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Australia's Maritime Petroleum Supply Chain

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Executive Summary

The movement of petroleum (crude and products) within and between countries is a significant part of the market dynamic for the global delivery of petroleum. Within that, the seaborne movement of petroleum (crude and products) via petroleum tanker forms a large part of that dynamic. Seaborne movement is a prominent feature of the Australian market and it relies on a continuing supply of tankers to keep petroleum flowing in its supply chains to the market. Hence the maritime supply chain is a key sensitivity in the security of supply to the Australian market.

This report considers how the maritime supply chain operates for Australia. It provides a high level summary of all the components in the shipping task from point of loading to discharge (the maritime supply chain). It describes features of the petroleum market where that interacts with the shipping task. The report is intended to inform those interested in understanding the maritime supply chain influences on the security of petroleum supply to Australia.

The security findings include:

- Australia's supply routes are diverse and are likely to remain that way, even with refinery closures, as more product imports will come from locations other than Singapore.
- Due to the time it takes a ship to travel around Australia, import ships spend a considerable part of their voyage in Australia's EEZ. This results in a large number of tankers close to or within Australia's EEZ and territorial waters at any time.
- While Australia has a lot of import ports, they are typically quite isolated from each other and this makes it difficult to provide land transport back-up from other ports; using shipping to distribute product between ports is a major means of managing local disruption.
- The number of product tankers servicing Australia will increase, even with
    - tankers increasing in size; and
    - refineries converted to import terminals receiving larger tankers.
- The import tankers can provide flexibility to respond to domestic supply disruption.
- For the majority of Australia's petroleum imports (those controlled by the IOCs and possibly other non-IOC volume), the Australian company is likely to own the oil from when it loads (FOB, CFR or CIF purchase). Shipping may still be contracted by the companies' international trading arm or a third party but the cargo owner will hold a documented property interest in the cargo.

Two scenarios were developed to consider how the shipping market would respond in a supply chain disruption.

- In the case of domestic refinery disruption, it is likely to be timely product supply rather than ship availability that will impact the resupply options.
- While a scenario can be contemplated which redirects of cargoes committed to Australian supply chain, the practical, commercial, legal and reputational issues associated with such an act would present a significant challenge to a company taking action of that kind.

In reality it is difficult to envisage a scenario in which shipping is not available and historically we cannot point to an event which saw the collapse of the petroleum tanker market. Supply disruption affecting tankers is far more likely to arise as a result of other components in the supply chain (e.g. disruption to liquidity in the banking system, geopolitical events).

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Glossary

Aframax	Crude oil tanker category (80-120,000 DWT)
AMSA	Australian Maritime Safety Authority
BOL	Bill of Lading
COA	Contract of affreightment
CFR	Cost and Freight – Incoterm used when buyer pays for freight in the purchase price
CIF	Cost, Insurance and Freight - Incoterm used when buyer pays for freight and insurance in the purchase price
DES	Delivered ex ship – Incoterm used when buyer takes ownership on delivery paying a price reflecting delivered cost
DWT	Dead Weight Tonnage - standard measure of ships' carrying capacity based on total weight of water, stores, bunkers and cargo.
EEZ	Exclusive Economic Zone
FOB	Free on Board – Incoterm used when buyer takes ownership and responsibility for shipping on loading
FPSO	Floating Production, Storage and Offtake vessels
GFC	Global Financial Crisis
GT&Cs	General Terms and Conditions - part of petroleum sale and purchase contract
H&M	Hull & Machinery - refers to particular insurance covering physical hull and machinery on board
ILO	International Labour Organisation
IMO	International Maritime Organisation
Incoterms	Incoterms or international commercial terms are predefined terms published by the International Chamber of Commerce.
IOC	International Oil Company – used to refer to the large, global, publicly listed oil companies (includes BP, Chevron, ConocoPhillips, ENI, ExxonMobil, Shell, Total among others)
ISGOTT	The International Safety Guide for Oil Tankers and Terminals
ISM code	International Safety Management Code
ISPS code	The International Ship and Port Facility Security Code
LPG	Liquefied petroleum gas
LR	Long Range tanker – larger categories of product tankers (although sometimes also used to refer to crude – LR1 is similar to Aframax size, LR2 to Suezmax)
MARPOL	The International Convention for the Prevention of Pollution from Ships
MR	Medium Range tanker – most common tanker used for transporting petroleum products
OCIMF	Oil Companies International Marine Forum
Panamax	Crude oil tanker category of a size that can fit through the Panama Canal (50-80,000 DWT)

P&I	Professional & Indemnity club – the means by which ship owners get pollution insurance
SAFE -T	Shell proprietary tanker vetting system
SIRE	OCIMF tanker vetting database
SOLAS	Safety of Life at Sea – an IMO convention
STCW convention	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers – an IMO convention
Suezmax	Crude oil tanker of a size that can fit through the Suez Canal (120-200,000 DWT)

1.0 Introduction

This report examines the maritime supply chain and key role it plays in Australia's petroleum supply chain. Where relevant it covers the related elements of the supply chain although these are more comprehensively covered in the Australia Competition & Consumer Commission (ACCC) reports on the petroleum industry[1] and the Department of Resources, Energy and Tourism (DRET) report on import infrastructure[2].

The maritime supply chain covers:

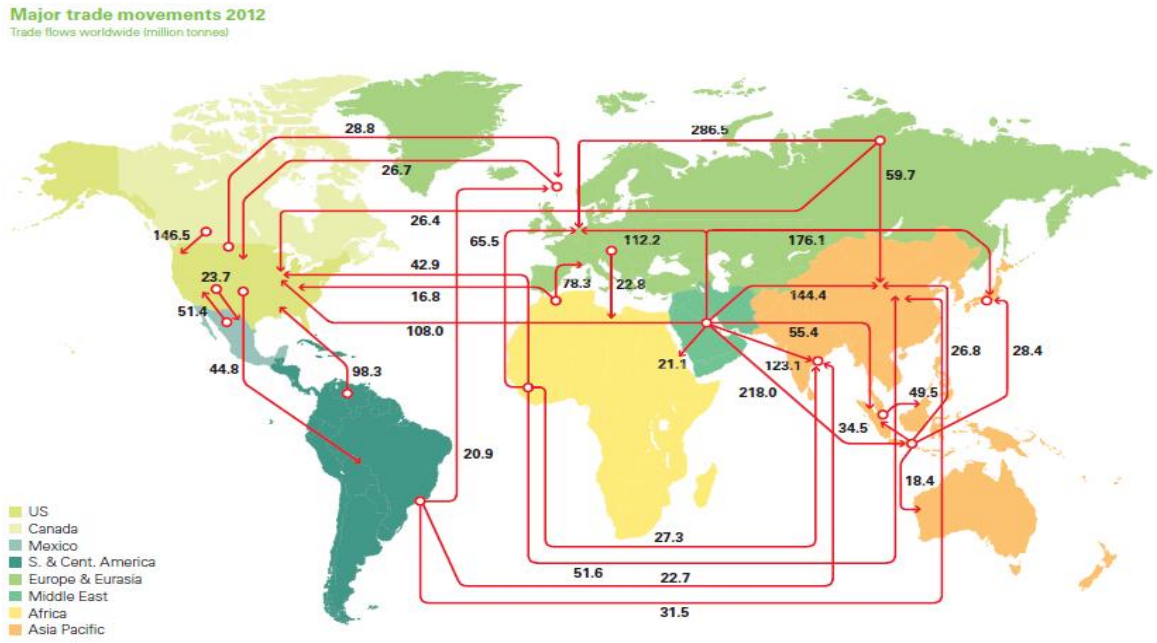
- Loading ports;
- Shipping routes;
- Ships used and the market they operate in;
- Cargo ownership and insurance;
- Australian ports and discharge; and
- Australian coastal operations.

2.0 The petroleum shipping market

2.1 The international market

Trade movements of petroleum (crude and products) within and between countries are a significant part of the market dynamic for delivering petroleum to markets (Figure 1).

Figure 1: Major Oil Trade Movements



Source: BP Statistical Review of World Energy

[1] http://transition.accc.gov.au/content/index.phtml/itemId/1092497

[2] http://www.ret.gov.au/energy/energy_security/fuels/conventional/petrol-refining/import/Pages/review.aspx

Within that global seaborne trade is a dominant part. Drewry Shipping Consultants Limited (Drewry)[3] estimates that global seaborne trade of petroleum and petroleum products is currently around 3 billion tonnes per annum (split approximately two thirds crude/one third product) and will increase by nearly 20% over the next 5 years. 3 billion tonnes represents around 65% of current global market demand for petroleum.

Table 1: Seaborne Trade in Petroleum

	Seaborne trade – million tonnes			Tonne miles – Billion			Average haul length – nautical miles		
	Crude	Products	Total	Crude	Products	Total	Crude	Products	Total
2009	2,025	834	2,859	8,512	2,339	10,851	4,203	2,805	3,796
2010	2,066	883	2,949	8,908	2,453	11,361	4,312	2,778	3,853
2011	2,075	900	2,975	9,320	2,494	11,814	4,491	2,760	3,971
2012	2,095	910	3,005	9,407	2,521	11,927	4,490	2,770	3,969
2013	2,115	920	3,035	9,560	2,576	12,136	4,520	2,800	3,999
2014	2,190	947	3,137	10,052	2,689	12,742	4,590	2,840	4,062
2015	2,274	980	3,254	10,597	2,822	13,419	4,660	2,880	4,124
2016	2,365	1,015	3,380	11,163	2,959	14,122	4,720	2,915	4,178
2017	2,445	1,040	3,485	11,650	3,063	14,713	4,765	2,945	4,222
2018	2,520	1,065	3,585	12,116	3,168	15,284	4,808	2,975	4,263

Source: Drewry Maritime Research

Seaborne trade will grow as global oil demand grows but the rate of growth will be influenced by factors such as:

- changes in the geography of oil demand - the shift in demand growth from North America/Europe to Asia Pacific, where refining capacity addition is occurring, will increase average haul length (a 26% increase in tonne miles); and
- changes in the profile of capacity - tanker classifications being built to a bigger size (e.g. MR vessels being increased to up to 55,000 DWT).

The supply demand balance for tankers will vary with the rate at which:

- capacity is added;
- older tankers are scrapped; and
- oil demand growth translates to higher shipping demand.

[3] Drewry Shipping Consultants is a specialist research and advisory organisation for the maritime sector.

3.0 Petroleum Tankers

3.1 Classification

Petroleum tankers are classified by the type of cargo they carry and their size. Classification societies are licenced by 'Flag States' (the state in which a ship's certificate is issued) to survey and classify ships. These societies develop their own standards and verify compliance with international and/or statutory regulations on behalf of Flag States. In Australia, AMSA has an agreement with a number of Classification Societies to undertake survey and certification arrangements for Australian ships. These include Lloyd's Register, American Bureau of Shipping and Nippon Kaiji Kyokai. The industry classifies tankers into a number of capacity categories as measured by the weight of cargo carried (referred to as dead weight tonnes (DWT))[4]. Some classifications refer to the historical or design reason for the name (e.g. Panamax vessels designed for Panama Canal transit). Some go by other names (Medium Range referred to by some as Handytankers). Each classification society has slightly different standards and the size range for each vessel type can vary.

Table 2: Tanker Classification

Crude Oil carriers		Typical DWT	Typical Length	Typical Beam	Typical Draft
	Panamax[5]	50,000 – 80,000	228m	32.2m	12m
	Aframax	80,000 – 120,000	244m	34m	20m
	Suezmax	120,000 – 200,000	274m	45m	23m
	Very Large Crude Carrier (VLCC)[6]	200,000+	333m	55m	28m
Product tankers[7]					
	Medium Range (MR)	25,000-55,000	179m	29m	11m
	Large/Long Range One (LR1)	55,000 – 80,000	226m	32m	13m
	Large/Long Range Two (LR2)	80,000 - 100,000	241m	40m	14m

Source: Clarksons, Danish Ship Finance[8]

[4] Dead weight tonnes – standard measure of ships' carry capacity based on total weight of water, stores, bunkers and cargo.

[5] The classifications applied to tankers can be confusing, for example Panamax can be used to transport crude or product.

[6] A category of Ultra Large Crude Carrier exists (ULCC), which can load around 320,000 tonnes but these vessels are relatively few

[7] Medium Range, LR1 and LR2 are referred to for use in the carriage of petroleum products. Over time the size of clean product capacity has increased resulting in adjustments to classifications (previously MR maximum DWT was 45,000).

The classifications in Table 2 form the basis of benchmarks for trading and price discovery in shipping markets.

3.2 How Tankers Are Used

It is important to understand how shipping is used and its limitations. For example crude oil tankers generally do not carry petroleum products. However a product tanker is capable of transporting crude oil. A crude oil tanker cannot transport refined products, as these products require coated tanks – a feature which a crude oil tanker does not provide. Likewise specialty chemical tankers (and LPG tankers) can carry petroleum products but not the other way round as chemicals may require specially designed tank coatings or stainless steel tanks.

3.2.1 Clean and Dirty

For petroleum products, shipping is delineated into Clean Petroleum Products (CPP - generally petrol, jet and diesel) and Dirty Petroleum Products (DPP - generally fuel oil and crude). Owners sometimes switch between clean and dirty operation when earnings potential supports this but will not do so on a cargo by cargo basis as charterers will be reluctant to accept the higher risk of CPP contamination. Charterers will look to see a history of CCP carriage before chartering such a vessel. Hence whether the vessel available for charter can be used will be influenced by the trade it is engaged in.

3.2.2 Dead freight

A charterer may choose to use a vessel larger than the capacity needed. At times port constraints (e.g. draft) may limit the carrying capacity but it may still be the economically or operationally feasible to do. Where the charterer has two refineries it may split the cargo to overcome the operational constraint. Hence larger-than-necessary vessels may be used in certain circumstances. If a ship is not used to capacity the unused capacity is called dead freight.

3.2.3 Coastal shipping

The oil industry also uses tanker capacity to operate within a defined sphere of their refining and wholesale marketing operations. This capacity is referred to as coastal shipping and can vary in size between small vessels (2- 5,000 DWT) up to MR sized vessels (typical of coastal shipping operated by the refiner/wholesalers on the Australian coast - see 8.4 Table 13). Coastal shipping will tend to have a higher level of complexity than equivalent sized vessels operating in international trade because of the need to handle a greater number of grades[9] (including dirty) and minimise the risk of contamination (more dedicated piping and pumping systems/valve segregation). Hence vessels of this nature can command a premium to the general tanker capacity.

[8] Clarksons is a global ship broker; Danish Ship Finance is a ship financing organisation.

[9] A typical import vessel could carry between 2-4 grades; a coastal could carry 6 or more.

4.0 Features of the maritime supply chain

4.1 The Participants

Table 3: Participants involved in the maritime supply chain

Participant	Definition
Ship owner	Person or entity owning the ship. Ship owners can be a range of public and private companies, national and international oil companies, petroleum trading companies and companies engaged in wider shipping markets. Ownership structures can be relatively complex as a function of financing arrangements to minimise cost (may involve high levels of debt gearing). Oil companies vary in their approach to ownership: some prefer ownership, others preferring to contract vessels from owners under long term chartering arrangements.
Ship flag state	Country under whose laws a ship is registered. The country has the ability to enforce regulations on a ship owner, including the international conventions governing standards under the auspices of the International Maritime Organisation (IMO).
Ship class	The requirement that a ship continues to comply with the technical standards of construction and operation, as assessed from time to time by classifications societies (Lloyds, DNV etc.). For maintaining class, vessels will be required to undertake regular dry docking (unavailable for carriage).
Ship manager	Companies operating ships on behalf of the owner, providing the crew and managing maintenance and operating requirements to keep the ship in class.
Ship charterer	A company who charters the ship to perform one (or multiple) voyages. The charterer is often (but not always) the cargo owner.
Cargo owner	The company that owns the cargo on the ship.
Ship brokers	Companies matching vessel availabilities against cargo requirements for a fee - broking is a competitive market.
Loading terminal/ port authority	Loading port authority and/or loading terminal (can be the same entity or different) - will undertake a vetting process to confirm the ship as acceptable for its facilities and operate the services to safely berth the ship (navigation/pilots/tugs).
Receiving terminal/ port authority	Receiving port authority and/or receiving terminal (can be the same entity or different) - will undertake a vetting process to confirm the ship as acceptable for its facilities and operate the services to safely berth the ship (navigation/pilots/tugs).
Tanker Vetting Agencies	Oil industry practice for approving of vessels nominated to load or discharge at a loading or discharging facility. Covers both technical suitability and safety and pollution prevention assessment. Supported by databases (OCIMF SIRE database, Shell SAFE-T, Rightship) which are updated as inspections occur or oil industry determines acceptability or otherwise.
Port State	Status under various international conventions requiring a country to undertake inspections of ships visiting its shores. Australia is a member of the Asia/Pacific Region Port State Control Group, which applies a consistent set of inspection criteria throughout the region.

4.2 Relationship between petroleum contracting and shipping contracting

It is important to recognise the distinction between a contract for purchase of a cargo of petroleum and the contract with a shipping provider to transport the cargo. In some cases the owner of the oil may be the same as the charterer but that is not always the case.

The oil industry has developed standardised contracts for the sale and purchase of petroleum. Contracts will reflect the particular terms of a purchase (quantity, timing, price etc.) and also the General Terms and Conditions (GT&Cs) reflecting the contracting basis and the standard conditions applying. The International Oil Companies (IOCs) all have their own GT&Cs; which GT&Cs get used will depend on the commercial balance of the parties to the transaction. In some cases transactions will be based on Incoterms[10], but the tendency is for market participants to prefer their own GT&Cs. Table 4 indicates the typical contracting arrangements for petroleum and how these interact with the arrangements for freighting the cargo.

Table 4: Petroleum Contracting

Oil Contract	Nature of Contract	Relationship to Shipping
Free on Board (FOB)	■ Buyer purchases cargo for lifting from the load port within prescribed date range. ■ Title and risk of loss passes to the Buyer at the load port.	■ Buyer responsible for organising shipping. ■ Will enter into a contract (a charter party) with a ship owner to transport the oil.
Cost and Freight (CFR)	■ Seller delivers the cargo on board the vessel to Buyer within a prescribed timeframe. ■ Risk of loss passes when cargo loaded to vessel. ■ Buyer is responsible for cargo insurance. ■ Title may pass before the oil is delivered to the Buyer (at the load port).	■ Seller responsible for organising the shipping. ■ Seller pays the freight necessary to bring the goods to the discharge port.
Cost, Insurance and Freight (CIF)	■ Same as CFR but Seller insures cargo for Buyer and includes in price.	■ Seller responsible for organising the shipping. ■ Seller pays the freight necessary to bring the goods to the discharge port.
Delivered ex ship (DES)	■ Buyer purchases cargo from the Seller at the Buyer's receiving terminal. ■ Title and risk (including losses) pass on receipt by the Buyer.	■ Seller responsible for contracting the shipping. ■ Seller pays all costs and recovers in sales price.

[10] Incoterms or international commercial terms are predefined terms published by the International Chamber of Commerce.

4.3 Ship contracting

The nature of a company's purchase or supply chain will influence the type of ship contracting. Petroleum may be purchased on a spot (e.g. one cargo of 600,000 barrels) or term basis (e.g. 20,000 barrels/day to be lifted when a shipping parcel has accrued every 30 days). The Buyer may also require shipping capacity to deliver product from its refining location to where it markets in other seaboard locations.

The Buyer will use different ship contracting structures depending on the nature of the task and the risks it has to manage in the particular supply chain. Table 5 illustrates the different ship contracting arrangements (or charter parties) and where these are likely to be used.

Table 5: Ship Contracting

Shipping Contract	Nature of Contract	Where likely to be used
Voyage Charter	■ Company contracts with ship owner to undertake voyage from load port to discharge port. ■ Specific cargo terms including voyage charter party. ■ Cost determined on lumpsum or benchmark basis (see discussion on Worldscale) - includes all ship costs including port costs (both ends). ■ Owner responsible for providing vessel and operation.	■ Spot or term purchase of petroleum or petroleum products. ■ Generally used when sourcing crude and products from supplying locations where good vessel liquidity available for ongoing requirements.
Contract of affreight-ment (COA)	■ Company contracts with ship owner to undertake series of voyages from the load port to the discharge port. ■ Ship owner provides suitable vessel on required timing for each voyager with agreed notice. ■ Specific cargo terms including voyage charter party. ■ Cost determined on lump sum (per voyage) or benchmark basis (see discussion on Worldscale in 6.1) - includes all ship costs including port costs both ends. ■ Owner responsible for vessel operation.	■ Term purchase of petroleum of petroleum or petroleum products. ■ Reduced or poor vessel liquidity for ongoing cargo requirements.
Time Charter	■ Company contracts with ship owner to provide specific vessel for specified period. ■ Company directs where the vessel is to go. ■ Company pays time charter fee ($ 000s per day) covering cost of vessel and crew.	■ Limited or no liquidity of vessels required to perform task. ■ Company has specific operational needs requiring it to control deployment. ■ Common in coastal operation where domestic refining used to supply seaboard markets.

	■ Company responsible for ship fuel and port costs. ■ Owner responsible for vessel operation, insurances and certification.	
Demise or bareboat charter	■ Ship owner provides specific vessel for (typically) long period. ■ Company acquires full control but is responsible for all costs, operation (including surveys for maintenance of class) and insurances. ■ Company responsible for crewing.	■ Limited or no liquidity of vessels required to perform task. ■ Company has specific operational needs requiring it to control deployment. ■ Common in coastal operation where domestic refining used to supply seaboard markets.

4.4 Documentation

4.4.1 Charter Party

At the heart of the agreement between the ship owner and charterer is the charter party. A charter party stipulates all aspects and terms and conditions for the voyage (or provision of the vessel in the case of a time charter) including:

- Vessel details (including certificates, P&I cover);
- Voyage particulars including route (as determined by loading and discharge ports), any particular voyage limitations[11] , speed, fuel consumption etc;
- Relationship with Bill of Lading; and
- General terms and conditions including where the voyage is subject to War Risk.

Standard contracting templates are available (e.g. Shellvoy6). A number of examples are available from this link.

http://www.seagullcorp.com.vn/index.php/en/support/cat_view/8-charter-pattern.html

4.4.2 Bill of lading

The Bill of Lading is also an inherent part of the freight contracting arrangement. A bill of lading is an acknowledgement by the ship owner that the goods have been received on board in accordance with the loading instructions (quantity, performance of loading port) for conveyance to the named place of delivery (the consignee, who is normally identified). It is also evidence of title to the cargo and governs aspects of the legal transfer of the cargo to another party (to the consignee at the receiving port) or to another party where the cargo has been sold to that party.

[11] Part III of Shellvoy stipulates certain routes to be followed e.g. when the vessel is in the region of Great Barrier Reef or transiting Torres Strait.

5.0 Regulatory framework for tankers

5.1 General

Tanker operation for meeting petroleum demand in Australia is subject to both the regulatory framework operating in Australia (which also includes Customs, border protection and biosecurity requirements - see section 8.9) and the framework set by operation of international conventions to which Australia is a party as a member of the International Maritime Organisation (IMO).

The domestic framework determines the conditions under which ships can be registered for operation as Australian flagged ships and implements the various environmental and safety requirements set internally and/or by being party to various international conventions. The Ship Registration Act 1981 provides for the registration of ships and the conditions under which Australian ships can fly the Australian National Flag or the Australian Red Ensign in accordance with Australia's obligations under the United Nations Convention on the Law of the Sea 1982, to which Australia is a party. The Act is administered by the Australia Maritime Safety Authority (AMSA). Currently none of the tankers servicing petroleum demand in Australia are Australian flagged (including the tankers used by the refiner/wholesalers in coastal trade).

The IMO has been responsible for the development of international standards and conventions covering construction standards, ship survey and safety, crewing, seafarers' qualifications and welfare, workplace health and safety, carriage and handling of cargoes, passengers and marine pollution prevention. In Australia, AMSA is generally responsible for meeting the requirements of various international maritime conventions.

Port States are required to conduct inspections of foreign ships visiting their shores (Australia performs this function as a member of the Asia/Pacific Region Port State Control Group). These inspections are intended to make sure that the ship, its equipment, and the safety and health of those on board, meet international safety and environmental protection standards. Over the years however there has been recognition that these inspections are not sufficient to form a comprehensive assessment of a ship, particularly where it is new to the country.

The oil industry has developed its own policy frameworks for standards to be applied to tanker operation, including placing age restrictions on acceptability, standards for operation including the interface with ports and storage terminals and inspection and vetting frameworks to determine acceptability of a tanker for use[12].

The vetting frameworks include comprehensive databases of tankers in operation (including quality of management systems) and frequency of inspection required to ensure a tanker remains current. An accepted part of chartering any vessel is that it must be acceptable to the charterer (largely by the status within the particular vetting system) who in turn has obligations to others including ports/receiving terminals that must approve the vessels for the facility.

[12] The Oil Companies International Marine Forum has the Ship Inspection Report Programme (SIRE - see http://www.ocimf.com/SIRE/Introduction).

5.2 IMO Conventions

There are a large number of IMO conventions covering a range of issues but four are generally regarded as the central pillars of international regulation with one of those emanating from the International Labour Organisation (ILO).

Table 6: IMO/ILO Conventions

IMO Conventions	Brief description
International Convention for the Safety of Life at Sea (SOLAS), 1974 and its amendments.	The SOLAS Convention specifies minimum standards for the construction, equipment and operation of ships, compatible with their safety. Flag states are responsible for ensuring that ships comply with its requirements. Obligations cover including: general, construction, fire, lifesaving, safety, cargoes, dangerous goods, nuclear, safe operations, high speed crafts, maritime safety and bulk carriers over 150 meters in length.
International Conventions for Prevention of Pollution from Ships (MARPOL), 1973, as modified by the Protocol of 1978 and 1997	MARPOL includes regulations aimed at preventing and minimising pollution from ships - both operational and accidental causes. It includes six technical annexes - oil pollution, noxious liquid, harmful substances, sewerage, garbage and air pollution from ships. The Protocol of 1978 was adopted in response to a spate of tanker accidents in 1976-1977 and 1997 Protocol amended the Convention and introduced Annex VI - Prevention of Air Pollution from Ships. Significant developments under MARPOL include the beginning of a program for tankers to be double hulled, a process which began in 1992.
International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) and its amendments including the 1995 and 2010 Manila Amendment.	The STCW convention prescribes minimum standards relating to training, certification and watchkeeping for seafarers (international level) which countries are obliged to meet or exceed. The 1995 amendment deals with administration measures to ensure compliance with convention. The 2010 Manila amendment is aimed at bringing the Convention and Code up to date with developments since they were initially adopted and to enable them to address issues that are anticipated to emerge in the foreseeable future (e.g. fraudulent practices, hours of work, security for ships that come under attack by pirates etc.).
ILO Conventions	**Brief description**
Maritime Labour Convention (MLC), 2006 will come into force on 20th August 2013.	The MLC Convention sets out seafarers' rights to decent conditions of work on a wide range of subjects, and aims to be globally applicable, easily understandable, readily updatable and uniformly enforced. It has been designed to become a global instrument known as the "fourth pillar" of the international regulatory regime for quality shipping, complementing the key Conventions of the IMO.

The IMO has also been involved in the establishment of conventions[13] for provision of oil spill compensation that occurs from spills of persistent oil[14] in member states. Established around 1969 these earlier funds have been subsequently superseded, most significantly in 1992. These conventions have also placed obligations on Owners to have in place insurance to cover pollution damage.

5.3 Other Standards including operating interface

A number of other standards operate to ensure safety and security, including in the interface between the tanker and port or receiving terminal. These have been generated out of international conventions (via the IMO) or by the industry itself, such as OCIMF and the International Chamber of Shipping.

5.3.1 Safety Management System (SMS)

The ISM Code International Safety Management Code (ISM Code), developed under SOLAS is an international standard for safe management and operations of the ships and for pollution prevention. Ship owners are required to certify that a ship operates with the approved safety management system (SMS).

5.3.2 International Ship and Port Facility Security Code

The International Ship and Port Facility Security Code (ISPS Code) is a set of measures to enhance the security of ships and port facilities, developed in response to the perceived threats to ships and port facilities in the wake of the 9/11 attacks in the United States. The ISPS Code is implemented under SOLAS and tanker owners and ports are required to certify compliance with the Code.

5.3.3 ISGOTT

The OCIMF has also developed policies aimed at requiring uniform operating and security standards across the maritime supply chain, including in the interface with storage terminals. Key among these is the International Safety Guide for Oil Tankers and Terminals.

5.4 Insurance

A voyage will include a number of insurable elements. These need to be confirmed by the Owner, demonstrating valid certificates and warranties to that effect. It is important again to distinguish the insurable elements related to cargo and those related to the ship.

5.4.1 Oil insurance

Responsibility for insuring the cargo falls on the party who bears the risk. Generally this will be the cargo owner who may be also the charterer but not necessarily. A charterer who does not own the oil may still look to insure loss in the cargo where the risk of loss is due to the charterer's actions.

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[13] The International Oil Pollution Compensation Funds

[14] Persistent oils are oils which do not dissipate quickly and therefore pose a threat when released to the environment. Oils which are normally classified as persistent include crude oils, fuel oils, heavy diesel and lubricating oils. Non-persistent oils include petrol, diesel and kerosene.

5.4.2 Vessel insurance

Categories of ship insurance include:

- Hull and Machinery (H&M) – a Ship owner will be required under a charter party to have in place valid H&M insurance (the value is to be declared). Where vessels are operating in areas at risk of conflict the Owner is entitled to recover War Risk insurance premiums from the Charterer (assuming the owner continues to operate to the original voyage instructions – Clause 35 of Shellvoy 6 provides an indication of how the rights and responsibilities might be altered where War risk etc. arises).
- Public Liability - Owners of vessels carrying greater than 2000 tonnes of oil as bulk cargo are required to have oil pollution insurance in place meeting the various international conventions and the Owner's liability for pollution damage under these conventions. This insurance is provided by the various Professional and Indemnity clubs (P&I) that operate as mutual insurance associations for the benefit of their members.

These requirements also form part of a charterer's vetting procedures, reinforcing the need on the part of the Owner to demonstrate acceptability for charter.

6.0 Ship costs and how price is established

As noted in Section 4.3 tankers operate in a range of markets. An Owner will offer capacity in a way that maximises the return on their investment, and this will be influenced by the returns available from the different market segments.

A market for tankers operates as a commodity market where the price is set is by the supply demand balance. However Owners can also choose to contract into longer term markets where they believe this provides the potential to optimise their investment taking into account the outlook (strengths and weaknesses) for price and returns (including costs to operate). Owners are weighing up returns in the spot voyage market with what may be available under longer term structures and as such the spot market provides the benchmark for longer term contracting options.

The cost of operating a ship is made up of four major components:

- Cost of the physical ship;
- Cost of the crew, provisioning and the related management functions;
- Cost of the fuel (bunkers); and
- Port costs - costs charged by port companies/authorities for the services provided going in and out of port (these do not include wharfage which is paid by the cargo owner rather than the Owner).

6.1 Establishing the cost for a spot voyage

The spot market operates both on a lump sum and benchmark pricing basis. However benchmark pricing is a significant part. The most common benchmark operating globally is the Worldscale mechanism which provides rates for standardised voyages and enables the market to set a rate for particular ship expressed as a percentage of the standard Worldscale voyage.

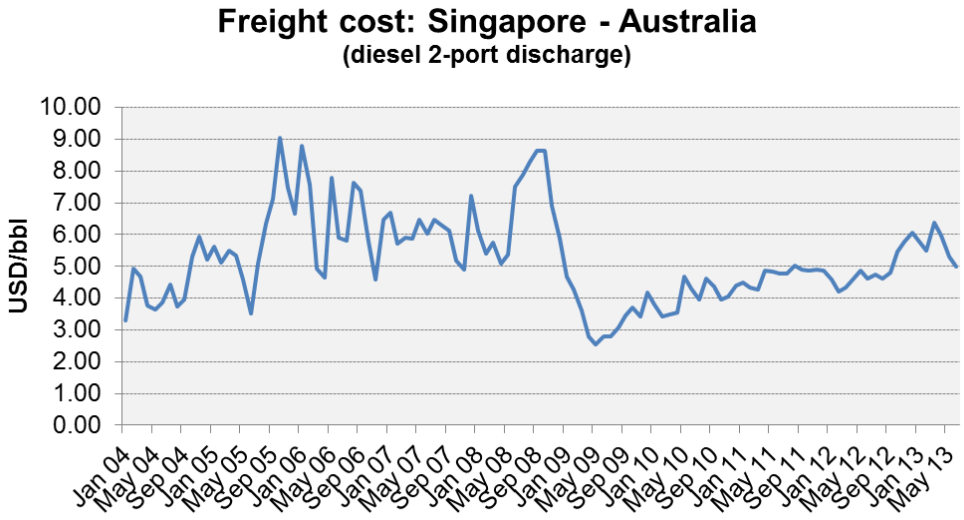
Worldscale: Worldscale freight rates (USD/mt) are published annually by the Worldscale Association for worldwide voyages. They are based on a standard (75,000 tonne) ship, return

voyage time (including load and discharge time) and associated costs (crew, port costs, bunker fuel).

Percentage Rate: All ships will charge a percentage of the Worldscale rate for the voyage in question. Generally larger ships charge a lower percentage, smaller ships a higher percentage. These percentages can vary on a daily basis and will increase when the market is tight. In this region Platts[15] report rates for a number of regions and vessel types including MR tankers from Singapore to Australia. This quote is used for Australian benchmark pricing monitoring by the ACCC.

The trend for the voyage calculated using the spot methodology for a MR product tanker from Singapore to Australia is shown in Figure 2.

Figure 2: Freight trend Singapore - Australia



Source: Hale & Twomey

Other charges

Overage: The market quotes for a standard ship size (e.g. 30,000 tonnes for MR). Many ships can be larger – generally the capacity above the market quoted size is charged at 50% of the rate and referred to as overage.

Demurrage: The charter party allows a certain amount of time for load and discharge (72 hours). If any more time is spent than this due to loading or discharge issues, the ship owner will charge demurrage at an agreed rate per day (agreed as part of the charter party).

[15] Platts are an international market report agency covering petroleum (amongst a range of commodity markets including shipping.

6.2 Establishing the cost for time charters

Owners will assess period rates against the spot market (converted into time charter equivalent terms)[16] but will also take into account the supply/demand outlook and expected returns taking into account costs over which the Owner has no control (e.g. fuel).

6.2.1 Ship operator costs and returns

Typical levels of costs estimated by Drewry for international operation currently covering crew, insurance, repairs and maintenance, stores and administration are shown in Table 7.

Table 7: Costs for ship operation ($US 000/day)

	Products 35-45,000 dwt		Aframax 80-120,000 dwt		Suezmax 140,000 dwt		VLCC 280,000 dwt	
Year	2012	2013	2012	2013	2012	2013	2012	2013
Manning	3,481	3,547	3,597	3,665	3 ,636	3,705	4,098	4 ,176
Insurance	550	568	870	8 98	1 ,050	1 ,084	1 ,230	1,269
Repairs & Maintenance	2,155	2,079	3,016	2,910	3,532	3,408	4,162	4,017
Stores/Supplies/Spares	960	920	1,210	1,159	1 ,265	1 ,212	1,610	1,542
Administration	951	932	1 ,103	1,081	1,221	1,197	1,310	1,284
Total	8,096	8,045	9,796	9,714	10,704	10,606	12,410	12,288

Source: Drewry Maritime Research

From the spot market the income after bunkers and port costs are paid is the income the Owner receives. Returns on the asset (assessed on market rates for newbuild construction or the second hand market) from period chartering can be assessed taking into account market rates less operating costs. Table 8 indicates that returns over the last two years have been poor, reflecting the excess supply of tonnage in all tanker classifications.

Table 8: Returns to ship owner

	MR	Panamax	Aframax	Suezmax	VLCC
Spot rates ($/day)					
Mar-13	13,000	15,000	7,367	10,350	-2,533
2012 average	9,345	15,404	4,014	10,188	10,139
2011 average	8,700	13,200	3,614	9,917	21,059
2007-11 average	13,055	19,863	22,434	29,791	41,038
Period rates ($/day)					
Mar-13	13,750	14,200	13,500	16,500	21,000
2012 average	13,325	13,263	13,600	17,500	20,996
2011 average	13,600	14,800	15,200	19,700	24,642
2007-11 average	17,880	21,728	24,300	32,700	45,450
Required rates for 10% IRR ($/day)					
Newbuilding (mar-13)	20,225	24,242	26,979	31,154	45,871
Secondhand - 5yr- (mar-13)	15,173	16,708	18,189	23,228	29,926
IRR on Mar-13 tc rate					
IRR - NB %	3.52	1.40	-0.84	0.75	0.12
IRR - SH (5yr) %	7.22	5.16	1.86	2.39	2.82

Source: Drewry Maritime Research

[16] Time charter equivalent is the voyage income less bunker and port costs divided by the round trip voyage in days.

7.0 Tanker Outlook

7.1 Ship availability

Table 9 indicates Drewry's estimated profile of the existing fleet included projections to 2018.

Table 9: Global Tanker Fleet

Size (dwt)		10-55,000		55-80,000		80-120,000		120-200,000		200,000+		Total	
End Period		No.	Dwt	No.	Dwt	No.	Dwt	No.	Dwt	No.	Dwt	No.	Dwt
2009		898	30,618	436	30,477	837	87,668	393	59,919	529	157,665	3,093	366,348
2010		809	29,451	396	28,177	877	92,639	410	62,911	547	165,397	3,041	378,679
2011		794	29,379	410	29,332	903	95,995	445	68,556	576	175,328	3,130	398,683
2012		782	28,678	399	28,596	901	96,525	469	72,524	609	186,314	3,160	412,637
2013		792	29,926	405	28,943	900	96,839	501	77,451	641	196,621	3,239	429,780
2014	forecast	796	30,848	411	29,445	909	98,093	525	81,237	665	204,530	3,306	444,152
2015		790	31,051	416	29,878	922	99,685	551	85,304	686	211,221	3,365	457,138
2016		784	31,076	422	30,289	930	100,770	574	89,009	706	217,643	3,416	468,787
2017		778	31,115	425	30,543	940	101,986	599	92,937	724	223,487	3,466	480,069
2018		774	31,167	431	30,994	945	102,714	624	96,946	744	229,767	3,518	491,588

Source: Drewry Maritime Research

7.2 Influences on availability

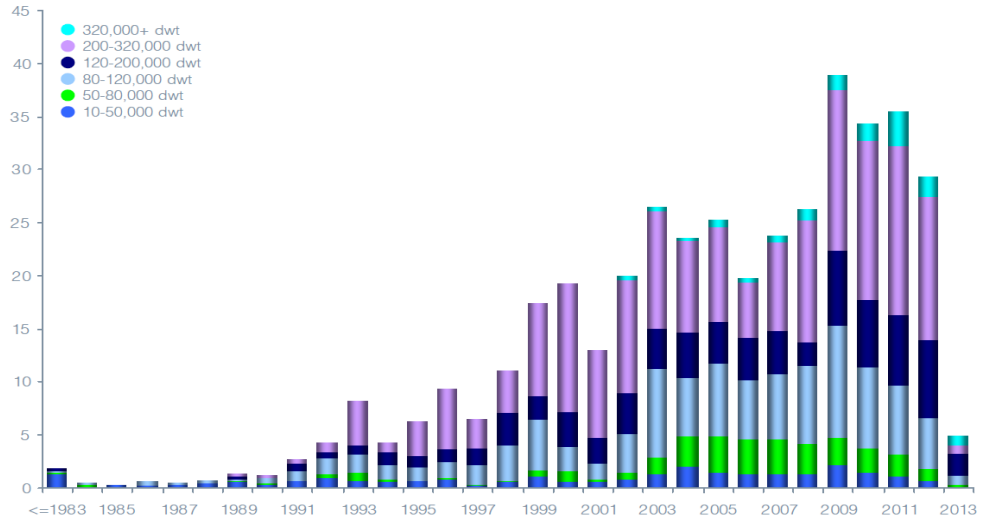
7.2.1 Cost cycle

The cost cycle is influenced by normal supply and demand activity in the sector, primarily the demand to ship petroleum and the supply of ships. Relatively small changes in either of these factors can have a major impact on the market price.

7.2.2 Lead time for newbuilds

On ship supply, it can take up to three years from deciding on the need for a ship to its delivery after construction, so market requirements when it is delivered can be very different. In recent years there has been significant fleet addition as the result of the strong economic conditions leading to greater newbuilding in the period prior to the GFC (Figure 3).

Figure 3: Age Profile of Tankers 1983 to 2013



Source: Drewry Maritime Research

7.2.3 Standards

Another influence on the cost cycle is the impact of marine regulations - international, domestic and those imposed by companies operating in the sector. The introduction of double-hulled oil tankers in the past decade led to a substantial rebuilding program in most tanker categories which means that currently the fleet has a relatively young average age.

While in the past oil tankers might be used for 20 to 30 years, the changes to the maritime regulations over the past decade (which had been flagged as coming a decade earlier) has meant much of the older tonnage has been scrapped. In addition many companies (and some countries) have policies on ship life for oil tankers, not using any tonnage over 20 years old and in some cases 15 years. The refiners/wholesalers in Australia generally operate to the shorter 15 year timeframe.

7.2.4 Technology

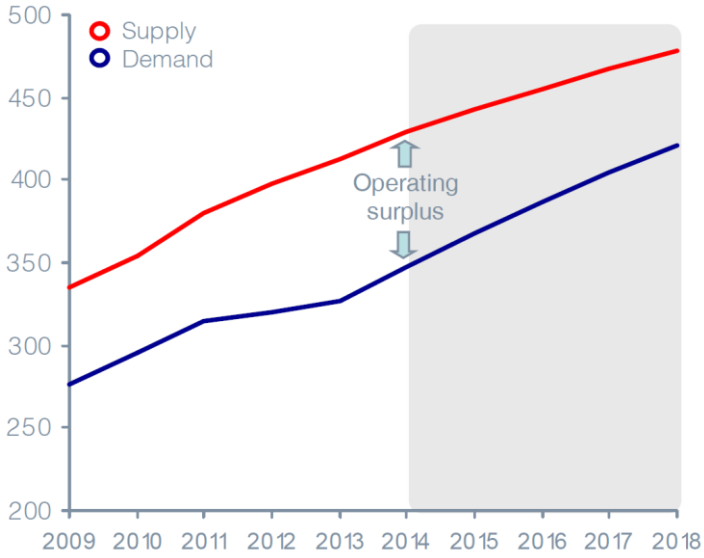
Technological advances may also be a spur to new investment as Owners look to achieve greater efficiency (carrying capacity, fuel efficiency) or to respond to further regulatory pressures (e.g. changes in emissions standards).

7.2.5 Forward Supply Demand Balance

In the period since 2008 significant capacity has been added as a function of order books committed pre GFC being delivered on. But correspondingly returns since then have been poor with capacity significantly exceeding supply.

Drewry is expecting economic conditions for owners to improve over the next 5 years, as the supply/demand equation comes back into balance. Nevertheless Drewry's projections (Figure 4, Table 10) indicate good availability to meet demand.

Figure 4: Global Tanker Fleet Supply Demand Balance



Source: Drewry Maritime Research

Table 10 provides Drewry's view for MRs to 2018. Again the same picture holds as for the general picture.

Table 10: Global MR Tanker Fleet Supply Demand

Period Averages		Supply	Demand	Balance	Balance % Supply
2009		17.0	15.4	1.6	9.3%
2010		18.6	17.1	1.5	8.2%
2011		20.2	17.9	2.3	11.3%
2012		20.1	17.6	2.5	12.4%
2013		20.7	18.0	2.7	13.2%
2014	forecast	22.5	19.6	2.9	12.9%
2015		23.6	20.5	3.1	13.0%
2016		24.2	21.5	2.7	11.0%
2017		24.6	22.3	2.3	9.4%
2018		25.1	23.0	2.1	8.2%

Source: Drewry Maritime Research

8.0 Australia's petroleum supply chain

8.1 Australia's maritime sector

As an island continent, the Australia petroleum supply chain is more dependent on shipping than the global average. Virtually all of the supply (~93%)[17] is dependent on shipping, either as domestic crude, imported crude or imported product. As petroleum is an essential input for a modern economy, this means that the maritime petroleum supply chain is a critical component in Australia's energy and economic security.

Australia's population is also relatively concentrated in coastal population centres which are separated by substantial distances. This means that unlike other developed continents (particularly North America and Europe) there is no network of pipelines that can also move petroleum around the country. Therefore the maritime supply chain plays a key role in the ability to link population centres.

Further rationalisation of the Australian refinery industry along with declining crude oil production (especially in the South East) is seeing a shift in imports from crude to product and a gradual increase in the dependency on shipping for supply (forecast to increase to around 95%).

8.2 Market participants requiring product

The drivers of ship demand are the cargo owners who need their cargo transported from the purchase location, to their demand locations in Australia. The companies importing crude and/or product and marketing in Australia can be grouped as follows:

1. Refiner/Wholesalers: These include BP, Caltex, ExxonMobil and Shell all of whom refine fuel in Australia (using imported and locally produced crude oil) and directly import product. The ACCC report indicated that these companies have over 90% of the wholesale market monitored by the ACCC[18]. These are (or are affiliated to) the major international oil companies (IOCs), with global reach and well established refining and shipping supply chains.

2. Independent Importer-Wholesalers: These include Ausfuel, Liberty Oil, Neumann Petroleum and United Petroleum (Ausfuel and Neumann Petroleum have recently been purchased by Puma Energy, a wholly owned subsidiary of Trafigura, a global commodity trading company). These companies directly import fuel and wholesale in the market. The ACCC reported that these companies were responsible for 30% of total product imports in 2011/2012.[19] These companies (both the Australian based companies and Trafigura) are privately owned.

3. Third party direct importers: These are companies (predominantly mining companies but also airlines) who import products directly for their own use. Their volumes are not available as they are not monitored by ACCC.

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[17] Hale & Twomey: calculated from Australian Petroleum Statistics data and H&T's refinery supply/demand model. The only demand portion not dependent on shipping is domestic pipeline fed crude to some refineries.

[18] ACCC Report: Monitoring of the Australian petroleum industry. December 2012. Pg. 79.

[19] Ibid. pg. 74 (note: ACCC only monitor companies who wholesale petrol and diesel. This figure may not include some third party direct imports).

How these companies manage their maritime supply chain varies both between and within each category. However in all cases the maritime supply chain is a critical part of the broader supply chain they manage.

8.3 Contracting strategy that these companies use

Imports

Table 11: Australian companies import contracting strategy

Company Type	Typical import contracting strategy	Comments
International Oil Companies (IOC)	FOB/spot	■ International affiliate manages shipping as an integral part of their supply operation. ■ Typically buy crude and product FOB and arrange shipping using the spot market (shipping may be organised by an international affiliate but title to the cargo will reside in the domestic company).
Global commodity trading companies with market presence in Australia	FOB/spot	■ As with the multinationals, for traders shipping is a key element of supply decisions. ■ When selling they will often sell on a basis where the freight is included (CIF or CFR). ■ Owner of the cargo while on the water uncertain.
Australian owned private companies	CFR/CIF/DES	■ These are often smaller companies concentrating on distribution and marketing. ■ Look for their supplier to provide the shipping expertise so buy on a basis including freight (may take title and risk on the water).
Third party direct importers	CFR/CIF/DES	■ These companies do not have shipping expertise so look for the supplier to provide the shipping. ■ Likely to buy on a basis including freight taking title and risk on delivery.

In summary as the Australian affiliates of the IOCs still import the bulk of Australia's petroleum, an Australian company will have an ownership interest in the bulk of cargoes while on the water to Australia. This could vary over time depending on the purchase strategy of the other purchasers and their relative market share.

The way companies operate in Australia will be similar to how the same companies operate in the other parts of the world where they have a presence.

Exports

Most crude and condensate exports will sell on a FOB basis where the purchaser takes ownership on lifting and organises the shipping. Our understanding is all Australian exports of crude oil and condensate are on a FOB basis.

Occasionally a producer will see shipping as an essential element to ensure they can sell their crude (where suitable ships are not widely available in the region) so will charter ships and sell on a CIF or CFR basis. H&T is not aware of this happening in Australia, but in New Zealand, Todd Energy sells crude to Australian refineries on a CFR basis as they use a MR tanker for transport, and MR tankers in dirty service are not common in this region.

Coastal

Three out of the four oil majors use dedicated petroleum ships on the Australian coast to link their local refining operations with Australian demand centres.

Company	Approach
Caltex	Time charters two MR vessels from an international third party owner/operator – likely the shipping requirement may reduce as refining operations are curtailed (see section 9.2).
BP	Time charters two MR vessels from their international shipping affiliate, managed by an Australia third party operator.
ExxonMobil	No coastal capacity - relies on mix of buy/sell arrangements with other suppliers and international imports.
Shell	Time charters one MR vessel from an international third party owner/operator – likely the shipping requirement may reduce if refining operations are curtailed.

Security perspective: The contracting strategy means that for the majority of Australia's petroleum imports (those controlled by the IOCs and possibly other non-IOC volume), the Australian company is likely to own the oil from when it loads (FOB, CFR or CIF purchase). Shipping may still be contracted by the companies' international trading arm or a third party but the cargo owner will hold a documented property interest in the cargo.

8.4 Profile of tankers used to service the Australian supply chain

Section 3 notes the types of tankers. The following table notes their use in the Australian supply chain.

Table 12: Ship categories for Australian supply

Crude Oil carriers[20]		Use in Australian supply
	Panamax	Not commonly used
	Aframax	Used for majority of Australia's crude imports and exports
	Suezmax	Used on occasions for long haul trips from Middle East/West Africa by refineries capable of receiving them
	Very Large Crude Carrier (VLCC)	Too large for Australian ports but have been used for part voyage before transfer to smaller ships (trans-shipment)

[20] There is also some crude supply on dirty MR tankers from New Zealand to Australia.

Product tankers		
	Medium Range (MR)	Used for all of Australia's product imports and coastal movements
	Large/Long Range One (LR1)	Expected to be used for product supply as demand increases and product terminals increase capacity as a result of refinery closures
	Large/Long Range Two (LR2)	Not used

The MR tankers used in Australian coastal service to move product between ports are shown in Table 13.

Table 13: Product vessels on the Australian coast

Vessel	Charterer	Built	Operator	Owner
Alexander Spirit	Caltex	2007	Teekay Shipping (Australia) Pty Ltd	Teekay[21]
Hugli Spirit	Caltex	2005	Teekay Shipping (Australia) Pty Ltd	Hugli Spirit LLC[22]
Tandara Spirit	Shell	2008	Teekay Shipping (Australia) Pty Ltd	Teekay
British Fidelity	BP	2004	ASP Ship Management	Speed Shipping Company Limited
British Loyalty	BP	2004	ASP Ship Management	Magpie Shipping Company[23]

Security perspective: There are a large variety of crude and product tankers bringing product to Australia on a continual basis (mainly obtained from the spot market). The ships used to manage supply chains from refineries are contracted on a longer term basis. In times of supply chain disruption, import vessels can and have been used to do coastal voyages to help distribute available product to where it is required.

[21] Teekay is a large US listed owner and operator of tankers; use Australian crewing

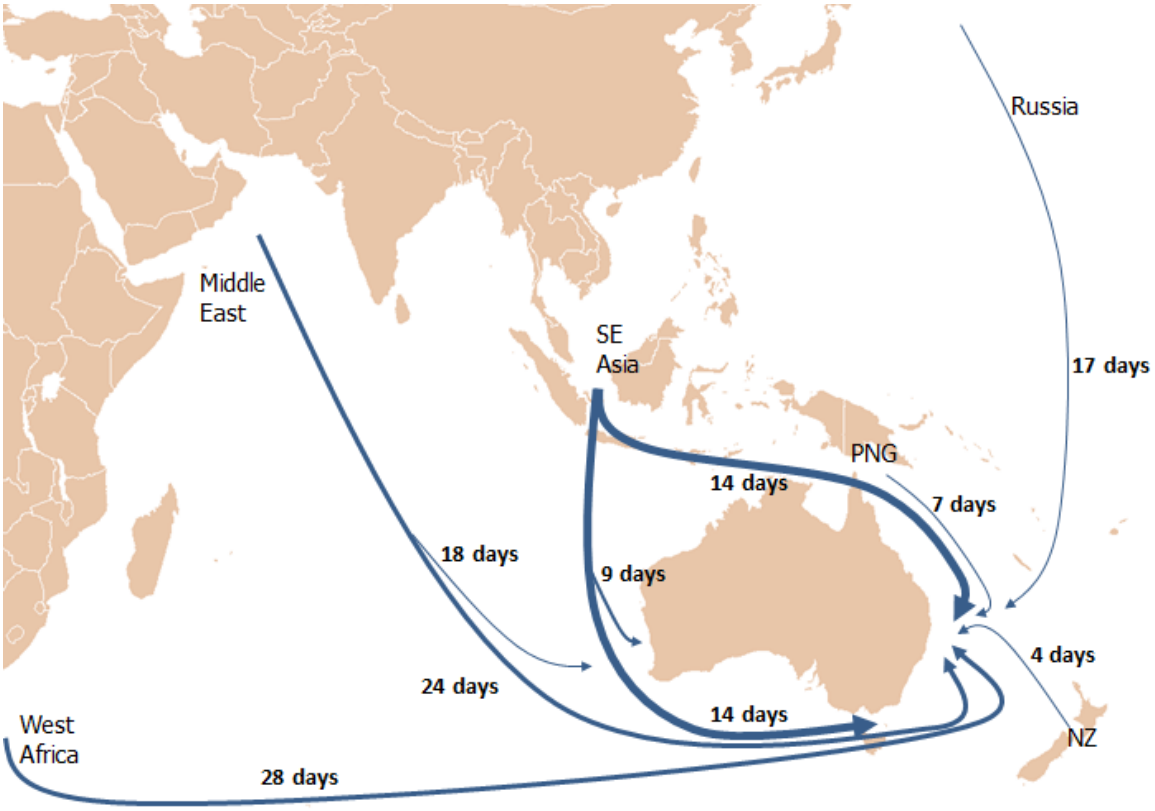
[22] Understood to be Teekay as the ultimate owner

[23] BP international shipping affiliate; ships registered in Isle of Man but use Australian crewing

8.5 Tanker routes

The following figures illustrate the major routes used by crude and product tankers travelling to Australia.

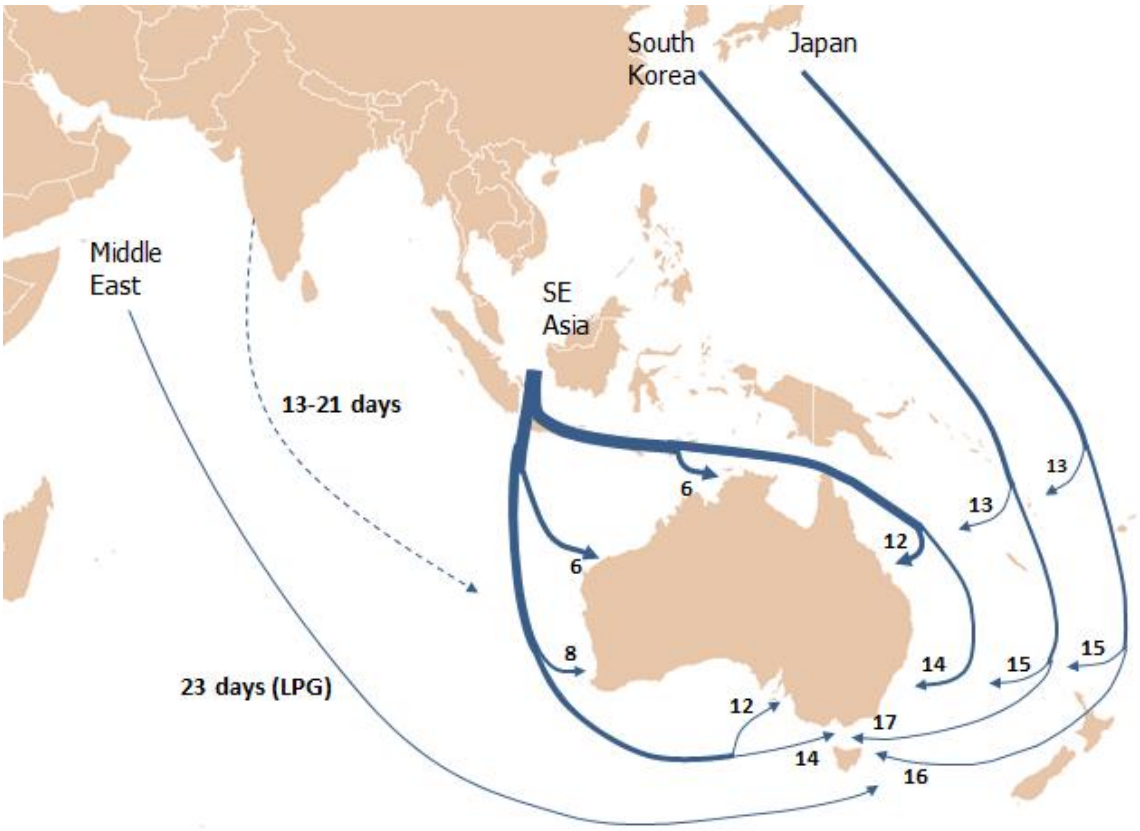
Figure 5: Australia's major import crude oil shipping routes



Source: Australian Petroleum Statistics (2011/12); Hale & Twomey supply/demand model
Note: Width of the arrows represents approximate volumes from each import location (2011-12 data).

- The sources for crude oil are dispersed with South East Asia as the largest supplier.
- In line with global market changes, volumes from further afield (e.g. West Africa, Russia) have been increasing in recent years.
- Generally the longer the voyage, the larger the ship used.
- The days indicated on the chart are sailing times and do not include load and discharge times (which are normally 3 to 6 days depending on the number of load and discharge ports).
- Based on feedback from industry, some crude is transhipped although statistics on actual volumes are not available (e.g. Middle Eastern crude shipped to waters around Singapore where some is transferred onto a ship coming to Australia).
- A crude ship will often load at two ports, load different crude oils and some companies (with two refineries in Australia) may discharge at two ports.
- Using the 2011/12 data the loading port information includes:
    - Malaysia is the largest source of crude (crude loads on east coast so does not need to go through the Straits of Malacca);
    - Middle Eastern crude is the second most significant source (primarily United Arab Emirates) and this route does pass through the Straits of Hormuz; and
    - Nigeria and Indonesia are the next largest suppliers.

Figure 6: Australia's major import product shipping routes



Source: Australian Petroleum Statistics (2011/12); Hale & Twomey supply/demand model

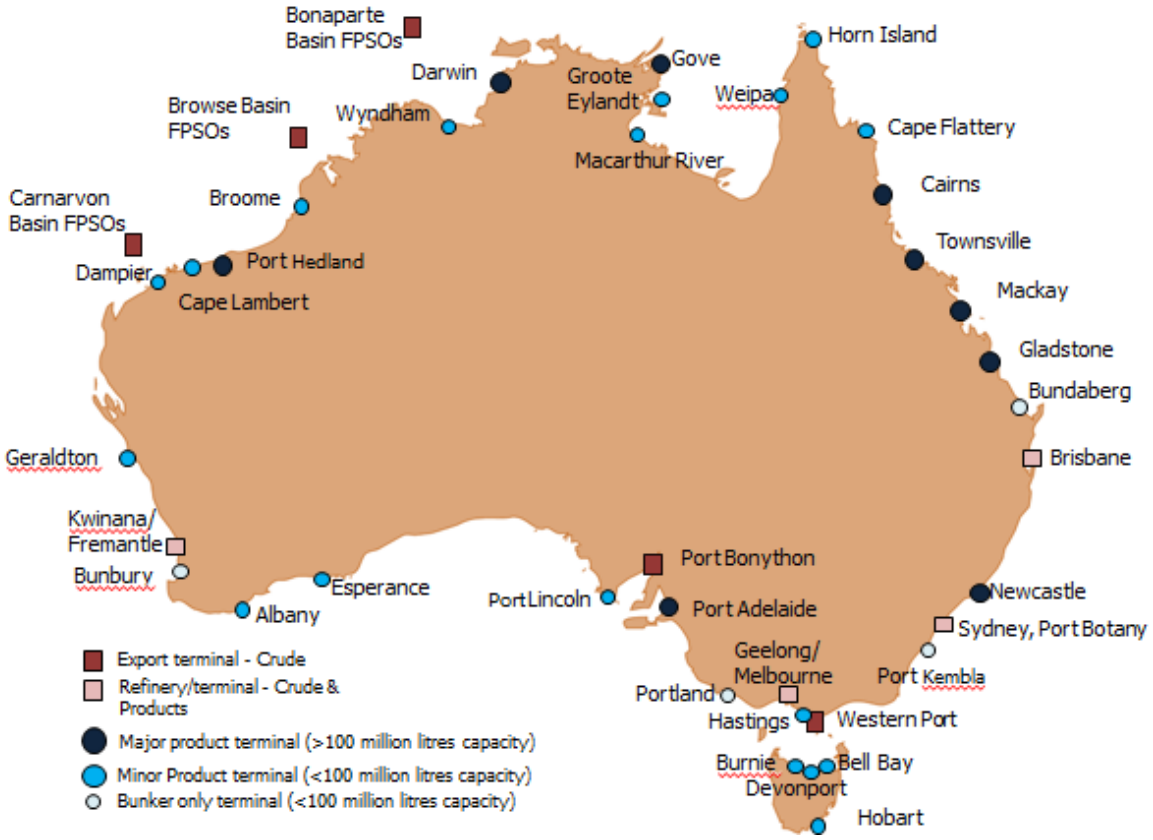
Note: Width of the arrows represents approximate volumes from each import location (2011-12 data). Dotted arrow represents imports from India, currently less than 1% of total imports. India could become an important import origin in the future.

- The majority of product supply currently comes from Singapore but this is expected to get more diverse as volumes increase (more from North Asia, India and possibly the Middle East).
- Based on 2011/12 data, Singapore supplies nearly three times as much petroleum (crude and/or product) than any other country.
- Discharges are dispersed around the country although volumes to the South-East of Australia will increase with refinery closures and investment in import terminals.
- Ships will often discharge at more than one port and include multiproduct cargoes.
- The days indicated on the chart are sailing times and do not include load and discharge times.
- A significant part of many voyages are in or near Australia's Exclusive Economic Zone (EEZ).
- The breakpoint for equal distance between a ship from Singapore coming around the north or around the south of Australia is a little to the south of Sydney. Ships servicing NSW and/or Victoria might not always take the shortest route if there are other factors that might affect the journey (e.g. weather).

Security perspective: Australia's supply routes are diverse and likely to become more so *as more product imports come from locations other than Singapore. Due to the time it takes a ship to travel around Australia, import ships spend a considerable part of their voyage in Australia's EEZ. This result is a large number of tankers close to or within Australia's EEZ at any time.*

8.6 Australian ports

Figure 7: Australian marine petroleum terminals



Source: ACIL Tasman Petroleum import infrastructure report 2009; BREE 2010/11 Import data; RET; Hale & Twomey.

- There are a large number of import ports, dispersed around the country
- Each port will have differing constraints which may restrict which ships can go to which ports
- There is limited ability to transfer product between major ports other than by ship (except between Sydney and Newcastle where there is a product pipeline)
- It would take over 1,000 truck movements to shift the volume carried by one MR tanker

Security perspective: While Australia has a lot of import ports, they are typically quite isolated from each other, making *it difficult to provide land transport back-up from other ports due to the large distance involved. Without a network of pipelines, Australia is dependent on trucking for internal movements and trucking does not have the capacity to replace shipping. This means that using shipping to distribute product between ports is a major means of managing local disruption.*

8.7 Timing and process for securing ships

Cargoes for Australia are likely to be secured on the following timetable, whether the company importing is contracting the ship or if it is being done by a third party.

Table 14: Timing for securing import shipping

Activity	Timing for crude	Timing for product
Secure/purchase cargo	6 – 10 weeks before loading date	~ 6 weeks before loading
Secure ship – freight contract confirmed when all conditions lifted.	2 to 3 weeks before loading	2 to 3 weeks before loading
Time commences under contract	Ship presents for loading (issues Notice of Readiness)	Ship presents for loading (issues Notice of Readiness)
Owner (via Master) confirms cargo by signing BOL	Completion of loading	Completion of loading
Time under contract finishes	When cargo is completely discharged	When cargo is completely discharged
Contract completion including determining liability for demurrage, losses, etc.	Can continue for some months after voyage	Can continue for some months after voyage

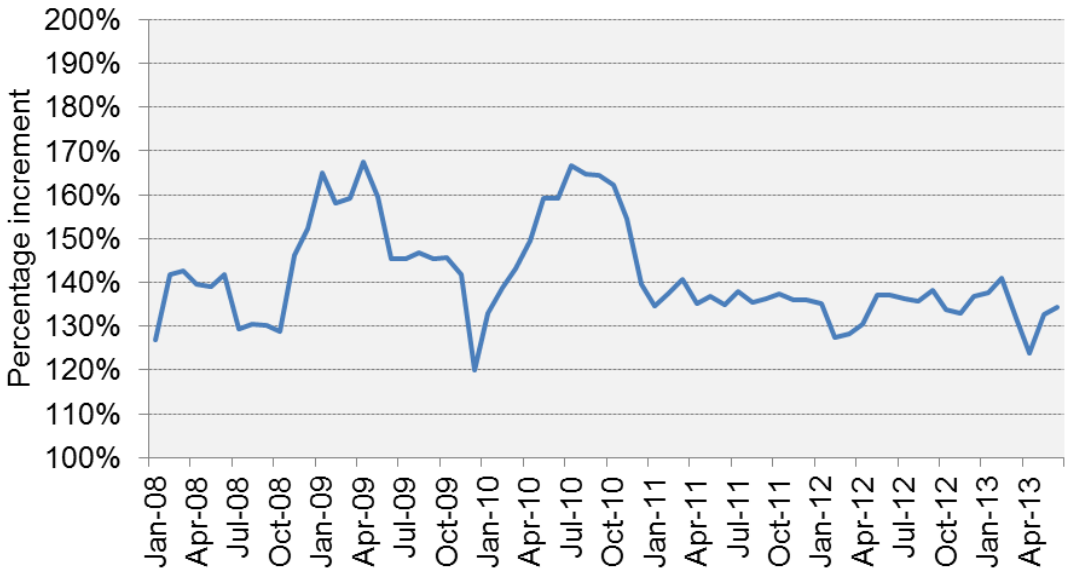
As the ports in the south-east of Australia are close to two weeks sailing away from Singapore, the ships delivering import product to this region may not yet have secured their next cargo. That provides some flexibility for Australian operators if they need the ship to discharge in additional ports as the ship will often have the ability (at an extra cost) to add that to the original voyage. Generally ships delivering to the north of Australia will be committing to their next voyage a little earlier, due to the proximity to Singapore.

Security perspective: Commitments are made for purchase of cargoes well in advance of the process for committing to shipping. Therefore in a disruption where additional product is required, it is usually access to additional cargoes rather than access to additional shipping which is the constraint.

8.8 Shipping cost for Australian market

As the volume of product imports to Australia has increased over the last decade, Platts has introduced a market quote to directly report on the spot cost of MR product tanker transport between Singapore and Australia (this was introduced in 2002). Typically the quote for the Australian voyages is higher than MR voyages that stay in Asia as there is no opportunity to secure backhaul trade for product tankers coming to Australia. For ships going to North Asia there is a realistic possibility of getting a backhaul cargo so the market prices accordingly. Figure 8 shows the increment of the Australian quote above that for the voyage from Singapore to Japan.

Figure 8: Increment for Australia market multiplier quote versus Japan



Source: Hale & Twomey

Ships that operate in coastal service need to have Australian crews (covered in section 8.10) so incur higher operating costs than the ships operating on international routes.

Security perspective: Owners are remunerated for the particular characteristics of Australian voyages. Late changes can be made to voyages to respond to disruption events although it will often be at considerable additional cost.

8.9 Customs and Border Control

Tankers entering Australia are required to comply with all Customs and border protection requirements under Australian law. In practice this includes providing required information within defined timeframes and demonstrating various certification requirements (generally this is undertaken by a shipping agent acting on behalf of the vessel owner). These requirements address the following areas:

Customs

- Cargo, quantity, origin of cargo, timing of arrival, etc.
- All vessel details including of owner's registry, operator, charterer.
- Tonnage dimensions of vessel.
- Last 10 voyages/next four ports of call.
- All safety and security certificates - see Section 5.0.

Customs clearance is required to allow a tanker to berth and to sail to its next port.

Responsibility for clearing the cargo through Australian Customs rests with the cargo receiver (which could also be the cargo owner).

Immigration (documentation administered as part of Customs requirements)

- Immigration details of all crew (names, passport numbers, etc.)

Biosecurity (Department of Agriculture, Fisheries and Forestry)

- Monitors biosecurity risk, which may include direct vessel inspection.
- Biosecurity requirements include reporting condition of ballast water (empty/full, location for taking on ballast, meeting requirements for exchange of ballast).

8.10 Australian shipping reforms

In 2011/12 the Australian Government introduced measures to stimulate its domestic shipping industry. These included measures to encourage investment in coastal shipping through access to tax incentives, the creation of a new international shipping register and a new regulatory framework governing the licensing system for vessels engaged in coastal trading in Australian waters (including where temporary licences were sought to engage in coastal trade). AMSA notes that "The register will maintain Australia's international reputation for high quality maritime safety and environmental standards while putting Australian companies on a level footing with their international competitors"[24].

Changes proposed to the licensing system allowing temporary exemption for import vessels to perform a coastal voyage proved problematic. The changes constrained flexibility needed to meet short notice disruptions, particularly in the context of upsets in refinery operation, via the use of import shipping. This difficulty has been addressed by the Minister for Infrastructure and Transport being required to address any application within 24 hours in the case of an energy security situation.[25] A number of applications have since been granted using the new provisions.

An emerging issue appears to be the way in which Australian Customs views changes to the legislation in the context of ships delivering crude oil from Australian FPSOs to refineries. It is suggested that Customs may view tankers as having been imported and regarded as if registered in Australia (requiring Australian crewing). This has raised some concern amongst crude oil producers, with the inference that crude oil produced from FPSOs will not be marketed to Australian refiners.

Security perspective: Policies intended to stimulate domestic shipping may impact on the flexibility needed to use international shipping to manage disruptions in the supply chain.

[24] http://www.amsa.gov.au/vessels/shipping-registration/

[25] Coastal Trading (Revitalising Australian Shipping) Act 2012 – Section 46 (4)

9.0 Forward/future trends impact on Australia

9.1 Shipping changes

The shipping industry continues to progress and develop in response to market needs and regulatory pressure. In an effort to improve returns tankers are generally getting larger and there is a strong emphasis on improving their fuel efficiency.

Size of ships

While there are ranges of ship category for different services, within each category ships are generally getting larger. For instance most new MR tankers are now around 55,000DWT, previously considered above the MR range band. Ship builders aim to get this capacity while staying within the generally accepted constraints of the class, be that beam or length. Some ship builders move outside a particular constraint if they can see a market for the extra capacity obtained. For example Stena, a ship owner/operator, have a range of product tankers that are a similar length to an MR but a wider beam (40 metres rather than 32.2m). For those companies which use facilities that can handle the wider beam, this can provide lower cost freight, as greater capacity generally means lower cost per unit volume. We understand Stena tankers are being used for Australian import supply.

The size of the tanker used will be limited by the import port constraints. Likely constraints include:

- Length overall;
- Beam (width of vessel);
- Draft (depth of vessel when loaded); and
- Position of loading/discharge piping.

The conversion of Australian refineries to import terminals will allow the larger categories of product tankers (LR1) to be used, as these locations have the berths and draft to manage these ships as they have been receiving crude tankers of this size. However LR1 ships will be too large for most of the other import terminals which have been designed for MR tankers. This means that Australia will use a mix of import product tanker types depending on both the load and discharge facilities.

Environmental changes

Oil tankers have changed over the past two decades following the introduction of double hulled tankers. The focus for environmental standards is now on fuel and emissions. In addition, bunkers are currently around half the cost of a shipping operation so there is significant incentive to reduce fuel use. Improvements in engine efficiency and hull design are seeing new tankers being about 20% more fuel efficient that the tankers they replace.

The ship bunker qualities are set by the IMO. In 2010 a reduction in maximum sulphur level was made to reduce sulphur dioxide emissions. Some regions (e.g. Europe, United States) have far more severe restrictions on fuel quality (particularly sulphur) which mean that ships have to use low sulphur diesel when in coastal areas.

The IMO is looking to improve fuel quality further and there is a push that only low sulphur fuel should be used. There is no agreement on the timing of these changes and any restriction could be managed by a change of fuel (to the much more expensive diesel) or by a technical solution (exhaust scrubbing). Improvements to fuel quality to improve ship emissions are expected to be

the major shipping change in the next decade. The UNFCCC[26] has considered a levy on bunker fuels to provide funding for climate change mitigation although the shipping industry appears to prefer that improvements come through the IMO conventions to achieve the same outcome.

A small specialist portion of the shipping market uses other fuels including LNG and electricity. These are typically used for specific services (electricity is good for variable speed engines) or where the fuel is available (LNG tankers can use the cargo as fuel).

Other than the cost impact, a change in the fuel used in ships (from fuel oil to diesel) would not have a major impact on Australia's product supply as it is an importer of both diesel and fuel oil.

Security perspective: The change in ship size and possible changes to their fuelling is not expected to have any supply security impact.

9.2 Australia's increasing reliance on product imports

Australia is increasing its reliance on product shipping primarily due to rationalisation of the refining industry and market growth. The Australian supply/demand model developed by H&T for the RET *Competitive Pressures on Domestic Refining* report has been updated with 2011/12 data and forecast 2016/17 demand for the announced closure of the Clyde and Kurnell refineries.

The major impact of the refinery closures is a shift from crude imports to product imports.

Table 15: Number of ships (import and domestic voyages/month).

	Crude tankers /month*	Product tankers /month*
2011/2012	27	42
2016/2017 with Clyde and Kurnell closed	19	69

* Excludes export tankers

The product tanker numbers include those operating in coastal service and assume no change in capacity over the period. Capacity impacts are analysed in Table 16.

Crude tankers changes

The refineries which are closing are those with lower drafts. We therefore expect the average size of an import crude tankers to increase (there are likely to be more Suezmaxes on a proportional basis).

Product tankers changes

Refinery conversions to import terminals will allow larger product tankers to be used (LR1 size rather than MR) at these ports, although based on discussions held with companies during the consultation for the *Competitive Pressures on Domestic Refining* report, a mix of tankers would be used depending on supplying refinery capability and the economics at the time. Most of the current import ports will remain suitable only for MR sized ships. Table 16 assesses the trend in

[26] United Nations Framework Convention on Climate Change

product tanker numbers, removing the domestic tanker proportion, assuming a range of cases for the ship capacity changes.

Case 1: No change to the average import tanker cargo of 40,000 tonnes

Case 2: An increase in the MR tankers servicing Australia so that the average cargo increases to 45,000 tonnes

Case 3: Half the incremental volume due to refinery closures is supplied on LR1 tankers (80,000 tonne cargos), with the average of all other deliveries being 45,000 tonnes

Case 4: All the incremental volume due to refinery closures is supplied on LR1 tankers (80,000 tonne cargos), with the average of all other deliveries being 45,000 tonnes

Table 16: Trend for product tanker numbers servicing Australia

Case	1: No change	2: Larger MR	3: Larger MR / Some LR1	4: Larger MR / Max LR1
Average cargo (tonnes)	40,000	45,000	50,200	53,750
2011/2012	34	31	31	31
2016/2017 with Clyde and Kurnell closed	62	55	51	49

In all cases the number of import tankers coming to Australia is expected to increase, even with the converted refineries receiving larger ships and MR tankers getting larger. Based on earlier discussions with industry, H&T would expect Case 3 to most accurately reflect the expected situation in 2016/17.

The decision on tanker size is not only based on a cheaper freight cost by using a larger tanker; the supplying refinery may only be capable of efficiently loading MR tankers. Larger tankers also result in higher average stock levels in terminals as companies will generally work to the same minimum stock point for replenishment. This can also mean more terminal tank capacity is required for larger tankers. However the size of the tanker does not impact the average amount of stock on the water.

Tanker time on the Australian Coast

H&T has analysed how much stock there is in Australia's maritime chain for DRET. As well as finding that Australia's supply chain includes an average of 15 days' supply on the water between load port and first port of discharge, H&T noted that much of the voyage is spent within Australia's Exclusive Economic Zone (EEZ). On average, H&T estimated that approximately 36% of the voyage would be within the EEZ. This means that on any one day there is a number of tankers on the journey to Australia, with some of these within Australia's EEZ. In addition, there are a number of tankers at port ready to discharge, or discharging (and loading in the case of coastal tankers). Estimated numbers are shown in the following tables.

Table 17: Expected number of crude tankers in Australia's supply chain on any one day

	Total Crude tankers travelling to Australia	Number within Australia's EEZ	Additional tankers within territorial waters/discharging[27]
2011/2012	14	5	2
2016/2017 with Clyde and Kurnell closed	10	4	1/2

Source: Hale & Twomey supply/demand model and stock on the water model.
The numbers exclude export tankers and the time the ships sail from Australia empty.

Table 18: Expected number of product tankers in Australia's supply chain on any one day (based on cargo sizes in Case 3 above)

	Total product tankers travelling to/around Australia	Number within Australia's EEZ	Additional tankers within territorial waters/discharging
2011/2012	17	9/10	4
2016/2017 with Clyde and Kurnell closed	25	12	6

Source: Hale & Twomey supply/demand model and stock on the water model.
The numbers exclude export tankers and the time the ships sail from Australia empty.

The *Competitive Pressures on Domestic Refining* report covered the change in supply due to refinery closures in Section 5.6. While the crude supply routes are currently more diverse than product (which is heavily weighted to Singapore); as product import volumes increase the dependency on Singapore is expected to decrease (on a proportional basis), with more product coming from North Asia and from west of Australia (India and Middle East). This assumes the continuation of the trend for excess capacity of Australian specification fuels available.

Rationalisation of the Australian refining industry would mean less product tankers will be needed in coastal service as there will be less product moved between refineries and other Australian ports. The reduction in these tankers will be more than offset by the number of import product tankers on the coast, as shown in Table 18, so should not result in any reduction in supply flexibility or supply security, provided import tankers can be used in supply disruption.

Security perspective: The number of product tankers servicing Australia will increase, despite both the ships increasing in size and the capability of the converted refineries to receive much larger product tankers. This will more than offset the loss of some coastal tankers and provides an increase in the flexibility to respond to domestic supply disruption provided exemptions are provided.

[27] Territorial water and within the 12 mile limit - i.e. the ship is waiting to discharge or discharging

10.0 Comparison of the Australian maritime supply chain to other locations

There is nothing that markedly differentiates the maritime market which services Australia from that servicing other markets. Shipping for the Australian market is drawn from the same pool of tankers that service the maritime market globally. The ships are engaged in the same generic activity where the participants are global in reach, voyages extend to areas outside Asia Pacific as a normal part of trade and the operational and security imperatives remain common.

Australia is characterised as being distant from main supply routes. Table 19 examines a range of differences and discusses how these might impact on security.

Table 19: Difference with Other Markets

Item	How manifest in shipping market?	Impact on security
1. Availability – Australia would become one of the larger importers of finished petroleum product	■ Availability is not anticipated to be an issue but more term chartering may be an outcome to underwrite perceived availability risk	■ Possibly higher costs where Owners can exert some market power
2. Geography of demand - supply chain relatively long compare to Asian countries where main supply routes are close to refining centres (Japan, Korea, Taiwan, Singapore, India, Middle East)	■ It takes longer to re-establish supply for domestic disruption ■ May require short notice voyage changes to manage disruptions ■ Owners will be asked for options as part of standard contracting	■ As covered in section 8.8 the isolated market does result in higher cost ■ Higher stock levels required to manage the longer supply chain ■ Investment in ports required to provide greater ship flexibility (larger drops)
3. Australian geography – lack of internal transport options	■ Compared to many other countries shipping is a more vital disruption response mechanism due to lack of inland transport options	■ The ability to use import shipping in disruption is a key requirement
4. Domestic shipping regime	■ This is relatively unusual within Asia-Pacific where shipping standards is driven more by the international standards.	■ Unknown

11.0 Scenarios analysis - disruption risk

This section examines two hypothetical scenarios to assess the capacity of Australia's maritime supply chains to continue to meet Australia's requirements. These scenarios rest on the assumption that the tanker industry will continue to operate regardless, which raises the question - is there a scenario where the tanker industry itself fails, where that failure is the cause of disruption to Australia's supply chain? What circumstances would cause the industry to fail?

The tanker industry is characterised by a diverse range of participants, including public and private companies, national and international oil companies, petroleum trading companies and companies engaged in the tanker market as segment of their involvement in the wider shipping market (dry bulk, container, etc.). Equally, diversity is also a feature in the number and type (crude/product, VLCC/MR) of tankers owned and controlled.

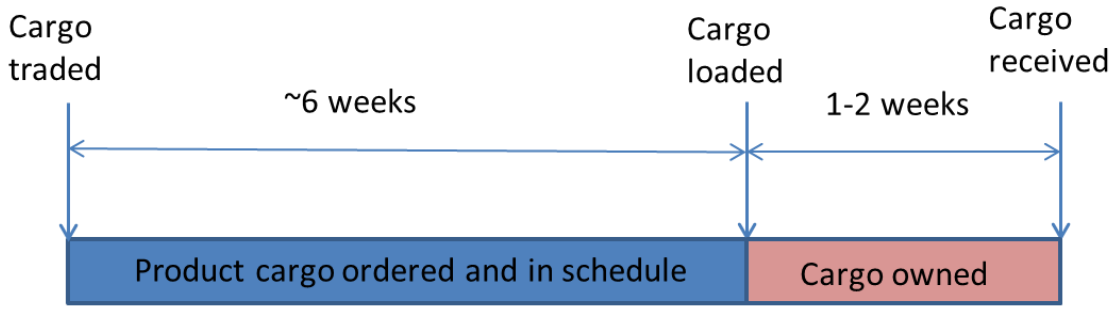
While there can always be instances of participants failing for their own reasons in reality it is difficult to envisage a scenario in which shipping is not available and historically we cannot point to an event which saw the collapse of the petroleum tanker market. Supply disruption affecting tankers is far more likely to arise as a result of other components in the supply chain (e.g. disruption to liquidity in the banking system, geopolitical events).

11.1 Spike in demand for imported product

This section reviews a disruption to Australia's local product supply (e.g. loss of domestic refining output) that necessitates an increased requirement for direct product imports. This will increase demand for product shipping.

How the petroleum market trades in the Asia-Pacific region was summarised in H&T's analysis of stock on the water for DRET. This noted that product cargoes are typically traded at least six weeks prior to loading. Therefore the import programme is set around eight weeks before a cargo is due in Australia.

Figure 9: Product cargo timeline



In the case of a disruption causing an urgent need for product, companies can usually get product cargoes in a shorter timeframe (approximately three weeks) although they will need to pay a premium for these cargoes. As ships are typically only put against cargoes two weeks before loading, it is product availability rather than shipping availability that will cause the most difficulty for company needing supply.

The gap between the disruption (e.g. at least one month unplanned shutdown of a refinery) and establishing resupply (four to five weeks) needs to be managed by other means. The maritime supply chain plays a key role in these actions. Actions could include:

- The company will use the buffer and safety stocks it carries in order to manage this sort of disruption
- Purchasing product from competitors (other refineries or from their imports). The company with the disruption buys product from competitors, who essentially sell some of their buffer stock at a premium. This may require some additional coastal ship movements or more likely some change in discharge ports of exports.
- The company with the disruption is likely to have a number of product import cargoes on the water. The discharge destination of these cargoes can be adjusted by adding extra ports so the available product is spread around the required ports to buy time until supply is re-established
- In more extreme cases the company can come to an arrangement with a company in New Zealand (particularly where they are affiliates) to take some of their import cargo (where quality allows) which means they are using some of the New Zealand company's buffer stock.
- Do a deal with a related party (e.g. a related affiliate) to purchase their cargo due to load within two weeks (that company might be able to manage a delay to their import for a couple of weeks). This manages the product quality problem as it probably gives the supplying refinery time to adjust product quality. If a ship has been secured against the cargo it is possible to adjust the charter party although it is likely to involve additional payment.

All these actions use the flexibility provided by the maritime supply chain to manage the disruption. In severe disruptions (particularly where a number of events compound on each other) there could still be market disruption as was seen with diesel supply to Victoria in December 2012.

As Australia shifts to a greater proportion of direct product imports, the risk of domestic product disruption actually reduces, as fewer refineries mean less chance of disruption, more product imports mean more opportunities to move product between ports, and companies are likely to have higher quantities of finished product stock available in country compared to operation with a refinery. The reduced risk of domestic disruption may be offset by increased risk from having more import supply.

Security perspective: It is likely to be product supply rather than ship availability that will limit the resupply options in the case of a disruption to Australia's domestic refining capacity. The maritime supply chain will provide significant flexibility to minimise the impact of the disruption. This flexibility is likely to increase as Australia's product imports increase.

11.2 Disruption to product supply

The scenario is a regional shortage of petroleum product. This may come about as a result of a serious refining incident (e.g. loss of a refinery in Singapore), a major disease outbreak (e.g. SARS) or a regional conflict disrupting normal supply chains (e.g. conflict in the South China Sea). The key differentiator from the previous scenario is that all Australian market participants are likely to be affected - a refinery outage in Singapore may not affect all participants in supply terms but they would nevertheless be exposed to the price impact.

Where any of these events occur, the resultant disruption is likely to see an immediate price response in the relevant product market (Asia Pacific). This in turn would open up a market price differential with other markets (Atlantic Basin, Europe), incentivising the flow of petroleum product to the Asia Pacific (and perhaps incentivising higher refinery operation if capacity was not being fully utilised). Rising prices would also impacting regional demand, perhaps freeing up more stock from alternative sources.

The ability of the supply chain to respond will depend on the nature of the event and how quickly it impacts supply.

- Geo-political conflict would have a significant impact but may be more gradual in its unfolding/uncertainty as to its spread (North Asian exports to South Asia could be severely restricted) - market participants will begin to adjust their supply chains in advance of the disruption
- Short notice disruption such as refinery outages may happen quite quickly (and possibly be of limited impact in the wider Australian market).

Either way there will be product in the existing supply chains as part of normal supply but there is likely to be a lag in availability if there is a need to switch to new supply points (e.g. Middle Eastern or Indian refining system).

We would expect the maritime sector to also respond to the price signal and position itself around the alternative supply source as the market sought to put these alternative supply chains in place – shipping would follow the product.

Switching refinery supply will take time (especially as product will need to be manufactured to Australian specifications). Nevertheless disruption to local supply is a possibility and short term shipping measures may be required to ensure that remaining stock is spread as evenly as possible over the demand points while alternative supply arrangements are put in place. This might require some coordination between industry participants (perhaps involving government to minimise constraints on sensible shipping responses).

Security perspective: It is likely to be product supply rather than ship availability that will impact the resupply options. Several weeks will be required to allow the supply chain to adjust (particularly where the supply disruption happens quickly). Short term shipping measures will be necessary to enable available stock to spread over market locations while alternative supply chains are put in place.

12.0Risk of redirection

Under what scenario could Australia face an increased risk of redirection of ships en route to the Australian market to other markets? Possible scenarios could be:

- A significant/short notice disruption at a major supply location e.g. disruption to Singapore refining infrastructure; or
- Major natural event impacting product supply similar to that which occurred with Hurricane Katrina in 2005.

Again it is likely that market prices would respond to the disruption with product flows (including shipping) responding to the price signals. However redirection is more likely to be a short term response (i.e. reconfiguring existing supply plans to meet the short term need while alternatives are put in place).

There are a number of factors to be taken into account by suppliers before taking these kinds of actions including:

- Impact on the local market;
- The ability to source alternative product within Australia;

- Product quality of the available product – it may not be possible to redirect product quality manufactured for one country to another;
- Product cargo profile – multi-product cargoes may not be able to be absorbed within the supply infrastructure of the alternative market as the complexity of making the adjustment would be too great;
- The impact of any changes on subsequent supply plans, including cost (this would be a significant impact given Australia's geographic location);
- The need to make regulatory authorities aware in case the disruption cannot be handled with the typical flexibilities of the supply chain raise;
- Reputational risk; and
- Contractual obligations.

From this perspective there are a significant number of challenges involved in simply redirecting, particularly if the consequences are likely to be severe.

There are also commercial and regulatory difficulties. As discussed in Section 8.3, IOCs will typically pass title and risk to the local affiliate, most probably at time of loading; the Australian affiliate will be the owner of the cargo. In this case any requirement to redirect will require agreement of the local affiliate to relinquish the cargo and enter into a transaction for the sale and purchase (including steps needed to pass title such as endorsement of title documents, Bill of Lading, etc.) including (presumably) a price as the market may have moved between when the cargo was loaded and when the subsequent transaction is agreed.

Where supply is on a delivered basis (title and risk pass when the cargo is delivered) this provides some greater flexibility but raises questions about the commitment to supply and what that means for the supplier's reputation if redirection resulted in a breach of contract for supply.

From this perspective, redirection would seriously interfere with or undermine the normal commercial processes supporting the supply chain and raise risks for the local affiliate (reputational and tax, if the transaction raised transfer pricing issues).

This raises a question whether a company would engage in redirecting a cargo without some justified or legal support from the relevant jurisdiction in the market it is operating. An example would be where as an IEA member, Australia responds to a call from the IEA to allow product to be redirected, enabling cargoes to be redirected.

Ultimately, under legislation (*Liquid Fuel Emergencies Act 1984*) the decision would be the Government's to make. Without that, the practical issues and the risks associated with the transaction suggest that companies would need to think very carefully before acting in a unilateral way.

Security perspective: While a scenario can be developed which contemplates redirection of cargoes committed to Australian supply chain, the practical, commercial, legal and reputational issues associated with such an act would present a significant challenge to a company taking action of that kind. It is likely a company would seek some support for doing so, possibly in the context of an IEA directed response to a supply event.

Monitoring of the way in which contracting petroleum was undertaken would provide a measure of whether commercial arrangements were being constructed with that purpose in mind. If the Australian market was to move toward more delivered sales (rather than FOB), the constraint on redirecting cargoes is reduced as the Australian company is yet to take title.