sydney Ports Corporation has now made an in-principle decision to proceed with construction of a second bulk liquids berth at Botany.

Vopak is currently expanding the storage capacity at its Botany terminal, and has foreshadowed further expansion plans that will almost double the total storage capacity of the terminal. The project is scheduled to be completed in mid-2010, and was conceived in anticipation of increased future demand for fuels in New South Wales.

However, Vopak has noted that its future ability to deliver product from its Botany terminal to inland distribution points may be restricted by insufficient pipeline capacity.

Constraints on the Sydney Metropolitan Pipeline and the Sydney to Newcastle Pipeline will be relieved to some extent with the connection of the BP Newcastle terminal to Newcastle port. Constraints will be further reduced if the proposed Marstel project proceeds.

Nevertheless further investment in pipeline capacity in the Sydney area and in the JUHI pipeline will be required in the longer term to meet demand growth.

With the 67,000 tonne LPG storage at Port Botany and LPG production from the local refineries, New South Wales is not likely to be constrained in its import capacity for the fuel.

7.3 Victoria

7.3.1 Current throughput and projected future demand

The current annual throughput and ACIL Tasman's projection of future demand for petrol and diesel in Victoria are shown in Table 55. Annual demand for petrol is projected to fall back to 4,950 ML by 2029-30 after increasing to 5,091 ML by 2024-25, compared with the current annual throughput of 4,590 ML. Annual demand for diesel is projected to reach 4,370 ML in 2029-30, compared with 3,120 ML today, an increase of approximately 1,250 ML. Annual demand for jet fuel is estimated to be 3,347 ML in 2029-30 compared with 2031 ML today.

Table 55 **Current and projected demand for petroleum products in Victoria**

Year	Petrol (ULP, PULP)	Diesel	Jet fuel	LPG
	ML/a	ML/a	ML/a	K Tonnes/a
2007-08	4,590	3,120	2,031	713
2014-15	5,173	3,148	2,424	863
2019-20	5,180	3,539	2,704	936
2024-25	5,091	3,945	3,009	983
2029-30	4,952	4,369	3,347	1,033

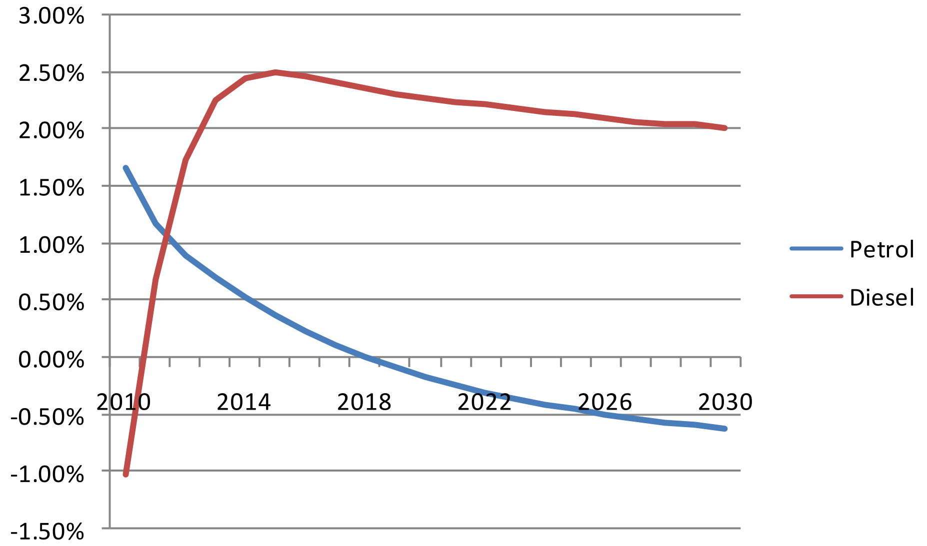
Note: Jet fuel projections have been calculated using Australia wide growth rates. LPG excludes petrochemical use.
Data source: ACIL Tasman

The annual growth rates associated with ACIL Tasman's projection of demand for petrol and diesel in Victoria over the next twenty years are shown in Figure 61. While annual demand growth for diesel is projected to be between two and 2.5 per cent over this period, petrol demand growth is projected to decline continuously from 1.5 per cent in 2010 to nearly minus 0.06 per cent by 2030.

7.3.2 Adequacy to meet future demand

The projections indicate modest growth in demand for patrol and diesel with a decline in petrol demand towards the end of the projection period. However current import capacity for petrol and diesel is likely to be adequate to meet demand in medium term. Jet fuel is projected to grow significantly. According to the audit, additional jet fuel pipeline capacity to Melbourne airport will be required.

Figure 62 **Projected growth rate of demand for petrol and diesel in Victoria, 2010 to 2030**



Data source: ACIL Tasman

The two refineries in Victoria currently produce around 4,978 ML of petrol and 3582 ML of diesel a year. It is likely that demand growth for Victoria can be met by diverting some refinery production into Victoria augmented by additional imports.

It is not expected that there will be any problems for the existing suppliers in Melbourne in managing (and, if necessary, expanding) supply infrastructure to keep pace with any anticipated demand for petroleum products in Victoria.

Holden Dock is currently subject to some berth congestion and at least one operator in Melbourne indicated that there could be land access problems for expansion of existing terminals.

As discussed previously, at present there appears to be some excess capacity at the independent terminal in Hastings. The potential for expansion at Hastings could potentially relieve any berthing congestion at Holden Dock. However, it should also be noted that further product importing facility could also be placed at Gellibrand Pier to service the four terminals on the western side of Melbourne.

While demand for LPG may continue to grow at around 2 per cent per annum over the longer term, production from Gippsland fields in the medium term and from refineries is likely to limit the need for significant additions to LPG import capacity.

7.4 Queensland

7.4.1 Current throughput and projected future demand

The current annual throughput and ACIL Tasman's projection of future demand for petrol and diesel in Queensland are shown in Table 56. Annual demand for petrol is projected to grow to 6,220 ML in 2029-30, compared with the current annual throughput of 4,305 ML. Annual demand for diesel is projected to reach 7,350 ML in 2029-30 from 5,598 ML in 2007-08. Annual demand for jet fuel is estimated to be 2,120 ML in 2029-30 compared with 1,286 ML today.

Table 56 **Current and projected demand for petroleum products in Queensland**

Year	Petrol (ULP, PULP)	Diesel	Jet fuel	LPG
	ML/a	ML/a	ML/a	K Tonnes/a
2007-08	4,305	5,598	1,286	276
2014-15	5,081	4,863	1,536	317
2019-20	5,478	5,677	1,713	339
2024-25	5,857	6,505	1,906	356
2029-30	6,222	7,353	2,120	374

Note: Note: Jet fuel projections have been calculated using Australia wide growth rates. LPG excludes petrochemical use. Queensland jet fuel includes domestic and imported product.

Data source: ACIL Tasman

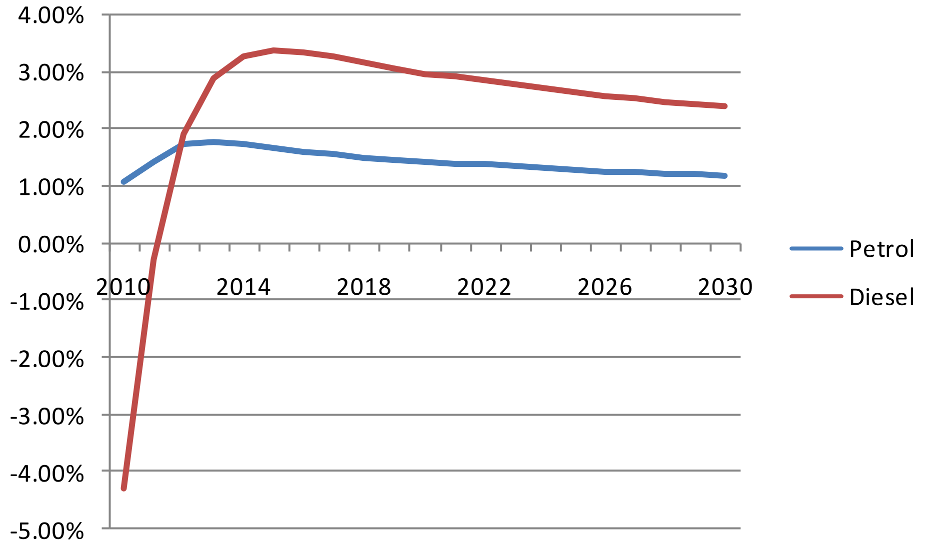
The annual growth rates associated with ACIL Tasman's projection of demand for petrol and diesel in Queensland over the next twenty years are shown in Figure 63. Demand for diesel is projected to rebound from the fall in demand due to the global financial crisis' impact on the Queensland resources sector, with annual diesel demand growth then projected to decline from about 3.2 per cent in 2015 to just above 2 per cent by 2030. Annual demand growth for petrol is projected to hover around 1.5 per cent.

7.4.2 Adequacy to meet future demand

The projections indicate that regardless of short term effects of the economic downturn, additional import capacity will be required to meet growing demand for petrol and diesel demand in Queensland over the longer term.

The refineries in Brisbane between them produce around 3,955 ML of petrol per annum and 4,436 ML of diesel per annum. As with the Sydney and Melbourne refinery production, this may increase marginally.

Figure 63 **Projected growth rate of demand for petrol and diesel in Queensland, 2010 to 2030**



Data source: ACIL Tasman

Local production of LPG amounted to around 200 thousand tonnes in 2007-08 but this was not sufficient to meet demand of 276 thousand tonnes in Queensland in that year. Production of butane that cannot be placed in local markets is exported.

Addition import capacity will be needed in Queensland for diesel, petrol and possibly jet fuel. The geographic distribution of investment that will be required to meet this demand growth will depend on the regional pattern of demand growth in the State. As discussed earlier in this report, the petroleum supply market is a network of supply chains that can be adjusted in many ways to meed growth in demand.

Brisbane

The refiner-marketers have identified a number of relatively minor constraints that would need to be addressed to increase supplies into the Brisbane region.

The current investment in new storage and terminal capacity in Brisbane that was discussed earlier will help address the short term constraints in Brisbane. Investment by Neumann Petroleum in a new berth with deeper depth alongside will allow for larger cargoes of product to be imported into their terminal. However over the longer term it is likely that more investment in import capacity will be required to meet demand growth for petrol and diesel in particular.

There is an emerging need to increase the capacity to import LPG into Brisbane.

As discussed previously, the Port of Brisbane Corporation has been developing a medium term strategy focused on provision of new petroleum product berths and storage facilities for Brisbane. These developments will be important to meet longer term growth in petroleum product demand in the Brisbane area.

Regional Queensland

Additional demand for diesel in Queensland will be derived from growth in regional areas adjacent to resources and mining related industries. Additional import capacity is likely to be required in regional ports.

The additional capacity being installed by Marstel at Bundaberg and Port Alma will assist in meeting additional demand in the medium term.

The Port of Brisbane Corporation, which is responsible for the Port of Bundaberg, has advised that there is space available to expand the existing import facilities or establish large new facilities.

Some investment in new capacity will be required at Gladstone. ACIL Tasman understands that this is likely to occur as demand grows. It will also be possible to relieve pressure at Gladstone by trucking product from Port Alma once the Marstel terminal is operational.

Storage capacity, shipping rotations and draught limitations are apparently impediments to greater petroleum product imports through Mackay. There do not appear to be any constraints in Townville or Cairns.

LPG import facilities in Gladstone, Townsville and Cairns are adequate to meet future demand growth in regional Queensland.

In aggregate therefore, there is a need for further investment in import capacity in Queensland both in Brisbane and in regional ports. The additional investment currently committed will meet short to medium term growth. However in the longer term further berth capacity in Brisbane and additional capacity in regional ports over and above that committed are likely to be needed. The ports corporations in Queensland are supportive of additional investment.

7.5 Western Australia

7.5.1 Current throughput and projected future demand

The current annual throughput and ACIL Tasman's projection of future demand for petrol and diesel in Western Australia are shown in Table 57. Annual demand for petrol is projected to increase to 2,312 ML in 2029-30, compared with the current annual throughput of 2,025 ML, a decrease of about 280 ML. Annual demand for diesel is projected to reach 4,380 ML in 2029-30. The initial decline in diesel consumption reflects assumptions on lower growth following the economic downturn that commenced in 2008-09. This decline is reversed over the longer term.

Annual demand for jet fuel is estimated to be 1,150 ML in 2029-30 compared with 609 ML in 2007-08.

The BP refinery at Kwinana currently produces around 3,139 ML of petrol and 2,409 ML of diesel per annum. Kleenheat also extracts LPG from the Dampier to Bunbury Pipeline which is exported.

Table 57 **Current and projected demand for petroleum products in Western Australia**

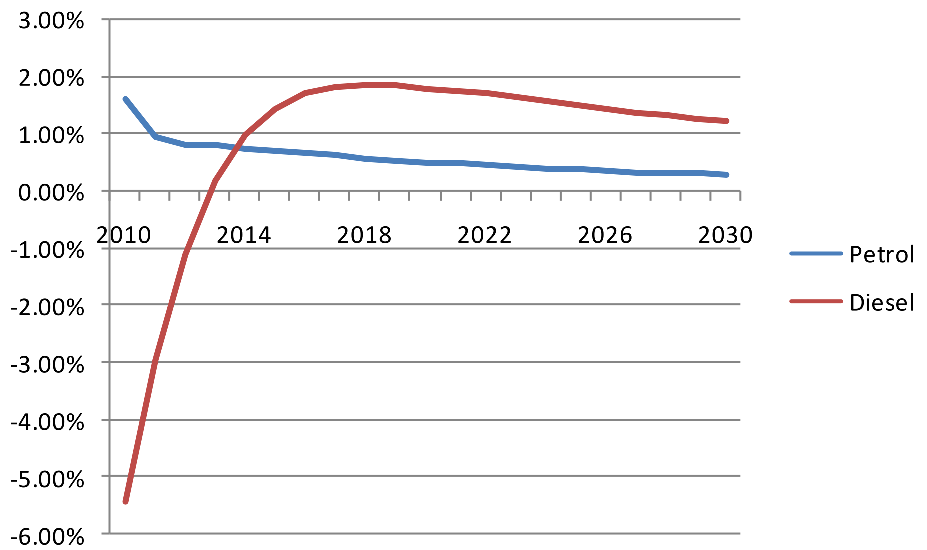
Year	Petrol (ULP, PULP)	Diesel	Jet fuel	LPG
	ML/a	ML/a	ML/a	K Tonnes/a
2007-08	2,025	4,187	609	173
2014-15	2,166	3,460	832	203
2019-20	2,229	3,782	927	219
2024-25	2,276	4,101	1,032	230
2029-30	2,312	4,380	1,148	242

Note: Jet fuel projections have been calculated using Australia wide growth rates. LPG excludes petrochemical use

Data source: ACIL Tasman

The annual growth rates associated with ACIL Tasman's projection of demand for petrol and diesel in Western Australia over the next twenty years are shown in Figure 64.

Figure 64 **Projected growth rate of demand for petrol and diesel in Western Australia, 2010 to 2030**



Data source: ACIL Tasman

Demand for diesel is projected to recover from the fall in demand due to the global financial crisis' impact on the Western Australian resources sector, with annual diesel demand growth then projected to decline from about 2 per cent in 2015 to about 1 per cent by 2030. Annual demand growth for petrol is projected to decline to just above zero per cent in 2030.

7.5.2 Adequacy to meet future demand

With two exceptions it is possible for petroleum imports to be increased at all ports. The exceptions are Port Hedland and Esperance where congestion is beginning to constrain supply into the market.

The BP Refinery at Kwinana is well placed to meet demand for petrol and diesel in the Perth area. There is also spare capacity in import facilities and terminals in the Fremantle/Perth area and any growth in demand could be met through imports through existing infrastructure for some time yet.

Plans are being considered to ease congestion at Port Hedland and Esperance and the Dampier Port Authority and Rio Tinto intend to construct new facilities as early as 2010.

Import infrastructure in Western Australia is therefore well placed to meet growth in demand in the future.

7.6 South Australia

7.6.1 Current throughput and projected future demand

The current annual throughput and ACIL Tasman's projection of future demand for petrol and diesel in South Australia are shown in Table 58.

Table 58 **Current and projected demand for petroleum products in South Australia**

Year	Petrol (ULP, PULP)	Diesel	Jet fuel	LPG
	ML/a	ML/a	ML/a	K Tonnes/a
2007-08	1,367	1,325	237	188
2014-15	1,349	1,438	282	222
2019-20	1,323	1,525	314	239
2024-25	1,297	1,607	350	252
2029-30	1,271	1,686	389	264

Note: Jet fuel projections have been calculated using Australia wide growth rates. LPG excludes petrochemical use

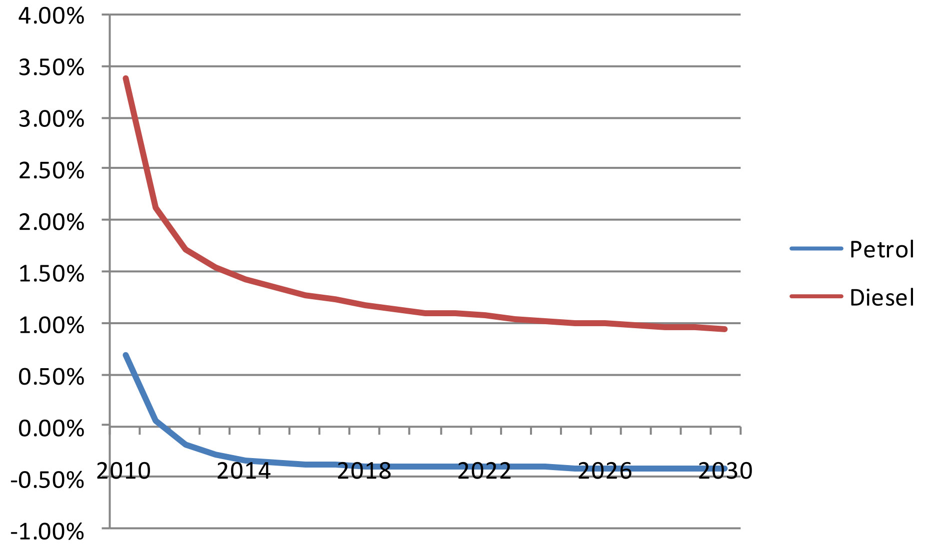
Data source: ACIL Tasman

Annual demand for petrol is projected to decline slightly to 1,270 ML in 2029-30, compared with the current annual throughput of 1,367 ML, a decrease of about 100 ML. Annual demand for diesel is projected to reach 1,690 ML in 2029-30, compared with 1,325 ML today, an increase of approximately 490 ML. Annual demand for jet fuel is estimated to be 365 ML in 2029-30 compared with 236 ML today.

South Australia currently exports LPG at Port Bonython. However, as production from the Cooper Basin declines imports may be required beyond 2018 (LPGA, 2008).

The annual growth rates associated with ACIL Tasman's projection of demand for petrol and diesel in South Australia over the next twenty years are shown in Figure 65. Annual growth in demand for diesel and petrol in the State is projected to decline to 1 per cent and -0.4 per cent respectively by 2030.

Figure 65 **Projected growth rates of demand for petrol and diesel in South Australia, 2010 to 2030**



Data source: ACIL Tasman

7.6.2 Adequacy to meet future demand

While there is some spare capacity at Port Lincoln, growth in demand for diesel in South Australia is likely to require some additional import capacity.

As can be seen in Figure 65, demand for diesel in South Australia is projected to increase only moderately to 2030, while demand for petrol is projected to decline slightly over time. Storage capacity and berth constraints in Adelaide are being addressed through installation of additional storage and upgrading terminal capacity.

While shipping frequency is an issue in Port Lincoln there is some spare capacity for further imports through the port (subject to product balance).

The development of new import capacity at Port Bonython proposed by Stuart Petroleum and the Scott Group of Companies would result in a substantial increase in capacity to import diesel into South Australia. Should this proposal proceed, an additional 80 ML of storage could be in place by 2011.

It also should be noted that the facilities and Port Stanvac may also be under consideration. The announcement by ExxonMobil in June 2009 that it intends to demolish the refinery would not necessarily preclude such consideration.

7.7 Tasmania

7.7.1 Current throughput and projected future demand

The current annual throughput and ACIL Tasman's projection of future demand for petrol and diesel in Tasmania are shown in Table 59. Annual demand for petrol is projected to increase very slightly to 470 ML in 2029-30, compared with the current annual throughput of 453 ML. Annual demand for diesel is projected to reach 460 ML in 2029-30, compared with 355 ML today, an increase of approximately 100 ML. Annual demand for jet fuel is estimated to be 55 ML in 2029-30 compared with 33 ML today.

Table 59 **Current and projected demand for petroleum products in Tasmania**

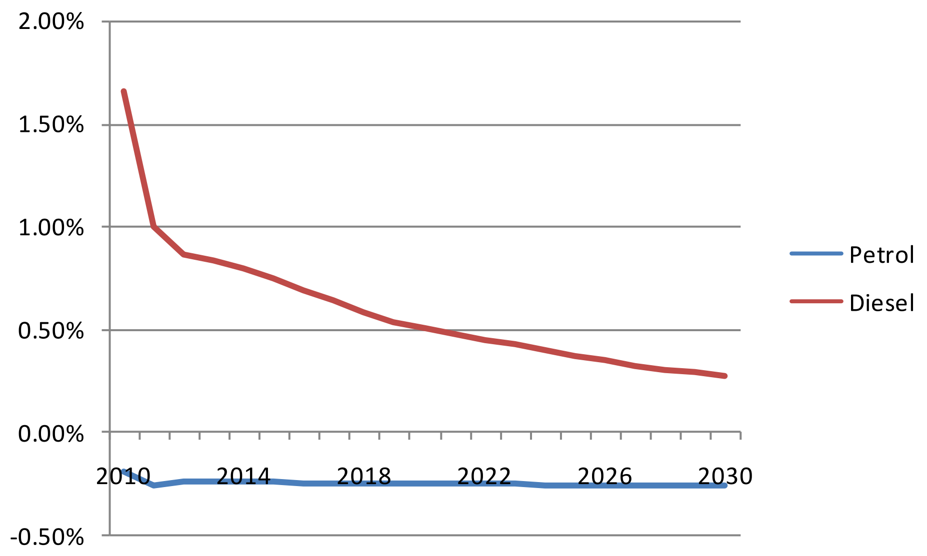
Year	Petrol (ULP, PULP)	Diesel	Jet fuel	LPG
	ML/a	ML/a	ML/a	K Tonnes/a
2007-08	453	355	33	33
2014-15	463	434	40	38
2019-20	457	447	44	40
2024-25	451	456	49	42
2029-30	446	463	55	44

Note: Jet fuel projections have been calculated using Australia wide growth rates. LPG excludes *petrochemical use*

Data source: ACIL Tasman

The annual growth rates associated with ACIL Tasman's projection of demand for petrol and diesel in Tasmania over the next twenty years are shown in Figure 66. After rebounding from the global financial crises in 2009 and 2010, annual growth in demand for diesel in the state is projected to decline to 0.6 per cent by 2030. Growth in demand for petrol is projected to remain negative to 2030.

Figure 66 **Projected growth rates of demand for petrol and diesel in Tasmania, 2010 to 2030**



Data source: ACIL Tasman

7.7.2 Adequacy to meet future demand

The projections for moderate growth in demand for petrol and diesel over the next two decades suggests that terminals and other import facilities in the state should not experience undue difficulties in meeting demand growth. Terminal capacity for importing LPG is also adequate to meet future demand.

There is spare capacity in Tasmania as discussed earlier in this report. It is likely that at current capacity levels, there will be no constraints on meeting Tasmanian demand in the future with existing capacity.

7.8 Northern Territory

7.8.1 Current throughput and projected future demand

The current annual throughput and ACIL Tasman's projection of future demand for petrol and diesel in the Northern Territory are shown in Table 60. Annual demand for petrol is projected to decline slightly to 120 ML in 2029-30, compared with the current annual throughput of 142 ML. Annual demand for diesel is projected to be approximately 520 ML in 2029-30, compared with 529 ML today. Annual demand for jet fuel is estimated to be 241 ML in 2029-1 compared with 198 ML in 2007-08.

LPG is currently imported into the Northern Territory by ship and by truck from Western Australia and South Australia. The Browse LNG project is expected to produce LPG from around 2014.

Table 60 **Current and projected demand for petroleum products in the Northern Territory**

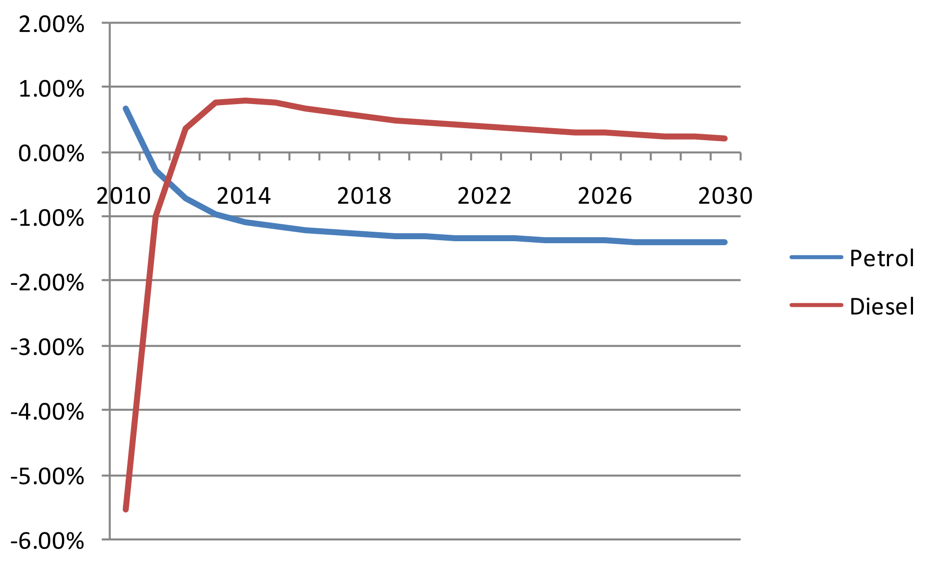
Year	Petrol (ULP, PULP)	Diesel	Jet fuel	LPG
	ML/a	ML/a	ML/a	K Tonnes/a
2007-08	142	529	198	11
2014-15	149	493	175	13
2019-20	140	507	195	14
2024-25	131	517	217	15
2029-30	122	524	241	15

Note: Jet fuel projections have been calculated using Australia wide growth rates. LPG excludes petrochemical use

Data source: ACIL Tasman

The annual growth rates associated with ACIL Tasman's projection of demand for petrol and diesel in the Northern Territory over the next twenty years are shown in Figure 67. After rebounding from the global financial crises in 2009 and 2010, annual growth in demand for diesel and petrol in the state are projected to decline to approximately 0.1 per cent and -1.5 per cent respectively by 2030.

Figure 67 **Projected growth rates of demand for petrol and diesel in the Northern Territory, 2010 to 2030**



Data source: ACIL Tasman

7.8.2 Adequacy to meet future demand

As demand for petrol and diesel is not expected to increase significantly in the Territory in the next two decades, barring a massive expansion in the resources sector that would greatly raise the demand for diesel, the Northern Territory should not experience difficulties in meeting future demand for petroleum products.

The LNG project in Darwin will produce LPG which will require additional storage for LPG. This will reduce the level of imports of LPG into the Northern Territory.

There is likely to be a need for small increases in capacity in Darwin. Vopak has indicated its intention for a modest increase in the capacity of its terminal at East Arm. The 2009 Federal Budget announced expenditure of $50 million on the expansion of the East Arm Wharf (Chief Minister, 2009).

Vopak has noted that the Darwin Port Bulk Liquids berth envelope is shared with other vessels such as cattle ships and off-shore supply vessels. It believes that dedicated space is critical to maintain an ongoing energy supply surety.

7.9 Consequences if a refinery closes

The above analysis assumes that the existing seven refineries in Australia continue to operate at their current level to 2030. This audit did not receive any advice to the contrary. However, there is a question as to how robust the above assessment is against the possibility of a refinery closure over this period.

At the time of writing, the Shell refinery at Clyde had been out of operation for around five months for maintenance. During this time product has been supplied via Gore Bay, bypassing the refinery process units. This has probably come at additional cost as the product supply chain has not been optimised for product-only supply. Nevertheless, this illustrates that it is possible for an operator to continue to supply the market should a refinery be shut down for an extended period.

All of Australia's existing refineries are located in the major metropolitan markets with access to deep water ports. Each refinery has the capacity to bypass refinery operations during periods of shut down using product storage associated with the refinery operations and at connected terminals.

It is therefore highly likely that, should a refinery close, its import and distribution facilities would be called upon to increase product imports to compensate for the loss of production. As discussed later in this report, there is an increased capacity on the part of Asian refineries to supply product to Australia to Australian fuel specifications.

ACIL Tasman therefore considers that the above assessment of adequacy is robust against a scenario where an existing refinery ceased its operations. In the event that this scenario occurred, there would be a need for investment in converting some of the refinery import facilities to product import facilities.

8 Competition and efficient investment

The terms of reference for this audit required commentary on current and potential barriers to competition and efficient investment with respect to Australia's petroleum import infrastructure.

8.1 Issues

In its report "Monitoring of the Australian petroleum industry released in December 2008, the ACCC raised the question as to whether the small presence of independents in the market meant that there was a weak threat of entry from independent importers (ACCC, 2008).

This audit has approached this question from the point of view of the operation of import terminals only. Retail arrangements and contracting arrangements downstream of the terminal gate are not part of the terms of reference for this report.

The factors that influence the level of competition between participants in the petroleum import market in relation to import terminals include:

- availability of imported petroleum products that meet the Australian fuel specification
- access to spare terminal capacity
- pricing policies for access to import terminals and facilities

These matters are discussed below.

8.2 Availability of imported petroleum products

Australian standards were progressively tightened between from 2002 to 2006. With Australian fuel standards out of alignment with specifications of products produced by overseas refineries for other markets, it became more difficult to access attractively priced Australian specification products. The choices open to independent Australian marketers were to:

- pay a premium to purchase products of higher quality than Australian specifications from independent refiners
- pay a premium for small batches of Australian specification products from independent refiners
- purchase Australian specification products from the major petroleum companies.

However, Australian specification diesel is now readily available from low cost Asian refineries. Recently, efficient Japanese and Korean refineries have begun offering attractively priced petrol product that meet Australian fuel specifications.

These developments appear to have been at least partly a result of rising standards of fuel produced by efficient Asian refineries. This would indicate further erosion of the product specifications barrier to competition and investment by existing companies and new entrants that are independent of the major oil companies.

Independent suppliers both currently in the market and potentially interested in the Australian market have indicated that this improved availability has made it possible for them to consider investment opportunities in Australia.

8.3 Access to terminal capacity

The audit found that, with the new investment that is committed, there will be spare capacity available in all jurisdictions except the Northern Territory. A significant proportion of this spare capacity is owned and operated by independent terminal operators in Queensland, New South Wales, Victoria, Western Australia and Tasmania. This conclusion does not apply to certain JUHI facilities at major airports.

Approximately half of the terminals currently operating in Australia host other parties. The refiner marketers indicated that their prime objective is to meet their own needs and those of their longer term hosted customers. ACIL Tasman was advised that the refiner marketers seek to maximise the utilisation of their facilities and will provide terminal services to third parties on a short or long term basis subject to spare capacity being available.

Some independent operators require term contracts for long term hosting arrangements. All parties require observance of relevant Australian fuel and safety standards.

Some exceptions to this policy may apply in relation to the operation of JUHI facilities at major airports. It is understood that some agreements require that users of JUHI facilities be part of the applicable joint venture agreement. Under such circumstances, fuel importers would have to be part of the joint venture agreement if they wished to source fuel from any party other than those involved in the JUHI joint venture. There are currently constraints on JUHI infrastructure in Sydney and Melbourne.

8.4 Pricing policies

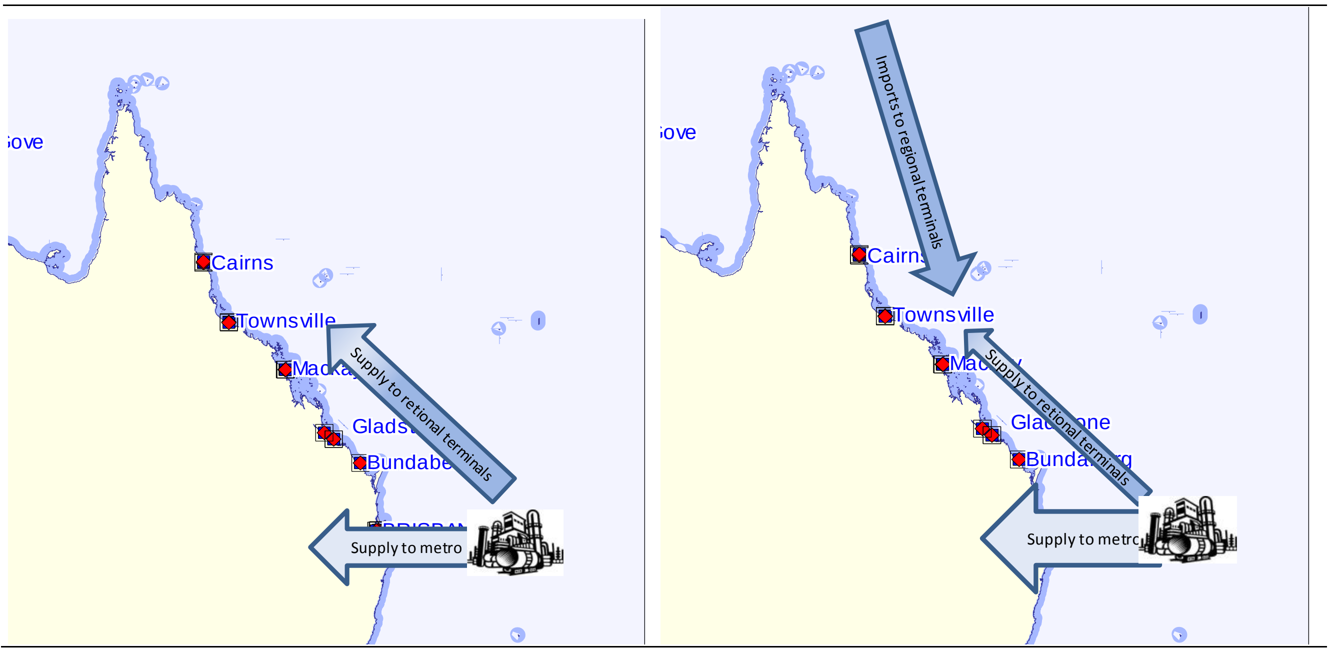
Pricing strategies for access to petroleum import facilities are also important when considering potential barriers to competition in petroleum import infrastructure. The economic structure of the fuel import supply chain is important to this consideration.

8.4.1 Economic structure of the fuel import supply chain

As explained earlier in this report, the throughput of an import supply chain is not a function of storage capacity alone. Throughput can be increased in a number of ways depending on the specific circumstances of each port.

For a refiner marketer with a refinery in a major metropolitan centre, growth in urban demand might be met by "contracting into the metropolitan centre" and reducing shipments to regional import terminals. The reduction in domestic shipments is replaced by imported supplies. This is illustrated in Figure 68.

Figure 68 **Adjusting supplies on a regional basis**



Note: an example of how refiner might meet growth in a major market by substituting imports for supply to regional terminals

Data source: Consultations

The commercial terms associated with fuel supplies also tend to favour contracts with existing refiner-marketers rather than with independent importers. Independent importers generally require commercial terms favouring earlier cash flow or term contracts to cover the risks associated with importing fuel and operating import terminals.

8.4.2 Cost structures in the supply chain

Terminal charges are based on supply chain costs that can include shipping and port charges, capital costs associated with storage and facilities, and terminal operating costs. Some of these costs, such as port charges and leasing fees, are outside the direct control of the terminal operator

The economics of petroleum import supply chains and the lumpiness of investment in new capacity mean that the short run marginal cost of servicing additional growth in the market is generally less than the long run marginal cost of adding additional capacity. Under such circumstances, existing suppliers can add small additions to supply at a lower additional cost than a new entrant.

An independent fuel supplier has three options to enter the petroleum product market:

- contract product from an existing refiner marketer.
- enter into a hosting arrangement with an existing terminal owner
  - under such an arrangement, an independent would need to source the imported product either from sellers offering product or by arranging the shipping and delivery of the fuel to the hosting terminal.
- either lease import capacity from another independent or invest in additional terminal capacity itself.

Under the first option, the independent would effectively pay a price based on the Terminal Gate Price. The final price and terms would depend on a range of factors, including volume discounts, credit risk, contract term and other contract specific factors. There is no standard contract for purchase ex-terminal and each is considered on a case-by-case basis. Responses to this audit and discussions with independents indicated that this was frequently the lowest cost option for an independent in the Australian market.

Under the second option, the independent would need to source product to be delivered to a hosting terminal, either from another seller, or by arranging the shipping and delivery to the hosting terminal. Approximately half of the terminals in Australia now host others. The audit responses indicated that hosting charges are negotiated on a case-by-case basis subject to contract requirements including volume, period of contract and credit risk and other matters.

For the third option there must be capacity available in an existing terminal or access to land for new terminal capacity. An intermediate step to acquiring land for new facilities is to recommission unused capacity. This is a less expensive option than a greenfields development and there is evidence that it is occurring in Australia.

Expanding capacity typically involves a two-year timeframe for planning and environmental approvals. This is discussed further in section 8.8.

Independent terminals also offer leasing arrangements. The audit responses indicated that leases generally require long term agreements with charges recovering capital and operating costs. In these commercial arrangements, terms may differ according to volume and contract period and other factors such as blending or other requirements.

8.4.3 Charging strategies

Terminal charging varies from location to location depending on the structure of the supply chain and terminal infrastructure. The audit responses indicated that all terminal operators allocate capital and operating costs to determine a transfer charge for use of a terminal. This charge may be applied as a single throughput charge per litre of product transferred, or it may be charged on the basis of a fixed component and a volumetric component.

The responses to audit questions by the refiner marketers indicated that a single throughput charge is the most common and this is applied to the distribution/retail arms of their operations as well as to hosted parties. Pricing also takes into account market factors such as contract length, volume purchased and the alternatives supply sources available. There are differences in pricing outcomes between the internal and external parties that reflect differences in contract risks such as credit and supply risk. ACIL Tasman was advised by the refiner marketers that the underlying pricing principles are the same for internal marketing arms and external hosted parties.

Some independent terminals include a fixed charge and a throughput charge. Such arrangements would result in higher per unit costs in circumstances where the customer is not able to maintain contract quantities. Such contracts can present financial disincentives to new entrants who may not be able to reach contract quantities in the early years. Many energy infrastructure charging structures include a fixed component to underwrite risks associated with capital investment that is recovered over a long term. This reflects sharing of the investment risk between the infrastructure investor and the customer, and is a characteristic of infrastructure pricing policies in other energy markets.

8.5 Conclusion on level of competition in the fuel import supply chain

ACIL Tasman advises on economics and policy and does not provide legal advice. The following conclusions should not be taken as legal advice.

The petroleum import supply chain is characterised by operators of different size and scope, and by varying commercial arrangements. There is evidence that these arrangements are evolving rapidly as independent operators enter the market in response to growing demand and as incumbents respond to market developments. It is also too early to judge how the current economic downturn will influence planned investment decisions.

On the basis of the responses to the audit, ACIL Tasman considers that, on the whole, the current operating environment and access arrangements for import terminals do not impose a material barrier or constraint to competition for importers of petroleum products. This conclusion is drawn on the basis of:

- availability of petroleum products from overseas refineries that meet Australian fuel specifications
- the existence of spare capacity that already either exists in most markets or will shortly be in place with committed investments[6]
- the availability of access to, or leasing of, import terminals (including those not owned by refiner marketers) on commercial terms
- terminal charging strategies are applied consistently to all terminal users.

There are likely to be exceptions that may apply from time to time where constraints or bottlenecks exist in maritime or terminal operations. ACIL Tasman did not examine specific port charges but notes that these are subject to State and Territory regulation or Ministerial approval. There may also be situations where commercial agreements for the operation of JUHI facilities at some airports require participation in the joint venture and therefore limit opportunities for hosting in the short term.

ACIL Tasman acknowledges that refiner marketers and possibly some larger independent wholesalers have short to medium term cost advantages in established supply chains because the short run marginal cost of increasing throughput in existing facilities is lower than the long run marginal cost of investing in new capacity.

This is the reason why some independents have found it economic to purchase from refiner marketers and major importers rather than to arrange and finance shipments of imported petroleum products (with associated commercial and credit risks).

ACIL Tasman's views on pricing policies relating to terminals are based on responses to the audit questionnaire and subsequent interviews. As noted previously, a detailed review of competition issues across the entire supply chain (extending beyond import infrastructure to the retail market, for instance) was beyond the scope of the audit, as was an examination of private contracts and port charges in specific markets. ACIL Tasman also notes that

[6] This conclusion is based on the assumption that spare capacity is not already subject to any pre-existing commitments or contractual rights which is likely to be the case for most of the independent terminal owners.

where concerns arise, fuel companies have the option of raising them with the ACCC or seeking their own private remedies in accordance with the *Trade Practices Act*.

8.6 Impact of demand

Most of the potential investors in new import infrastructure are focusing on the growing market for diesel. The expectation in the industry is that while the growth rate for diesel may decline by one or two per cent due to the global financial crisis, it is still likely to grow in the short term. There is also optimism that over the medium to longer term growth rates will recover. There are indications that Asian refiners are now keen to take advantage of their ability to meet any growth in Australian demand.

There is some anecdotal evidence that the effects of the downturn in the Japanese and other Asian markets would have increased Asian refineries' interest in penetrating the Australian market.

8.7 Import competition by State

8.7.1 New South Wales

The expansion of terminal capacity in New South Wales has created opportunities for petroleum product importers in New South Wales. Expansion of import capacity in Newcastle will reduce pipeline constraints in Sydney. The in-principle decision to proceed with a second bulk liquids berth in Sydney is also important for competition in the Sydney market.

The four refiner marketers have long had a major presence in the Sydney and Newcastle markets. As discussed previously in Section 4.2.2, there is an intricate network of pipelines interlinking the refineries and terminals owned and operated by these companies.

However, the market is not completely closed to independent importers. Two independent bulk logistics companies, Vopak and Terminals Pty Ltd, own and operate terminals at Botany Bay. While the storage capacity at the Terminals Pty Ltd facility is currently very small, the Vopak facility is large and expanding. Its current throughput is greater than most of the terminals owned and operated by the refiner-marketers in the Sydney Area, and its storage capacity (particularly for petrol) is larger than most of these other terminals.

Vopak has indicated that any refiner-marketer or independent importer of petroleum products will be able to access the new storage capacity arising from the expansion. It indicated that the focus will be on companies that are able to take-up medium-term contracts of three years or longer. All the additional tankage is being developed by Vopak on a speculative basis, with none committed or contracted so far. This presents an opportunity for potential importers into the Sydney market.

8.7.2 Victoria

Like Sydney, Melbourne is a well-established market for the refiner marketers. The terminals in Melbourne appear to be heavily utilised and do not have the capacity to host significant volumes.

However, the United terminal at Hastings on the Mornington Peninsula to the south-east of Melbourne offers an opportunity for potential independent importers to gain a foothold into the Melbourne market. United has around 20 per cent spare capacity and the potential to significantly increase its throughput capacity if market conditions justify further investment.

United has noted that underutilisation at its Crib Point Berth results in higher unit port charges than would otherwise apply. Port charges were raised by other terminal operators in other jurisdictions as a key competitive issue.

While storage capacity is available at Hastings, an equally important question facing a potential new importer of petroleum products is the demand for such products. In relatively stable and mature markets such as Melbourne an entrant may have to wrest market share from the existing players instead of tapping into a rapidly-expanding market. To defend their market shares, the refiners are likely to lower their prices in response to this competitive threat, which may be beneficial to consumers and other end-users of petroleum products.

8.7.3 Queensland

While import facilities in Queensland are constrained at the present time, new investment by both refiner marketers and independents is creating spare capacity for importers.

Brisbane

Neumann Petroleum’s plans to invest in new tankage at Eagle Farm terminal and a products pipeline between the terminal and the Pinkenba Grain Berth will increase capacity in Brisbane. This investment would allow Neumann Petroleum to import and store larger diesel cargos, and to import petrol, rather than relying solely on piped supplies from BP and Caltex. The move downstream to a deeper berth will also help to lower transport costs.

For the longer term, several local and overseas entities have expressed interest in investing in storage facilities in the Brisbane port area.

Regional port-specific issues

Barriers to entry in regional Queensland include regional market size, the economic advantage that the existing suppliers have in those markets, and the cost of establishing new facilities.

Until recently, strong growth in markets with a strong mining base had been eroding these barriers. This (and removal of the fuel standard barrier) is evidenced by a surge of interest from independent marketers in establishment of new facilities in Gladstone, Mackay and Townsville to target mining enterprises and other bulk diesel customers. Further evidence of this barrier erosion has been provided by Marstel's investment in Port Alma.

Marstel's entry to Port Alma and Bundaberg has been facilitated by being able to access and refurbish former Mobil terminals, rather than having to build new terminals. Caltex also has the opportunity to recommission the old Ampol terminal at a reasonable cost.

Access to the north and north-west Queensland and northern Bowen Basin markets would also be facilitated by the (possible) development of a deep water sheltered port facility at Abbot Point.

8.7.4 Western Australia

While Western Australian capacity for importing petroleum products is constrained in Port Hedland and possibly Esperance, overall there is spare capacity available in Western Australia.

The BP refinery at Kwinana imports the bulk of petroleum products into Western Australia via its own jetty and currently supplies all users in the Perth Metropolitan Area except for Verve Energy. There are pipelines from the manifold at Fremantle Port which connect to Coogee Chemicals, Gull, and the BP Refinery and then on to Shell, Caltex and BP's own facilities at North Fremantle and Kewdale.

However, there is some flexibility in the import and distribution network for petroleum products in the Perth metropolitan area. As discussed previously, Coogee Chemicals are expanding capacity and there is considerable spare capacity at the Gull Petroleum terminal.

There are a small number of independents operating successfully in Western Australia. At Kwinana, Verve Energy is supplied by the Port of Fremantle while Gull and Coogee Chemicals are currently supplied by BP. All own their terminals and their pipelines. At Wyndham, the Port of Wyndham owns its own pipeline and terminal and imports fuel off the open market from a refinery in Korea.

All ports except the Port of Bunbury are capable of importing petroleum products, and they operate fairly efficiently with few bottlenecks (save some congestion issues at Port Hedland and possibly Esperance, as well as draught concerns at Dampier and Broome due to the large tides in those areas).

There are no material barriers to competition from importers in Western Australia beyond the natural economics of infrastructure investments. Independents at Fremantle have the opportunity of importing through connections to the import berths. The port authorities have shown a willingness to facilitate investment in new import infrastructure should investors approach them.

8.7.5 South Australia

South Australia has the distinction of being a state where, currently, there are effectively no independent import facilities, with the exception of the Terminals Pty Ltd terminal at Port Adelaide. In Adelaide, BP and Caltex own and operate a terminal apiece while Mobil and Shell jointly own a terminal. At Port Lincoln, Caltex and Shell both own and operate import terminals.

As the demand for petrol has been declining in South Australia for various reasons (such as slow population growth in Adelaide), potential independent importers are unlikely to want to compete in this market.

While there are some constraints for importing petroleum products in Adelaide, there is some spare capacity in Port Lincoln. New investment in Adelaide will help alleviate bottle necks although berth constraints will continue. Potential new investment by Stuart Petroleum and the Scott Group of Companies at Port Bonython would create spare capacity in the system. With this terminal in place, there would be few barriers to competition for imports of petroleum products into South Australia.

8.7.6 Tasmania

The Tasmanian market for the importation of petroleum products is currently being serviced primarily by the refiner-marketers. BP owns and operates terminals in Hobart and Burnie. Caltex and Shell have back-to-back terminal agreements in Devonport (operated by Shell) and Hobart (operated by Caltex).

However, independent bulk logistics operator Marstel has established a terminal at Bell Bay with a storage capacity for petrol and diesel that is greater than the other terminals in Tasmania owned by the refiner-marketers. It is currently leasing tank space to independent importer and retailer, United Petroleum.

There is spare capacity for petroleum imports in Tasmania and opportunities for independents to enter the market. There are thus few material barriers to competition in the import of petroleum products into the State.

8.7.7 Northern Territory

There is little spare capacity for imports of petroleum products into Darwin. However, with an independent terminal owner, there are unlikely to be any obstacles to competition from importers of petroleum products in future.

In a small and relatively stagnant market, the problem of lumpy investment and the high capital costs of building new storage tanks means that it is difficult and unattractive for independent importers to enter the market.

In such a situation, the incumbent players in the market have a natural advantage in that they can meet moderate increases in demand by, say, adjusting their shipping schedule without having to undertake major investments in new tankage.

As noted previously, Vopak are planning a modest expansion for 2010. Independent operators face the same competitive environment for access to this additional capacity as the refiner marketers.

8.8 Planning and development processes

The audit indicated a mixed response to the impact of planning and development processes on new investment in petroleum import infrastructure. In all cases examined, it was found that port authorities were supportive of new investment. Some State governments also provide special process for significant projects. Independent terminal developers reported such support in New South Wales and South Australia.

However, some companies reported that legislation and planning approvals processes can cause delays in implementing investment plans to increase the capacity to import petroleum products.

Neumman Petroleum's problems in seeking pipeline approval to provide access to a deeper berth (which was noted previously) is one example. BP has also drawn ACIL Tasman's attention to planning delays with respect to the construction of a pipeline from their Carrington Terminal in Newcastle to Dyke 1 in Newcastle Port and in Port Hedland.

8.8.1 BP case studies

Newcastle

The BP expansion project at Newcastle terminal highlights some issues that can delay an infrastructure investment project and affect expansion in import capacity.

This project is in its final stages of construction with the new infrastructure expected to be commissioned around February 2009. The project objectives were:

- Construct tank ship discharge facilities at berth Dyke 1 at Newcastle Port Hunter to facilitate the discharge of ULP, PULP, Ultimate, and ADF. BP Ultimate premium petrol will be a new product to the terminal;
- Construct pipeline and wharf infrastructure to facilitate the transfer of petroleum products from Dyke 1 to the BP Newcastle Terminal;
- Construct/ re-commission tanks to capture shipping benefits and meet expected demand growth; and
- Provide environmentally compliant bunding, drainage and pollution control system to safely store and handle petroleum products within the scope of the project.

The following licences and approvals were required

- pipeline easements from Newcastle City Council, Australian Rail Track Corporation (ARTC), and Newcastle Ports Corporation (NPC).
- licence to operate pipeline under the Pipelines Act 1967
- statutory approvals for works and operations.

The company had to deal with four different parties in the course of seeking approval:

- NSW Maritime
- Newcastle Port Corporation
- Newcastle Council
- Australian Rail Track Corporation (ARTC).

The Environmental Assessment was lodged in May 2007 with the Development Application lodged in the third quarter of 2007. Development consent was expected to be in place by end of 2007. The pipeline easement was promptly approved, but the licence was not approved by the Minister for Energy until September 2008. It was necessary to order the piping prior to obtaining the licence to ensure timely delivery of the project. This left BP with potential exposure if the project was not able to proceed. Further delay occurred waiting for the Section 96 to be approved before BP were able to start construction.

During the lifetime of the project, there was a change of staff at Newcastle Ports Corporation who had new ideas about berth location. As such the project team were still reworking proposals with Port Corporation well outside the development stage of the project. There was also an issue around separation distances to the boundary of the site, which could be affected by construction plans at neighbouring sites. Assurance had to be obtained from the Council regarding potential development adjacent to the BP site.

The process of getting a project through the approval stages is complex and both resource- and time-intensive. Government and/or government instrumentalities can negatively impact on project timelines and ultimately project success.

Other approvals processes include occupancy certificates for both the berth and pipeline.

Port Hedland

Another example of a complex project is BP's Port Hedland expansion, which is in the early stages of execution where BP is seeking relevant project approvals. In order to be able to extend their facility it has been necessary to negotiate with both the Port and the neighbouring TCC Group to move the latter to a new site. The approvals which must be obtained in the next 12 months cover both the new TCC site and BP's own expansions. The list includes but is not limited to:

- Wedgefield (TCC's new land)
- Port Hedland Port Authority (PHPA) consent for TCC to use Greenfield land
- Council approvals
- Development Application (DA) for sand blasting shed
- Building Application (BA) for sand blasting shed
- DA for TCC offices
- BA for TCC offices
- Power Corporation approvals to provide services
- Water Corporation approvals to provide services
- P006 for BP project
- Contamination remediation
- Department of Environment & Conservation (DEC) & PHPA release from TCC obligations

- PHPA approval of BP infrastructure development including environmental management plan, traffic management plan
- Dangerous Goods licence approval
- Council approval not required but informed.

While most project developers must manage the development approval process, it would seem desirable that administration of the multiple approvals required might be made as efficient as possible. There is a case for governments to examine the approvals processes with a view to lowering the delay and cost in approval procedures.

8.9 Access to land

The audit also found a mixed response to questions related to access to land. Owners of some existing terminals reported access to additional land to expand storage facilities was a concern. Others did not see access to land as a major issue. Most port corporations indicated a willingness to make land available for future investment in bulk liquids facilities.

It is also important to take into account the regional nature of competition in some markets. Increasing import capacity in Newcastle for example can reduce demands in import infrastructure in Sydney by reducing the amount of product that must be shipped up the Sydney to Newcastle pipeline.

In most cases access to land was a factor for consideration for new investment, but not the main obstacle. There could be constraints in Sydney, Melbourne and Brisbane. However in many cases such constraints are not an insurmountable obstacle for new investment.

In addition, increasing import capacity at a regional port such as Port Alma might allow the Brisbane refineries to redirect their product normally shipped to coastal regions back into the Brisbane market.

The issue of access to land therefore needs to be considered in the context of the overall operation of the petroleum product supply network.

At this stage, ACIL Tasman does not see these issues as being obstacles that could not be addressed through negotiation and appropriate commercial arrangements.

9 Key findings

This audit has revealed the highly regional nature of the operation of petroleum import infrastructure. The conclusions on demand for new infrastructure investment, the nature of competition and investment requirements, and the level of interest from independents vary by region. With these qualifications in mind, the following key findings are drawn from ACIL Tasman's audit of existing infrastructure, projections of future demand and other analysis.

9.1 Adequacy to meet current and forecast demand

While there was some spare capacity in Victoria, South Australia, Western Australia and Tasmania as at December 2008, there was little spare capacity in the other States/Territories. However the audit found that current investment underway plus planned investments will change this situation over the next two years.

Expansion projects underway will increase storage capacity at terminals by 15 per cent in New South Wales, 10 per cent in Queensland, 14 per cent in Western Australia. With the completion of these committed investments there should be spare capacity in all jurisdictions except the Northern Territory.

Further expansions in New South Wales and South Australia are in the planning stages and port corporations in Queensland and Western Australia are actively examining the prospect for further expansions where demand growth is expected.

There may be a need for increased investment in crude oil storage in Victoria as domestic oil production declines and for LPG import facilities at some ports. However the audit did not reveal any major constraints beyond those already discussed.

9.2 Fuel standards

The increased availability of fuel from Asian refineries that meets Australia's fuel specifications, along with growth in some sectors of the fuel market, has increased the interest of independents in entering or expanding in the Australian petroleum market. There is strong evidence of this in Queensland in particular.

Different fuel standards in Western Australia have the potential to limit the relative availability of product from Asian refineries compared to the rest of

Australia. However there are also important environmental issues to be taken into account that are unique to Western Australia. The benefits and costs of maintaining different fuel standards in Western Australia might be reviewed to ensure a balanced approach to competition is maintained and Australia's energy security is not adversely affected.

9.3 Barriers to competition

The following conclusion does not constitute legal advice.

On the basis of responses to the audit, ACIL Tasman considers that, on the whole, the current operating environment and access arrangements for import terminals do not impose a material barrier or constraint to competition for importers of petroleum products. This conclusion was based on the availability of petroleum products from overseas refineries, the existence of spare capacity now or coming on stream in the near future, and the availability of access to terminals (including those not owned by refiner marketers) on commercial terms that are applied consistently to all terminal users.

There may be exceptions to this conclusion that emerge from time to time where bottlenecks apply or where specific circumstances such as JUHI arrangements limit access to parties that are not part of the JUHI agreement.

The current economic climate may affect some plans in the short term but in the longer term demand growth will provide further opportunities.

This situation should be assessed over the next three years as the economic downturn works its way through the fuel market and demand growth for petroleum fuels reverts to the longer term trend.

9.4 Petroleum statistics

Ongoing assessment of the adequacy of petroleum import infrastructure and of barriers to competition from petroleum importers will depend on complete import and storage capacity data. ACIL Tasman noted that the Australian Petroleum Statistics may not include import data from all independent fuel importers, as the provision of such data is not mandatory.

ACIL Tasman believes it is important that the Australian Petroleum Statistics encompass data on imports of petroleum products at import terminals, stocks of petroleum products at import terminals and the storage capacity at import terminals from *all* industry participants, and to ensure that data are provided by all independent terminal owners and importers, including the smaller ones.

9.5 Planning

The audit found examples where planning and development approvals processes were less than optimal. This was not a universal finding. There is some evidence in some cases that legislative and approval arrangements appear more complicated and time consuming than desirable in some jurisdictions.

ACIL Tasman considers that there is a case for Governments to review planning processes, legislation and any regulation of port land use or charging policies to ensure that decisions can be made in a timely manner and planning approval processes are as efficient as possible while meeting environmental requirements.

9.6 Recommendations

ACIL Tasman recommends that:

- The costs and benefits of retaining different fuel standards in Western Australia should be reviewed.
- Consideration be given to measures for ensuring that the publication of Australian Petroleum Statistics captures all petroleum product imports, relevant stock level indicators and storage capacity at all import facilities.
- The Commonwealth Government consult with State and Territory Governments with a view to ensuring that planning processes, legislation, and regulation of port land use support timely planning and development approvals for petroleum import terminals.

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A Terms of reference

A.1 OUTCOMES REQUIRED

a) The Department is seeking a comprehensive evaluation that examines current and forecast supply and demand for imported crude oil and petroleum products, and the capacity of Australia's existing import infrastructure (specifically major ports, refineries, terminals, loading and storage facilities and pipelines and other distribution infrastructure) to meet our expanding petroleum import requirements as well as identifying any barriers to competition or impediments to efficient investment. The Evaluation will address the following key issues:

(i) Location of existing major petroleum import infrastructure currently used (or that could be used) for imported crude oil and petroleum products;

(ii) Ownership and usage arrangements, including joint venture, sharing, hosting, leasing and other commercial arrangements;

(iii) Capacity and capacity utilisation of existing major petroleum import infrastructure currently used (or that could be used) for imported crude oil and petroleum products;

(iv) Cost and charging strategies related to usage;

(v) Planned capacity extensions or new infrastructure developments;

(vi) Current and forecast Australian demand and supply for imported crude oil and petroleum products covering the period to 2030;

(vii) The adequacy of major existing or planned infrastructure facilities to meet current and forecast supply and demand for imported crude oil and petroleum products to 2030;

(viii) Current and potential barriers to competition and efficient investment in respect of Australia's petroleum import infrastructure;

(ix) Strategies to address any issues identified in (viii); and

(x) Any other relevant factors.

The Evaluation is intended to be a clear and concise strategic examination of Australia's current and future import infrastructure and its ability to cope with projected demand for imported crude oil and petroleum products as well as identifying any barriers either to efficient investment or competition.

The findings of the Evaluation will be presented clearly and succinctly in Report form, with the addition of maps, graphs, spreadsheets, etc, as appropriate.

Any contract entered into as a result of this RFT will be based on the Draft Form of Contract. However, the Department may vary the terms and conditions.

Because of the commercial-in-confidence nature of much of the information to which the consultant/contractor may be exposed in conducting the Evaluation, those who are employed by the consultant/contractor to perform functions under Contract may be required to sign a Deed of Confidentiality.

A.2 DETAILED SCOPE

To achieve those outcomes, the comprehensive Evaluation will have regard to, but not necessarily be limited to considering the following issues:

Location, infrastructure and capacity

- Location and infrastructure of existing major port, terminal, storage and distribution facilities (including loading facilities and pipelines) currently used (or that could be used) for importing crude oil and petroleum products into Australia.
- Existing capacity, including volume, size, and other relevant information for the facilities identified in (i). This should include:
  - a breakdown by type of fuel
  - the capacity reserved for use by particular companies (by fuel type)
  - the capacity available, if any, for use by other parties (by fuel type)
  - for each facility, specify whether it is possible to switch fuel types
- Ability of the port and associated facilities to handle increased traffic flows in shipping lanes and at wharves
- Infrastructure bottlenecks (current or emerging)

Ownership and usage arrangements

- Details of current ownership arrangements
- Details of current usage arrangements, including by the owner, joint venture, sharing, hosting, leasing and other commercial arrangements
- Charging strategies for those commercial arrangements and how they have been derived.

- Any foreshadowed changes to these ownership and usage arrangements.

Capacity utilisation

- Outline the use (or intended use) of each facility identified in (i) for the financial years 2007-08 and 2008-09.
- Where more than one company uses a facility, outline the usage by company and describe the sharing arrangements between these companies,
- Is there any spare capacity that could be used by other parties? If so, how much? On what basis can other parties access any spare capacity?
- Identify all major facilities at which cargos of fuel have been (or could be) imported.
- Identify any impediments to increasing imports of fuel (e.g., capacity constraints at the facility, physical constraints such as channel depth).
  - Is it likely that these impediments will be addressed in the future?

Planned capacity extensions or developments

- Details of current and proposed capacity extensions or development of major port, terminal, refinery storage and distribution facilities.
- Details of current and potential capacity withdrawals and reasons.
- Assessment of the probability of the potential changes occurring.
- Details of any changes in the ownership and usage arrangements of these changes to existing facilities.
- Identify and barriers to capacity expansion.
- Where major project extensions or developments are identified, please provide:
  - Project specifics
  - Planning and project timelines
  - Estimated amount of investment (current and proposed).
- Assessment of the general prospects for investment and the impacts of ageing infrastructure.

Current and forecast Australian demand and supply

- Current and forecast demand and supply for imported crude oil and petroleum products to 2030.
- Individual product trends/forecasts to 2030 if available.

Adequacy of facilities to meet forecast current and forecast supply and demand

- Ability of current and future major port, terminal, refinery, storage and distribution infrastructure facilities to meet current and forecast supply and demand for crude oil and petroleum products to 2030

Current and potential barriers to competition and efficient investment

- Any current or potential barriers to competition and efficient investment, particularly for independent importers
- Local, State and Australian Government laws including planning and environmental approval processes, competition law, etc.
- Availability of and access to suitable land.

A.3 Other Relevant Factors

2.2 The Evaluation should involve the four Australian oil majors (BP, Caltex, Mobil and Shell), independent importers (such as Neumann Petroleum and United), the Australian Institute of Petroleum, the Independent Importers Association, the LPG Association, distributors and retailers in the petroleum industry, other independent petroleum companies, petroleum storage providers (such as Vopak, Marstel, Terminals West and Coogee Chemicals), LPG storage providers such as Elgas and Kleenheat, significant fuel users, jet fuel storage providers and distributors, and other relevant stakeholders, and Commonwealth stakeholders including – the Department of Resources, Energy and Tourism, the Australian Competition and Consumer Commission, the Department of the Treasury, Infrastructure Australia, and the Australian Bureau of Agricultural and Resource Economics.

A.4 RELEVANT BACKGROUND MATERIAL

3.1 The following reports should be taken into consideration in addressing this request:

- Reports of, submissions to, and transcripts of hearings of relevant Parliamentary Inquiries, etc.
- The 2007 ACCC report on *Petrol Prices and Australian Consumers* (including the report, submissions and transcripts of public hearings)
- The 2008 ACCC report, *Monitoring of the Australian Petroleum Industry: Report of the ACCC into the Prices, Costs and Profits of Unleaded Petrol in Australia*
- The Australian Government response to the ACCC report.
- International Energy Agency In-depth Report Australia 2007

- Australian Bureau of Agricultural and Resource Economics Forecasts

B Glossary of terms

Terminal	A loading facility where road tankers gain access to supplies of petroleum products for distribution to retailers and end users. Facilities at terminals usually include loading gantries, storage and pipeline connections to import facilities or refineries.
Buy sell arrangement	Bilateral arrangements between domestic refiners for the supply of petrol to a refiner in a non-home refinery state
Liquid Petroleum Gas	Propane and butane. Stored under pressure to maintain liquid state. Used in autogas, cooking and heating, fork lift trucks and petrochemicals
AIP	Australian Institute of Petroleum
ARTC	Australian Rail Track Corporation
BA	Building Approval
DWT	Dead weight tonne
DA	Development Approval
E10	Ethanol blend
JUHI	Joint User Hydrant Installation
LAT	Lowest Astronomical Tide
LPG	Liquid Petroleum Gas
ML	Megalitre
ML/a	Megalitre per annum
RTIO	Rio Tinto
SMP	Sydney Metropolitan Pipeline

C Organisations consulted

In the course of this project, ACIL Tasman undertook consultations with the following organisations:

- Australian Institute of Petroleum
- Australian Competition and Consumer Commission (ACCC)
- Department of the Treasury
- Australian Bureau of Agriculture and Resource Economics (ABARE)
- Department of Resources, Energy and Tourism
- Caltex
- ExxonMobil
- Shell
- BP
- Neumann Petroleum Limited
- Gull Petroleum Limited
- Vopak Terminals Australia Limited
- Marstel Terminals Limited
- Manildra Park
- Stuart Petroleum
- United Petroleum Limited
- Terminals Pty Ltd
- Terminals West Pty Ltd
- Sydney Ports Corporation
- Newcastle Ports Corporation
- Port Kembla Ports Corporation
- Brisbane Ports Corporation
- Port of Fremantle
- Port Hedland Port Corporation
- Wyndham Port Corporation
- Broome Port Corporation

D Petroleum import terminals

Table 61 **Fuel terminals in Australia not including LPG**

State	Port/ Centre	Facility	Owner	Characteristics
NSW	Sydney	Banksmeadow	Caltex	Spot hosting. Product supplied by ship and from Kurnell refinery.
	Sydney	Botany	Mobil	No current hosting
	Sydney	Silverwater	Caltex- Mobil Joint Venture	Product supplied from Banksmeadow and Clyde refinery
	Sydney	Botany	Vopak	Leasing arrangements. Product imports
	Sydney	Botany	Terminals Pty Ltd	Leasing arrangements. Product imports
	Sydney	Parramatta	Shell	Supplied by Clyde refinery and some product from Gore Bay berth
	Sydney	Sydney Airport JUHI	Joint venture operated by Shell	Supplied by Clyde and Kurnell refineries and imports
	Newcastle	Wickham	Caltex	Product supplied from Caltex Pipeline. Spot hosting
	Newcastle	Hamilton	Shell-Mobil Joint Venture	Product supplied from Caltex Pipeline
	Newcastle	Carrington	BP	Spot hosting. Product supplied from Caltex Pipeline and by ship
Victoria	Melbourne	Newport	Caltex	Supplied by pipeline from the Altona and Geelong refineries and from Holden dock.
	Melbourne	Newport	Shell	Supplied by the Geelong refinery. Also connected to the Altona refinery and to the pipeline network from Holden dock
	Melbourne	Yarraville	Mobil-BP Joint Venture	Supplied by Altona refinery and by pipeline connection to the Newport terminals and Holden dock
	Melbourne	Sommerton	Mobil-BP-Shell Joint Venture - connected to Melbourne Airport JUHI	Supplied by pipeline from Newport and Yarraville terminal. JUHI at Melbourne airport is supplied by pipeline from Sommerton and by truck from Newport and Yarraville terminals.
	Hastings	Crib Point	United Petroleum	Hosting possible. Receives product imports.
Queensland	Brisbane	Pinkenba	BP	Receives product from Bulwer Island refinery, can import product.
	Brisbane	Whinstanes	BP-Mobil Joint Venture	Supplied by pipeline from Lytton and Bulwer Island refineries. Can receive imported product.

State	Port/ Centre	Facility	Owner	Characteristics
	Brisbane	Lytton	Caltex	Supplied by Lytton refinery. Can receive imported product.
	Brisbane	Pinkenba	Shell	Supplied from Bulwer Island and Lytton refineries and by ship
	Brisbane	Eagle Farm	Neumann Petroleum	Supplied from Bulwer Island Refineries and by ship.
	Bundaberg	Wharf drive	Marstel	To be commissioned in 2009. Supplied by ship.
	Gladstone	Stockarck Street	Caltex Mobil Joint Venture	Hosting by negotiation. Supplied by ship.
	Gladstone	Barney Point	BP-Shell Joint Venture	Some commercial hosting.
	Port Alma	Port Alma Road	Marstel	To be commissioned in 2009. Supplied by ship.
	Mackay	Harbour Road	Caltex	Supplied by ship.
	Mackay	Heggle Street	BP	Hosting arrangements. Supplied by ship.
	Mackay		Shell	Hosting arrangments
	Townsville	Hubble Street	BP	Hosts Mobil. Supplied by ship.
	Townsville	South Townsville	Shell	Supplied by ship
	Cairns	Portsmith	BP	Hosts Mobil. Supplied by ship.
	Cairns	Portsmith	Caltex	Spot hosting. Supplied by ship.
	Cairns	Portsmith	Shell	Supplied by ship.
	Weipa	Weipa Port	Rio Tinto managed by BP	supplied by ship - mainly diesel.
	Cape Flattery	Ports Corporation of Queensland	Cape Flattery Silica Mines	Supplied by ship
	Torres Strait	Ports Corporation of Queensland		Supplied by barge
	Karumba	Ports Corporation of Queensland		Supplied by ship during wet season.
Western Australia	Perth	North Fremantle	BP	Hosting arrangements. Supplied from refinery
	Perth	North Fremantle	Shell-Caltex Joint Venture	Supplied by Kwinana Refinery
	Perth	Kewdale	BP	Hosts Caltex
	Perth	Kwinana	Gull Petroleum - operated by Terminals West	Supplied by Kwinana refinery. Could import through connection via connection to the Fremantle Port manifold.
	Perth	Kwinana	Coogee Chemicals	Imports on behalf of Mobil and Caltex.
	Albany	Albany port	Caltex	Supplied by ship. No hosting arrangements
	Broome	Broome port	BP	Some commercial hosting. Hosts Mobil. Supplied by ship.
	Dampier	Dampier port	Rio Tinto managed by BP	Hosts Shell, supplies Rio Tinto. Hosts Mobil. Supplied by ship.
	Cape Lambert	Cape Lambert port	Rio Tinto managed by BP	Supports hosting arrangements. Hosts Mobil. Supplied by ship.

State	Port/ Centre	Facility	Owner	Characteristics
	Esperance	Esperance port	BP	Supports hosting arrangements. Hosts Mobil. Supplied by ship.
	Esperance		Shell	Hosting arrangements. Supplied by ship.
	Geraldton	Geraldton port	Shell	Hosts Caltex. Hosts Mobil. Supplied by ship.
	Port Hedland	Port Hedland	BP	Supports hosting arrangements.
	Wyndham	Port of Wyndham	CGL Fuels	No hosting
South Australia	Adelaide	Birkenhead	Caltex	Supports hosting arrangements. Hosts Mobil. Supplied by ship.
	Adelaide	Birkenhead	Mobil-Shell Joint Venture	Some hosting. Supplied by ship.
	Adelaide	Largs North	BP	Supports hosting arrangements. Hosts Mobil. Supplied by ship.
	Adelaide	Port Adelaide	Terminals Pty Ltd	Leasing arrangements. Hosts Mobil. Supplied by ship.
	Port Lincoln	Port Lincoln	Caltex	Some spot hosting. Supplied by ship.
	Port Lincoln	Port Lincoln	Shell	Hosts Mobil. Supplied by ship.
Tasmania	Hobart	Hobart	BP	Hosts Mobil. Supplied by ship.
	Hobart	Hobart	Caltex	Hosts Shell and other spot hosting arrangements.
	Bell Bay	Bell Bay Berth	Marstel	Leases to United Petroleum
	Devonport	Devonport	Shell	Hosting arrangements. Supplied by ship.
	Burnie	Burnie Port	BP	Hosts Caltex and Mobil.
Northern Territory	Darwin	East Arm	Vopak	Leases to BP, Caltex, Mobil and Shell.
	Gove	Port	Rio Tinto	Supplies mine.
	Groote Eylandt	Port	GEMCO (BHP Billiton)	Supplies mine.
	McArthur River	Port	Xtrata	Supplies mine

Note: Does not include LPG storages and terminals. Some smaller terminals in New South Wales have not been included for confidentiality reasons.

Data source: ACIL Tasman Survey, *(ACCC, 2007)*.

E LPG Storages

Table 62 **LPG storages in Australia**

Port	Operator	Capacity	Use
Botany	Origin	4,710 tonnes	Propane and propylene
Botany	Elgas	65,000 tonnes	Importing and storing propane
Botany	Qenos	14,400 tonnes	Propane (petrochemicals)
Darwin	Kleenheat	1,000 tonnes	LPG imports
Brisbane	Origin Energy	1,700 tonnes	LPG imports
Brisbane	BP	2,100 tonnes	LPG storage
Cairns	Origin Energy	2,500 tonnes	LPG imports
Townsville	Origin Energy	1,200 tonnes	LPG imports
Port Bonython	Santos	70,000 tonnes	LPG exports
Devonport	Origin Energy	2,000 tonnes	LPG imports
Hobart	Origin Energy	1,800 tonnes	LPG imports
Dandenong	Elgas	2,000 tonnes	LPG distribution
Westernport	Esso/BHP	85,120 tonnes	LPG storage and export
Lang Lang (Victoria)	Origin Energy	2,125 tonnes	LPG storage and distribution
Otway	Woodside Petroleum	800 tonnes	LPG storage and export
Dampier (WA)	Woodside Petroleum	62,000 tonnes	LPG storage and export
Kwinana	Kleenheat	40,000 tonnes	LPG storage and export

Data source: ALPGA Supply and Demand Study 2008 *(ALPGA, 2008)* and ACIL Tasman survey

F Reference scenario assumptions

The Tasman Global reference scenario is a set of projections of key economic, energy and technology variables over the period to 2030. In the reference scenario, the pattern and rate of real economic growth is a function of assumptions on:

- Changes in population – particularly changes in the number of people of working age (15 years old and over).
- Changes in workforce participation rates – defined here as the average number of hours worked in the labour force by all people of working age. This measure encompasses changes in participation rates by age by gender, the unemployment rate and average hours worked.
- Growth in labour productivity – defined here as the average output per hour worked.

The projection of each of these elements is discussed in the following sections.

F.1 Population growth and labour supply

Population growth is an important determinant of economic growth through the supply of labour and the demand for final goods and services. Population growth for 86 international regions and the 8 States and Territories of Australia represented in the Tasman Global database is projected using ACIL Tasman's in-house demographic model. The demographic model projects how the population in each region grows and how age and gender composition changes over time and is an important tool for determining the changes in regional labour supply and total population over the projection period.

The demographic model was derived from the CHIMP (Fisher et al 2006) and GTEM (Pant 2007) demographic models with updated parameter specifications based on the latest data from the ILO, UN (2006), ABS (2008) as well as ACIL Tasman's own estimates. For each of the 94 regions, the model projects the changes in age-specific birth, mortality and net migration rates by gender for 101 age cohorts (0-99 and 100+). The demographic model also projects changes in participation rates by gender by age for each region, and, when combined with the age and gender composition of the population, endogenously projects the future supply of labour in each region. As per the CHIMP specification, changes in life expectancy are a function of income per capita as well as various assumptions regarding technical progress on lowering mortality rates (for example, through better medicines, education, governance etc). Participation rates are a function of life expectancy as well expected changes in higher education rates, fertility rates and changes in the work force as a share of the total population.

For this analysis, global population is projected to increase by 0.83 per cent a year, increasing the global population from around 6.7 billion in 2008 to 8.04 billion in 2030 (Table 1). Most of the growth occurs in the next decade, with the average annual growth projected to be 0.95 per cent a year to 2020, falling to 0.67 per cent a year between 2020 and 2030. The slowing rate of growth is due to continuing declines in fertility rates across developing countries coupled with aging population effects across many developed economies and China. For example, Japan's population is projected to begin declining in the 2009 calendar year while the population of the European Union over the period is projected to increase moderately before falling back to current levels around 2030.

Population growth for the 8 Australian States and Territories has been calibrated such that it matches the average of the latest Series A and Series B projections by the ABS (2008). Consequently, Australia's population grows by 1.6 per cent a year to 2020 to reach 25.7 million people. Population growth slows to 1.4 per cent a year between 2020 and 2030 to reach a total population of 29.5 million in 2030 (Table 1).

Table 63 **Projected population growth and 2030 totals, selected regions**

	Average annual growth 2008-20	Average annual growth 2020-30	Total 2030
	%	%	Million
NSW	1.15	1.07	8.89
VIC	1.43	1.28	7.12
QLD	2.27	1.91	6.76
SA	1.02	0.93	1.98
WA	2.18	1.85	3.35
TAS	0.87	0.73	0.59
NT	1.93	1.74	0.33
ACT	1.41	1.25	0.46
Australia	1.56	1.39	29.49
OECD	0.45	0.26	1,292.71
non-OECD	1.06	0.76	6,750.44
World	0.95	0.67	8,043.15

Notes: Total may not add due to rounding.
Data source: ACIL Tasman projections.

Labour supply is derived from the combination of the projected regional population by age by gender and the projected regional participation rates by age by gender. Over the projection period labour supply in most developed economies is projected to grow slower than total population as a result of ageing population effects. Some developing economies, notably China, are also projected to have slower growth in labour supply compared to total population. In aggregate, labour supply in OECD regions is projected to grow by 0.35 per cent a year to 2020 and by 0.03 per cent a year between 2020 and 2030, notably slower than total population growth. In contrast, average labour supply in non-OECD regions is projected to grow by 1.40 per cent a year to 2020 and by 0.91 per cent a year between 2020 and 2030, which is still faster than total population growth.

In Australia, average labour supply is projected to increase by 1.42 per cent a year to 2020 and by 1.08 per cent a year between 2020 and 2030 – which, again, is notably slower than the projected growth in total population.

F.2 Labour productivity

Labour productivity is a measure of the quantity of goods and services per unit of time worked. Labour productivity is highly variable on a year to year basis and is influenced by many developments in the economy, including changes in capital intensity and the composition of the work-force (Treasury 2007).

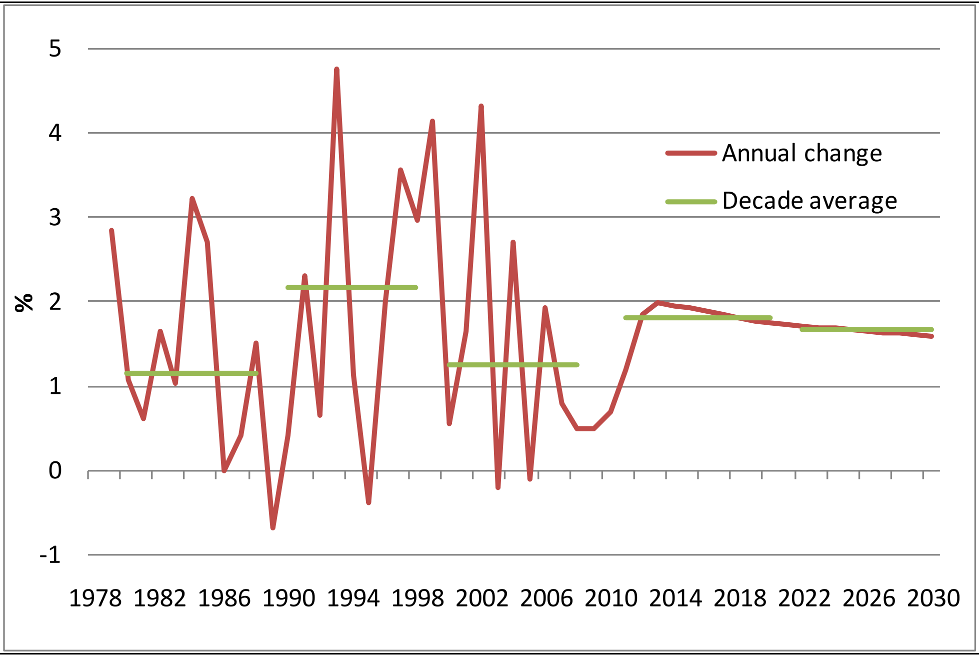
Over the past 30 years Australian labour productivity has averaged 1.75 per cent a year and 1.8 per cent over the past 40 years (Treasury 2007). Near term labour productivity is projected based on the near term projections of labour supply and real GDP. The average Australian labour productivity is subsequently assumed to gradually decline such that the average over the period 2011-2030 is 1.75 (see Figure 69).

Globally, labour productivity is projected to average 2.2 per cent a year between 2011 and 2030, with OECD economies averaging 1.81 per cent a year and non-OECD economies averaging 4.3 per cent a year.

F.3 Real economic output growth

In Tasman Global, reference case growth in economic growth (GDP and GSP) is based on a mixture of historical data, near-term projections and medium-long run projections. Australian historical GSP growth to 2008 is sourced from the ABS national accounts, while historical growth for all other regions is sourced from the IMF World Economic Outlook. Near term projections (to 2013) are primarily sourced from the IMF but are modified to incorporate projections from various State and National Government projections as well as ACIL Tasman's own assumptions. Projections for economic growth beyond 2013 are determined using ACIL Tasman's projections of labour supply and labour productivity.

Figure 69 **Australian labour productivity growth 1978-2030 (financial years)**



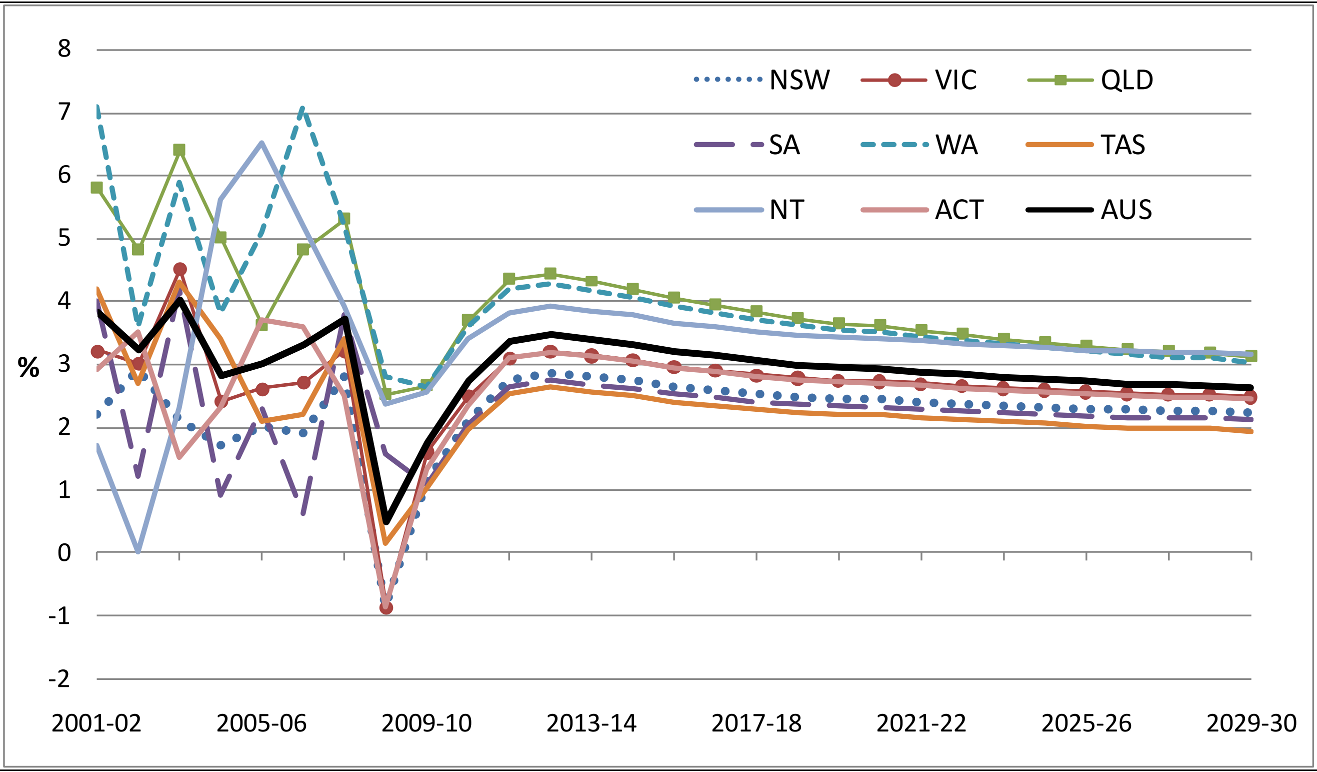
Note: 2000's decade average is the actual average labour productivity estimated by the ABS to June 2008.

Data source: ABS (2008), *Australian National Accounts*, Cat no. 5206; ACIL Tasman projections.

The impacts of the current financial crisis are expected to take a couple of years to move through the system, with the global economy returning to historical growth trends by 2012. Global real GDP (using market exchange rates) is projected to average 3.4 per cent a year between 2011 and 2020, easing to 2.9 per cent a year between 2020 and 2030. The average annual growth in real GDP for the OECD is projected to be 2.2 per cent a year between 2011 and 2020, easing to 1.76 per cent a year between 2020 and 2030 – with the easing largely driven by the easing in labour supply growth. Average annual growth in non-OECD real GDP is projected to remain strong over the projection period at 6.1 per cent a year between 2011 and 2020 and 4.9 per cent a year between 2020 and 2030.

Australia's real GDP growth is projected to average 3.15 per cent a year between 2011 and 2020, easing to an average of 2.75 per cent a year between 2020 and 2030. This is below historical growth of 3.3 per cent over the past 30 years due to the effects of population ageing reducing future growth in labour supply. Figure 2 shows Australia's year on year historical and projected real GDP growth together with state GSP growth.

Figure 70 **Australian total and State and Territory real economic output growth, 2001 to 2030**



Data source: ABS data (to June 2008) and ACIL Tasman projections

G Econometric estimation

G.1 Approach

The multivariate, time series structure of the data suggested a time-series econometric methodology for the estimation – vector auto regression and vector error correction. There are several reasons to stick to a simple ordinary least squares estimation for this demand function estimation. Firstly, the motivation for a time series analysis is mainly subject to unknown feedback effects from the dependent variables to the independent ones. This is hardly the case for the current exercise. It should not be expected that consumption of oil-derived product has an effect on the price, when the latter is mainly determined by international oil prices. Nor the consumption of an oil-derived product is to have an effect on state-aggregate income.

Reverse causality might be the case for the variable fuel efficiency used in the petrol and diesel estimation. The logic in this case would be that high prices of oil-derived products have negative impact in demand, not only for oil-derived products but for cars too. Then car manufacturers become motivated to produce more fuel efficient cars. This motivation has increased in the last few years by global warming awareness too. The sustainability for this reverse causality is weak for the current analysis on which only contemporaneous effects are considered and the lag structure of each oil-derived product accounts well for the time series properties of the data.

Fuel efficiency is considered a valuable variable in the current estimation, but further exploration of such a long term dynamic relationship is not considered necessary this study.

A final issue that can be considered in any econometric estimation is the possibility of omission of an important variable. This issue is known as omitted variable bias and is the source of incorrect econometric estimation and, therefore, an incorrect forecast. For the current estimation and forecast, an effort was made to maintain prices and income as the core variables that explain demand. It can always be argued the inclusion of other variables to avoid omitted variable bias; economic theory postulates the need of these two variables for the appropriate econometric specification.

The demand equation to be estimated for each oil-derived (i) product by state (j) is derived from a desired volume (D^*), of oil-derived product, prices (P) and income (Y).

$$D_{ij}^* = \alpha_1 P^{\alpha_2} Y_{ij}^{\alpha_3}$$

With an adjustment process that follows:

$$D_{ij} = \left(D^*_{T,ij}\right)^{\theta}\left(D_{T,ij}\right)^{1-\theta}$$

Solving for D^*_{ij} and taking logs, the following equation for an econometric estimation is obtained:

$$Ln\left(D_{T,i,j}\right) = \beta_0 + \beta_p Ln\left(P_{T,i}\right) + \beta_Y Ln\left(Y_{T,j}\right) + \epsilon_T$$

Besides income and prices, when necessary, fuel efficiency and price of a substitute was included for a good specification, details of the econometric results in appendix A.

The forecast presented here for oil-derived products, is based on the behavior of exogenous variables or the independent variables in the econometric estimation.

G.2 Coefficients

The results of the econometric exercise are shown in the following set of tables.

Table 64 **Petrol - Coefficients of econometric estimation**

VARIABLES	Australia	NSW	VIC	QLD	WA	SA	TAS	NT
Price Petrol (Real-NLog)	-0.0533	-0.122	-0.178	-0.114	-0.191	-0.103	-0.131	-0.341
	(0.0237)	(0.0349)	(0.0571)	(0.0606)	(0.0652)	(0.0625)	(0.0807)	(0.137)
Households Consump. Expenditure (NLog)	0.0734	0.158	0.188	0.457	0.248	0.0487	0.0295	0.119
	(0.0306)	(0.0497)	(0.0523)	(0.104)	(0.0697)	(0.0709)	(0.0927)	(0.0755)
L.petrol_ln	0.729	0.327	0.796	0.0458	0.406	0.434	0.0268	0.531
	(0.127)	(0.182)	(0.135)	(0.215)	(0.185)	(0.189)	(0.228)	(0.165)
Passenger vehicle efficiency (Milles/Gallon) (NLog)	0.0570	0.182	-0.357	0.231	-0.0828	-0.145	0.331	-0.0606
	(0.0756)	(0.107)	(0.122)	(0.164)	(0.149)	(0.134)	(0.168)	(0.257)
Constant	1.857	4.132	1.647	3.119	3.221	4.531	5.281	3.141
	(0.841)	(1.052)	(0.944)	(0.678)	(0.890)	(1.457)	(1.186)	(0.929)
Observations	33	23	23	23	23	23	23	23
R-squared	0.983	0.965	0.830	0.985	0.952	0.450	0.669	0.853

Data source: ACIL Tasman

Table 65 **Diesel - Coefficients of econometric estimation**

VARIABLES	Australia	NSW	VIC	QLD	WA	SA	TAS	NT
Price Diesel (Real-NLog)	0.00216	-0.0510	-0.0490	-0.136	-0.279	-0.0931	-0.25	-0.615
	(0.0557)	(0.0894)	(0.0797)	(0.0669)	(0.183)	(0.126)	(0.0862)	(0.290)
Final Demand (NLog)	0.319	0.761	0.518	0.57	0.417	0.345	0.384	0.681
	(0.0835)	(0.170)	(0.105)	(0.125)	(0.154)	(0.142)	(0.103)	(0.147)
L.diesel_ln	0.678	0.1	0.436	0.437	0.65	0.504	0.528	0.232
	(0.0857)	(0.220)	(0.124)	(0.129)	(0.134)	(0.167)	(0.116)	(0.188)
Trucks efficiency (Milles/Gallon) (NLog)	-0.00206	-0.336	0.00850	-0.151	-0.134	0.0546	0.523	-0.467
	(0.161)	(0.231)	(0.184)	(0.151)	(0.400)	(0.253)	(0.183)	(0.599)
Constant	-0.819	0.0887	-1.076	-0.525	0.0750	0.412	-1.014	3.175
	(0.399)	(0.589)	(0.445)	(0.348)	(0.918)	(0.612)	(0.426)	(1.423)
Observations	33	23	23	23	23	23	23	23
R-squared	0.992	0.961	0.982	0.995	0.956	0.930	0.964	0.824

Data source: ACIL Tasman

Table 66 **LPG - Coefficients of econometric estimation**

VARIABLES	Australia	NSW	VIC	QLD	WA	SA	TAS	NT
Price LPG (Real-NLog)	-0.137	0.358	-0.35	-0.955	0.366	0.0295	-0.191	0.240
	(0.189)	(0.386)	(0.275)	(0.305)	(0.245)	(0.442)	(0.336)	(0.626)
Households Consump. Expenditure (NLog)	0	-0.210	0	0	0.282	0	0	0.347
		(0.183)			(0.250)			(0.372)
L.lpg_ln	0.803	0.589	0.886	0.817	0.899	0.811	0.823	0.481
	(0.0443)	(0.129)	(0.0471)	(0.0665)	(0.0943)	(0.0629)	(0.0880)	(0.284)
Price Petrol (Real-NLog)	0.0615	-0.0831	-0.0207	0.823	-1.035	0.0660	-0.0781	0.0197
	(0.184)	(0.507)	(0.268)	(0.319)	(0.317)	(0.437)	(0.318)	(0.848)
Constant	2.194	3.399	3.058	3.408	0.178	0.671	2.197	-2.528
	(0.811)	(1.908)	(1.066)	(1.185)	(1.613)	(1.673)	(1.315)	(2.160)
Observations	23	23	23	23	23	23	23	23
R-squared	0.949	0.657	0.953	0.925	0.984	0.917	0.827	0.836

Data source: ACIL Tasman

Table 67 **LPG - Coefficients of econometric estimation**

VARIABLES	Australia
Price Jet Fuel (Real-NLog)	0.0118
	(0.0518)
L.jetfuel_ln	0.773
	(0.137)
Aircraft departures (NLog)	0.000593
	(0.132)
Available seats Km (000) (NLog)	0.151
	(0.117)
Households Consump. Expenditure (NLog)	
Constant	-0.755
	(1.068)
Observations	30
R-squared	0.978

Data source: ACIL Tasman