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Infrastructure Australia and the National Transport Commission

Background Paper 5 for the NPS

"The possible future market challenges for relevant ports"

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1. Introduction

This background paper, one in a series to help inform the development of the National Ports Strategy (NPS), presents views on forecasting, identification of possible nationally significant ports and cargoes, and possible scenarios of long-term future market challenges for national ports in Australia. Scenarios of the future are used for some key relevant cargo-sectors, which allow for the identification of possible port system infrastructure requirements (or the equivalents thereof) at a high-level and what this may mean for land use planning. There is also discussion of increases in port system productivities which are considered the priority method of matching capacity to demand ahead of constructing new physical infrastructure.

This background paper number five, entitled "The Possible Future Market Challenges for Relevant Ports", may be used as a reference document for stakeholder and general public review of the draft NPS document jointly released for comment by Infrastructure Australia and the National Transport Commission.

2. The approach to forecasting

2.1 Context within a national ports strategy and long-term planning

Forecasting, and the monitoring of actual performance to forecasts, has an important role to play in informing the national ports strategy and the decisions regarding the long-term planning and actioning of the national ports system.

This 'strategic' use of forecasting over future time horizons out to 25-50 years allows insights to be obtained as to what could possibly happen if certain future scenarios unfold. In particular, with the use of consistent national forecasts, the timely monitoring of actuals, and identified port system capacity constraints, early warnings can be obtained of when actions in plans need to be undertaken to successfully meet a looming future situation and which of the identified strategic options are best to be used by governments in terms of the national interest.

This applies equally to both the capital city container sector, and the mineral- and energy- based bulks sector. The difference between the two sectors is largely one of complexity – the metropolitan container sector having more landside connections and multiple cargo-owners each with their own door-to-door supply chains, compared with bulk mineral ports often operated as part of a vertically integrated supply chain which includes associated landside (rail) connections (particularly in Western Australia).

For example, a port master or land use plan with a typical ten-year planning horizon may show that there is sufficient capacity to handle forecast freight demand in low to high scenarios, but just beyond the ten year horizon this is not the case. If there is no possibility to expand existing facilities this will trigger decisions on two possible expansion options – a new green-field port at some distance, or the use of capacity at one or more existing neighbouring ports. The earlier this is picked up and signalled through longer-term forecasting and ongoing monitoring the better, given that projects can take five to ten years from planning to start of operation.

2.2 Forecasting the long-term future

2.2.1 Time horizons

Port infrastructure, such as berths, cargo storage areas and shipping channels, typically has useful lives of up to fifty years or even more in the case of channels. Reflecting on the world, trade, ports and shipping fifty years ago shows us that the world in fifty years time will be for sure a very different place (fifty years ago, for instance, there were no containerships). The challenge of the long-term future is all about understanding and monitoring the triggers of change, having the ability to adapt, planning for the change ahead of time, and being ready for the new situation when it actually occurs. This applies equally to the world of port infrastructure and the connecting landside freight networks exposed to underlying global and domestic growth-drivers, which tend to generate 'boom/bust' cycles of varying sizes and durations.

2.2.2 Forecasting accuracy

In general, the accuracy in forecasting the future declines significantly as the planning horizon increases beyond five to ten years – which is to be expected.

A good example is the BITRE[1] (then BTE) paper (WP14.3) from 1994, which assessed the adequacy of Australia's seaports infrastructure by forecasting demand over the next twenty years:

- Container demand for the five main container ports was projected to reach 2,647,300 TEU[2] in 2014/15 from a 1995/96 base of 1,734,300. In reality, it already reached this level in 1999 and is currently around 6 million TEU, more than double the 2014/15 projection
- The growth assumptions for the container trade included the projection that exports would grow faster than imports (i.e. exports 2.2-5.6% per year and imports 0.6-1.8% per year). This appears not to have foreseen the outsourcing of consumer goods production to Asia (notably China) and the positive impacts of free-trade agreements with Asia
- In terms of the bulk sector analysed in the paper, the port of Newcastle, a mainly coal export port, was projected to have a throughput of 75 MT in 2014/15 based on an annual growth rate of 1.6%. In 2008/09, some six years earlier than 2014/15, the port of Newcastle achieved an actual throughput of 95 MT.

Another example is the forecasts made in the 2003 Sydney Ports Corporation Port Botany Expansion Study. These forecast Sydney container throughput increasing to 1.9-2.5 million TEU in 2018/2019 (based on low/medium/high growth scenarios). In 2008/2009, Sydney container throughput has already reached 1.8 million TEU. Based on current trends, projections with a 7% annual growth rate suggest that the throughput is more likely to be around or exceeding 4 million TEU in 2018/2019.

2.2.3 Understanding the drivers of demand

It is accepted that forecasts will always be inexact, particularly as time horizons increase. However, quite often, forecasts appear to be extrapolations of past trends without a full understanding of the drivers of demand, or their relative values, and how these can change with the possibility of new ones also emerging in the future.

For instance, the drivers of port import container demand are different to port export container demand, which are again different to port iron ore export demand. To what degree will increased population in Australia increase container import demand, or when will China become a developed country with significantly less demand for iron ore?

A more robust forecasting methodology which understands the drivers of demand, and attempts to place relative values along with risks of change on them, is recommended for assessing the needs and adequacy of port- and related- infrastructure with long term economic lives.

2.2.4 Forecasting and planning using future scenarios

As the world becomes increasingly populated (Australia projected to be at 36 million by 2050) and demand for land, conventional energy and production resources increases, constraints will, sooner or later, play their part in shaping the future in fifty years time.

Combined with this, will be the increasing impacts on the environment of continued world population growth and desired per capita consumption increases leading to a likely need to have to mitigate and

[1] BITRE means the Bureau of Infrastructure, Transport and Regional Economics (a commonwealth government unit).

[2] TEU means Twenty-foot Equivalent Units of containers.

adapt to these impacts – if not, then the world future scenario in fifty years time may well be very different again.

The best that can be said of the long-term future is that it will be very different from now and may, or may not, be driven by a combination of one or more possible dynamics such as unconstrained economic growth versus the applied use of demand management; climate change resulting in relocation of food production areas; declining oil supplies and the need to switch to an alternative mix of energy supplies; current technologies being replaced by new ones; or consumption based on localised production and the re-use of resources. It may or may not be the case that certain heavily-impacting resources, as deemed by society and governments, will be taxed in ways which limit or reduce there production with the focus on developing more acceptable alternatives.

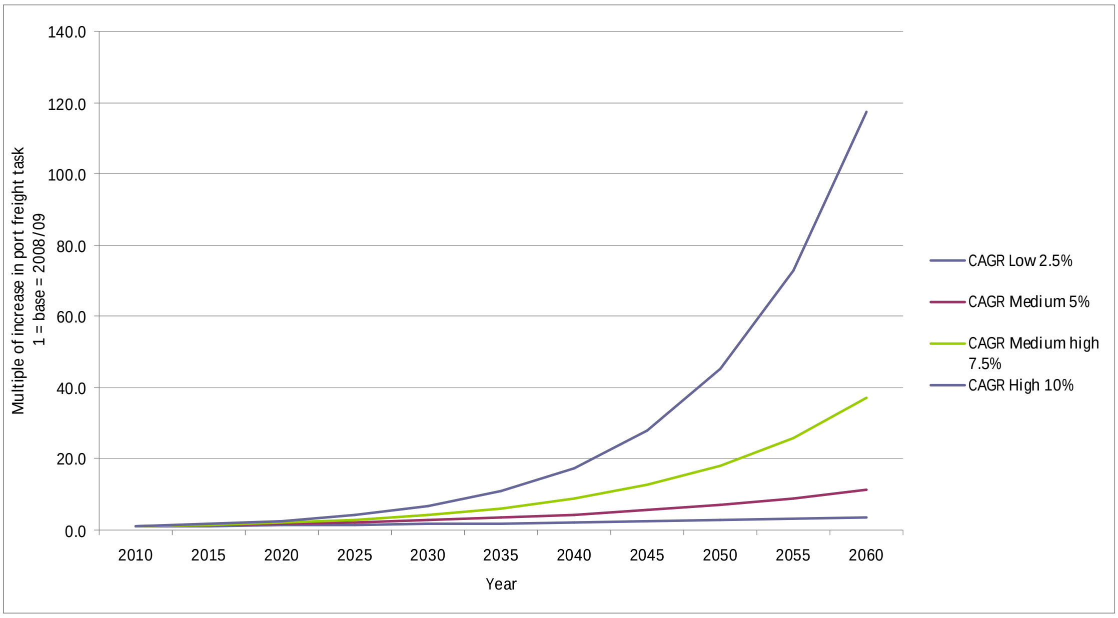
Understandably, there have been very few attempts in the past to forecast future freight markets 25-50 years out and, in our opinion, it has now become even harder given the possible factors just discussed.

The key response to this future challenge is '**fast reaction and adaptation**' using scenario planning as a preparatory tool allowing the identification of possible options and the required decision-making. Each scenario of the future should include robust forecasts which take account of changing values of the drivers of demand.

2.3 Impact on port demand of typical compound trade growth rates

It is very useful to set the future scene by understanding the level and timing of impacts on the port freight task of varying compound trade growth rates (including typical business-as-usual growth). Figure 1 shows the impacts going out 50 years.

Figure 1 Impacts on the port freight task of varying trade growth rates



The main generic messages from Figure 1 for infrastructure planning at the national-level are that:

- A compound annual growth rate (CAGR) of **7.5%** will lead to a **doubling** of the port freight task every **ten years**
- A typical business-as-usual trade CAGR of 5.0-7.5% will increase the port freight task by around 3 to 6 times in 25 years and 12 to 37 times in 50 years
- A low trade CAGR scenario of 2.5% will only increase the port freight task by around double in 25 years and triple in 50 years
- A high trade CAGR of 10% will increase the port freight task by 11 times in 25 years and 117 times in 50 years.

In practice, these increases in demand do not fully translate into the same increases in new infrastructure. Increases in the productivity of existing infrastructure will partly offset the need for matching new capacity. Increases in port system productivities often occur as intermittent step-changes as investments in new transport systems and economies of scale are made (for example, containerisation, bigger channels for larger ships, quicker and more cargo-handling systems per ship using new technology, and land transport systems carrying more cargo per trip and quicker).

Smaller more regular increases in port system productivities are often made as efficiencies in the processes around the port system and interfaces with land transport systems are realised (i.e. introduction of improved information systems, harmonisation and introduction of one-time-only processes, etc.).

However, it is clear that, based on past trends, increases in the productivity of existing infrastructure are generally not able to fully cater for the increases in trade demand meaning that there is often a requirement for new infrastructure.

3. The role of increasing port system productivity

3.1 Context within a national ports strategy and long-term planning

Increasing the productivity (or efficiency) of the port system[3] is a strategic priority.

The productivity of the port system also affects the international competitive position of Australian exporters when supplying overseas markets:

- Competition with Brazil in the North Asia iron ore market - the Brazilians/Japanese importers are now deploying 320,000 tonnes deadweight / 21 metre draft ships versus typical 150,000 tonnes deadweight ships used at the Pilbara ports
- Competition with Europe/North America in the Asian agricultural products market – the size of containerships typically used on Europe/North America trades to Asia is two to three times larger than those in the Australia trades.

Similarly it affects the cost of overseas manufactured products (mainly from Asia) for the Australian consumer (i.e. consumer buying power) moved through Australian ports. Both of these export and import effects have multiplier impacts for the Australian national economy.

Improving productivity also provides the most desirable solution to increasing port capacity with the least expansion of the port footprint into possible urban areas, while minimising the incremental negative impacts on the surrounding environment.

Any national ports strategy should have as its first priority for meeting the future requirement of increased capacity increasing the productivity of the port system through focussed planning and encouraging investment for efficiency gains (helped by planning stability and transparency). This is particularly applicable to alleviation of land network interface bottlenecks.

A desirable goal would be to plan for a realistic target share of any future requirement to increase port system capacity to be met through increased productivity in the existing port system. This would help reduce the capital required to keep up with increased market demand, as well as minimise land use and the negative impacts on the environment of new port infrastructure.

3.2 The drivers of increased port system productivity

The major port systems are effectively international supply chains connecting overseas ports (markets) with Australian ports which in turn connect (interface) with road, rail and pipeline networks to distribution centres/warehouses, factories/production facilities, refineries/processing facilities, agricultural storage facilities, and mines.

Layered on top of this physical supply chain are transactional processes which can impact on the efficiency of the physical supply chain.

Each component (leg or node) of these international port supply chains and any one of the multitude of transactional processes can be the limiting factor of the overall capacity of the port system.

It would be wrong to assess the ultimate capacity or capability of a port system by just analysing one part of the system and expanding/improving just that one part – for instance, investing in doubling the quay

[3] The port system is defined as covering both the marine- and land- side network interfaces,

handling speed of cargo to cater for increased cargo demand would be ineffective if the landside transport system cannot reduce congestion/eliminate bottlenecks by increasing its productivity or capacity by a similar amount.

Port system productivity is dynamic and where the limiting factors (bottlenecks) occur can change in time as parts of the system change either through direct effects or indirect effects caused by using shared infrastructure. Examples of the drivers or constraints of port system productivity include:

- Overseas port constraints limit the size of ships calling at the Australian port
- Maritime approach channels, depth alongside quays or quay lengths at the Australian port limit the size of ships calling at the Australian port[4]
- A lack of cargo-handling equipment or high-technology fast cargo-handling equipment limits
- The size of port cargo storage and assembly areas (on- and off- dock) or lack of availability of land to expand
- Poor interfaces, bottlenecks, congestion and low productivities of the connecting rail and road networks and/or the land transport modes themselves (freight trains and trucks)
- Lack of coordination, planning and timely information exchange of shared supply chains by cargo-owners (particularly at common-user facilities)
- Lack of one-stop, advanced/smart port community information systems and the need to meet regulatory processes earlier in the supply chain
- Work practices and mismatched hours of operation along the supply chain
- Government policy settings (or the lack thereof) on the required share of land transport modes, dedicated land freight infrastructure (including pricing), and operational regulations (noise, light, weight, etc.)

What is needed is to adopt a 'whole-of-supply-chain' approach to port system planning for both the container and bulk sectors. This will allow productivity improvements in each element of the system to add up to an overall cumulative increase in system efficiency.

[4] It may limit the size of vessels calling at other Australian ports if ships have part loads for different ports / areas of Australia. A recent example is the limit of the depth of the channels at the port of Melbourne placed on the size of large containerships calling at the other Australian capital-city ports on the same voyage: this had an economic opportunity cost for both the Victorian state and the Australian nation.

4. Relevant ports and cargo-sectors

4.1 Current national port throughput

The national port throughput in the financial year 2008/2009 was around 815 million tonnes of cargo (as reported by Ports Australia – see Table 1). Around 85% of this total throughput comprised exports. The current financial year (2009/2010), even with the impacts of the Global Financial Crisis, is expected to see the total throughput increase to levels of around 850-875 million tonnes. The statistics of Ports Australia appear not report upon the Western Australia iron ore export port of Port Walcott (Cape Lambert) which is believed to be exporting around 55 million tonnes of iron ore, or the Queensland port of Weipa which is handling around 13 million tonnes of bauxite shipped to domestic refineries around Australia. This would suggest that the 2008/2009 national total is closer to 880 million tonnes (of which 87% exports) with the current financial year likely to be in excess of 900 million tonnes.

Table 1: Australian national port throughput, 2008/2009

Port Throughout in 2008/2009 (Mass Tonnes)			
	Imports	Exports	Total
New South Wales			
Eden (NSW Maritime Authority)	447	1,198,725	1,199,172
Newcastle Port Corporation	3,027,138	92,812,719	95,839,857
Port Kembla Port Corporation	7,329,944	17,063,783	24,393,727
Sydney Ports Corporation	20,304,032	7,449,990	27,754,022
Yamba (NSW Maritime Authority)	4,709	11,293	16,002
New South Wales total	30,666,270	118,536,510	149,202,780
Victoria			
Geelong Port	6,611,000	3,000,000	9,611,000
Melbourne Port Corporation	17,361,276	11,740,863	29,102,139
Port of Hastings	1,154,509	1,499,326	2,653,835
Port of Portland	1,274,426	1,605,392	2,879,818
Victoria total	26,401,211	17,845,581	44,246,792
Queensland			
Abbot Point (PCQ)	0	14,443,487	14,443,487
Cairns Port Authority	653,005	433,470	1,086,475
Cape Flattery (PCQ)	0	1,483,250	1,483,250
CQPA (Port of Gladstone)	16,341,644	62,807,632	79,149,276
CQPA (Port of Rockhampton)	110,258	117,828	228,086
Hay Point (PCQ)	0	82,449,664	82,449,664
Karumba (PCQ)	2,714	1,007,489	1,010,203
Lucinda (PCQ)	0	598,955	598,955
Mackay Port Authority	1,013,083	1,391,443	2,404,526
Mourilyan (PCQ)	0	648,521	648,521
Port of Brisbane Corporation	16,428,346	15,466,386	31,894,732

Quintell Beach (PCQ)	2,181	268	2,449
Skardon River (PCQ)	0	0	0
Thursday Island (PCQ)	80,552	0	80,552
Townsville Port Authority	4,767,034	4,317,787	9,084,821
Queensland total	39,398,817	185,166,180	224,564,997

South Australia			
Klein Point	0	1,425,748	1,425,748
Port Adelaide (Flinders)	5,233,979	4,485,631	9,719,610
Port Giles (Flinders)	0	326,593	326,593
Port Lincoln (Flinders)	169,408	1,265,418	1,434,826
Port Pirie (Flinders)	407,272	304,296	711,568
Thevenard (Flinders)	0	1,999,638	1,999,638
Wallaroo (Flinders)	37,784	549,241	587,025
South Australia total	5,848,443	10,356,565	16,205,008

Western Australia			
Albany Port Authority	144,368	4,024,311	4,168,679
Broome Port Authority	176,481	0	176,481
Bunbury Port Authority	1,538,472	11,738,777	13,277,249
Dampier Port Authority	702,239	140,121,508	140,823,747
Esperance Port Authority	501,465	9,455,264	9,956,729
Fremantle Port Authority	12,544,526	14,058,167	26,602,693
Geraldton Port Authority	294,533	7,361,588	7,656,121
Port Hedland Port Authority	1,008,866	158,381,794	159,390,660
Western Australia total	16,910,950	345,141,409	362,052,359

Tasmania			
Bell Bay (TasPorts Pty Ltd)	1,598,150	3,105,090	4,703,240
Burnie (TasPorts Pty Ltd)	1,291,548	2,874,826	4,166,374
Devonport (TasPorts Pty Ltd)	1,327,270	1,865,337	3,192,607
Hobart (TasPorts Pty Ltd)	1,068,036	1,722,995	2,791,031
Tasmania total	5,285,004	9,568,248	14,853,252

Northern Territory			
Darwin Port Corporation	1,255,314	2,519,324	3,774,638
Northern Territory total	1,255,314	2,519,324	3,774,638

Grand National Total	125,766,009	689,133,817	814,899,826

Source: Ports Australia (website), 2009

Ports generally fall into three categories reflecting the cargo sectors serviced and their geographic locations, namely:

» Bulk (mainly single commodity) export ports

» Capital-city metropolitan (mainly container) ports

» Mixed cargo sector ports (can be regional or capital cities).

In terms of types of cargoes (sectors) for 2008/2009, and using Ports Australia statistics, the bulks accounted for 733 MT[5] (90%), containerised general cargo for 53 MT (6.5%), and other non-containerised general cargo for 29 MT (3.5%).

Within the bulks sector, for 2008/2009, iron ore exports accounted for 284 MT (39% of all bulks), coal exports for 264 MT (36% of all bulks), bulk liquids for 72 MT (10% of all bulks), and grain exports for 19 MT (3% of all bulks).

The 53 MT of containerised general cargo for 2008/2009 represented a container throughput (volume) of 6.1 million TEU (of which 4.6 million TEU were loaded and 1.5 million TEU were empties). In terms of trade direction, 59% of the loaded containers were imports, and 41% exports.

It is also worth noting the relevance of major cargo sectors and some specialised cargoes to the national economy in terms of value (2008/09 as reported by ABARE[6], except containers and motor vehicles – estimates by BITRE/GHD):

	$ billion/year
» Containers	154 (of which exports $ 52 billion)
» Coal exports	54.7
» Iron ore exports	34.2
» LNG	10.1 (but only 15.4 MT)
» Grain exports	7.6 (but only 21.3 MT)
» Motor vehicle exports	7.5 (but only 500,000 tonnes)
» Nickel exports	2.7 (but only 190,000 tonnes)
» Manganese ore exports	1.4 (but only 3.2 MT)
» Zinc concentrate	0.9 (but only 2.1 MT).

There are also other specialist sectors, such as cruise shipping, which comprise relatively few port calls compared with bulk vessels, but contribute a not-insignificant value to the national economy.

4.2 Relevant ports

A port's relevance to the national ports strategy and nation is deemed to be more than just the level of cargo tonnage throughput (quantity) but extends to include economic and strategic relevance to the nation, both current and in the future.

Using this broad definition (covering tonnage, economic and strategic), a possible list of six relevant cargo sectors emerges:

- Iron ore exports (part of bulks)
- Coal exports (part of bulks)
- High-value mineral and agricultural exports (part of bulks)
- Containers - exports and imports

[5] MT means Million Tonnes of cargo.

[6] ABARE means Australian Bureau of Agricultural and Resource Economics (a commonwealth government unit).

- Liquid bulks – in particular crude oil, petroleum products and LNG (part of bulks)
- High-value specialised – in particular rolling cargoes (vehicles), project cargoes, and cruising.

4.3 A possible current list of relevant cargoes and ports

Based of the broad definition of relevance, and a port throughput filter of 200,000 TEU per year for containers or a total port throughput of 5 MT per year, a possible current list of relevant ports could be as follows:

State/Port:	*Type*	*Cargo sectors*	*2008/2009 (MT)*
1. WA – Port Hedland	Bulk export	Iron ore	159
2. WA – Dampier	Bulk export	Iron ore	141
3. WA – Port Walcott	Bulk export	Iron ore	55 (est.)
4. WA – Fremantle	Capital city/mixed	Containers & others	27
5. WA – Geraldton	Bulk export	Iron ore/hi-value bulks	8
6. WA – Esperance	Bulk export	Iron ore /hi-value bulks	10
7. Qld. – Hay Point	Bulk export	Coal	82
8. Qld. – Gladstone	Mixed	Bulks & others	79
9. Qld. – Brisbane	Capital city/mixed	Containers & others	32
10. Qld. – Abbot Point	Bulk export	Coal	14
11. Qld. – Weipa	Bulk outbound	Bulk (bauxite – domestic)	13 (est.)
12. Qld. – Townsville	Mixed	Bulks & others	9
13. NSW – Newcastle	Bulk export/mixed	Coal & others	96
14. NSW – Sydney	Capital city/mixed	Containers & others	28
15. NSW – Port Kembla	Mixed	Bulks & others	24
16. Vic. – Melbourne	Capital city/mixed	Containers & others	29
17. Vic. – Geelong	Mixed	Bulks & others	10
18. SA – Port Adelaide	Capital city/mixed	Containers & others	10
19. Tas. – Bell Bay	Mixed	Containers & others	5
20. NT – Darwin	Mixed	Bulks & others	3 (increasing)

This possible current list of 20 relevant ports represents some 95% of the 2008/2009 national port throughput (with Port Walcott and Weipa included).

4.4 Future cargoes and ports of relevance

There are a number of cargo sectors which are set to significantly expand in the coming years which have already lead to planned new ports and expansions of existing (minor) ports.

The LNG sector (bulk liquids) will see new LNG terminals/ports being developed in NW Australia and Queensland which will be of relevance.

The iron ore sector in WA will see the port of Oakajee as a new port of relevance, as well as a further new Pilbara port, together with iron ore expansions at the SA port of Port Bonython and/or elsewhere in the state.

In the long-term, the Pilbara in WA may possibly see the need for a metropolitan-style container port as the area is developed and the population (with urbanisation) increases.

5. National outlook for the container sector

5.1 Background

The container sector is primarily driven by international imports of consumer goods and inputs for local production with the lesser export component dependent upon Australia's international competitive position for global products and levels of agricultural production.

This imbalance in import and export containers means that significant volumes of empty containers have to be exported from Australia back to major overseas shipping hubs (most often in Asia).

Coastal (domestic intra- and inter- state) containers currently play only a minor part in the overall container sector (two domestic trades of note are the Bass Strait container trade to/from Tasmania, and the East-West container trade to/from Western Australia).

The main complication with containers is their proximity to metropolitan areas and the requirement for import containers to be transported to nearby distribution centres (the majority of import containers go to destinations within 50 kilometres of capital city ports).

This means container freight has to contend with the increasing use of the existing road and rail networks in metropolitan areas for both personal transport and domestic freight (typically port container freight represents less than 5% of all traffic on key road highways in capital cities with ports).

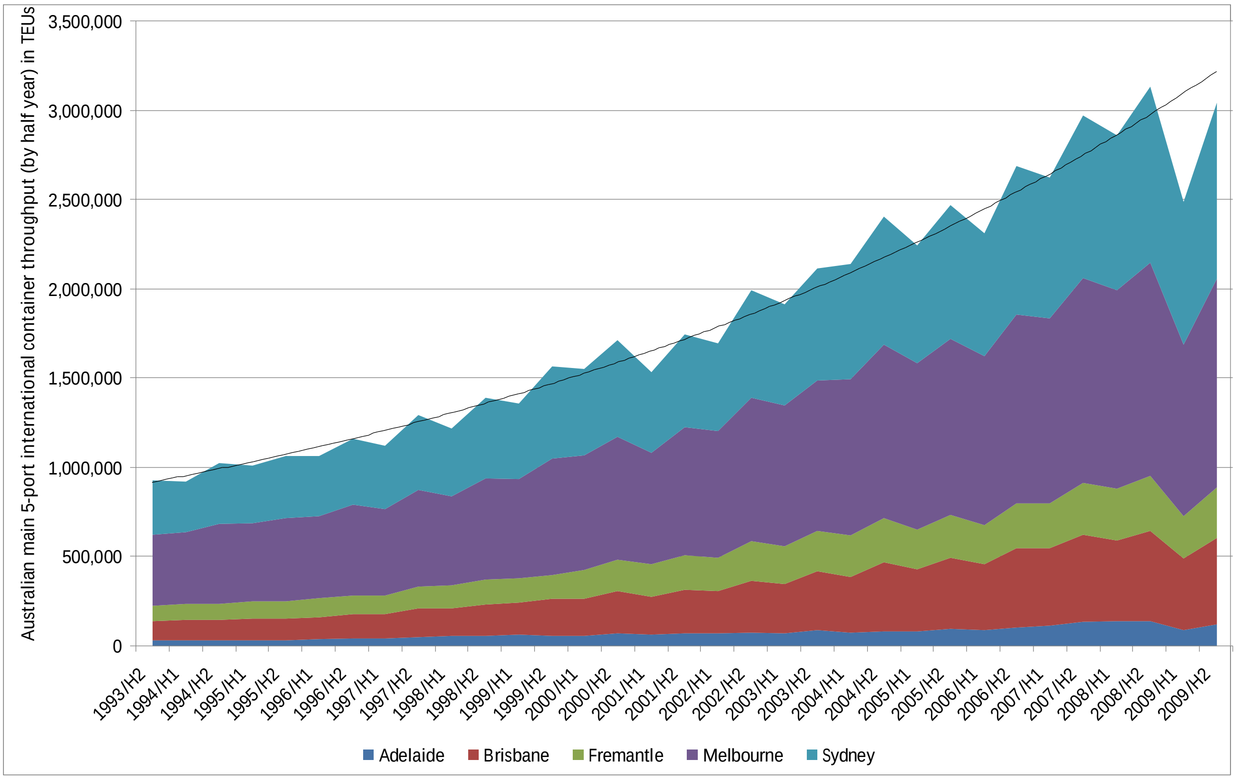
Conversely, export containers are often originating in regional areas of Australia. Both empty containers from the port to the region where they are required for loading and the loaded export containers returning to the port have to pass through metropolitan areas to connect with the main capital city container ports.

5.2 Past trends

International container trade at Australia's five main capital city ports (Brisbane, Sydney, Melbourne, Adelaide, and Perth/Fremantle) has increased from a combined 1.9 million TEU of containers in 1993/94 to a current combined level of around 5.5-6.0 million TEU of containers, representing an average national CAGR of around 6.8% over the previous 15-year period (if the global financial crisis in 2009 is excluded then the CAGR for the 14-year period from 1993-2008 rises to 7.8%).

Figure 2 shows this development in terms of six-month container throughput numbers as well as the relative market shares of the combined total of each of the five main ports.

Figure 2 Development of the main 5-port container throughput (six-monthly), 1993-2009



Source: Industry data / analysed & graphed by GHD Meyrick

It is also interesting to note that there are repeated annual seasons and some capital city container ports have grown at different rates in differing periods to others (growth in Brisbane and Fremantle has been particularly robust), but the general long-run historical trend at the national-level remains the same. The GFC[7] of 2009 has provided some limited breathing space in capacity requirements (current levels are only now reaching pre-GFC levels of 5.5 million TEU of containers per year).

If there had been no GFC and growth had continued at historic levels then the current level of annual throughput would be around 6.3 million TEU of containers.

5.3 Possible future market scenarios and capacity requirements

The boundaries of the possible future combined international container task for the five main capital city ports are summarised as follows:

- A **continued long-run business-as-usual CAGR of around 7.5%** will **double** the port international container task to just over 11 million TEU of containers by **2020**, and in 25 and 50 years time the port international container task will multiple by around **6,** and **37** times respectively to levels of around 35 and 212 million TEU of containers respectively
- A **low CAGR of 2.5%** will increase the port international container task by **1.2, almost 2** and **over 3** times in 10, 25 and 50 years time respectively to levels of around 7, 10 and 19 million TEU of containers respectively

[7] GFC means the Global Financial Crisis.

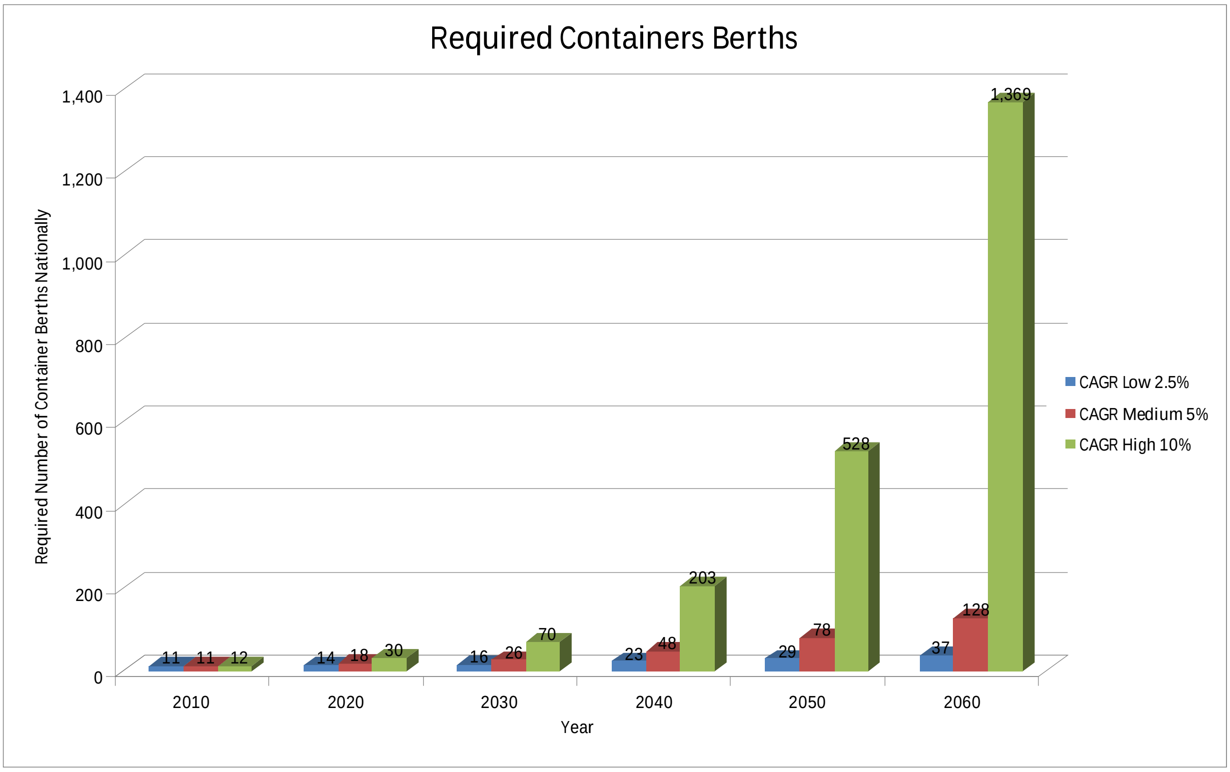
» A **medium CAGR of 5%**, which is less than the historic long-run average, will increase the port international container task by **1.6, over 3** and **11** times in 10, 25 and 50 years time respectively to levels of around 9, 19 and 64 million TEU of containers respectively.

A better understanding and ongoing monitoring of the underlying drivers of port container demand will help improve planning for possible future impacts of change, i.e. the constraint of Australia's population growth on import consumption demand, possible implementation of demand management policies, possible increased use of coastal shipping in the light of increasing inter-state land network congestion and/or changing origins of products.

The requirements for future national container port infrastructure will be determined by a combination of projected future container port productivities and the future port container task.

Figure 3 shows how many container berths nationally will be required assuming different container task growth levels and a constant average berth productivity of 500,000 TEU of containers per year (a typical container terminal would consist of two berths so that the number of terminals should be half the numbers shown in the figure, i.e. an assumed two-berth container terminal productivity of one million TEU of containers per year).

Figure 3 Possible future required number of container berths, 2010-2060



The indicative messages from Figure 3 for national container port infrastructure, with the assumed constant container berth productivity, are that:

- A continued long-run business-as-usual CAGR of around 7.5% will require nationally 23 (up from 11), 69 and 424 container berths (or half these numbers in terms of two-berth terminals) to handle the national main capital city port international container task in 10, 25 and 50 years respectively
- A low CAGR of 2.5% will require nationally 14 (up from 11), 20 and 37 container berths (or half these numbers in terms of two-berth terminals) to handle the national main capital city port international container task in 10, 25 and 50 years respectively
- A medium CAGR of 5%, which is less than the historic long-run average, will require nationally 18 (up from 11), 38 and 128 container berths (or half these numbers in terms of two-berth terminals) to handle the national main capital city port international container task in 10, 25 and 50 years respectively
- On the positive side, the indicative requirements for new container port infrastructure can be reduced by any additional increases in port system productivities beyond levels of the underlying assumption of 1,800 TEU per berth metre per year.

5.3.1 Short assessment of the drivers of container demand and their future values

The drivers of past and current container demand are seen to fall into three groups:

- Domestic (consumption) and global (Asian) economic growth – also linked to population growth. The question here is will this level of growth be sustainable – it is possible that it will not be. Past world economy growth times a multiplier of 1.8-2.0 has equalled world (and Australian) container trade growth, i.e. 3.75% world economy growth has driven 8% container trade growth. A more accepted forecast is that in the long-term (next 10-20 years+), the multiplier may well drop to 1.0-1.5 or possibly less
- Containerisation of goods – this is now almost 100% and is not likely to drive container volumes in the future
- Outsourcing of production from domestic to overseas locations (Asia/China) – this trend has for the most been completed – it is likely this will not drive container volumes much further in the future.

In short, it may well be the case that long-term growth in international container demand at Australian ports will be less than the recent past due to a dampening of drivers but growth is still likely to exceed the rate of economic growth. Container volumes could possibly be boosted by an increased domestic container task through Australian ports given a long-term future scenario of more localised production.

5.4 Conclusions

It is clear that for the main capital city container ports:

- Current typical project elapsed times of up to ten years for developing major port infrastructure (including maritime channel access) caused by current multi-tiered planning regimes and approval processes makes it extremely difficult to keep up efficiently with a freight task that is doubling every ten years
- The long-term need for more container berths close to the main capital cities, and the required connecting land infrastructure, make it imperative to reserve appropriate available land and corridors (including maritime access). It will also be necessary to explore the possible use of nearby regional ports and the requirements for their connection to the land freight network, together with the possible

need for new green-field container ports and connecting land infrastructure. Most capital city container ports are planning or are busy with the next waive of expansion but the issue of location will become more acute after this

- Typically 80-95% of containers to/from the main capital city ports are transported by truck, and the viability of short-haul rail is still questionable. As a result, the anticipated long-term increase in the container task will impact the metropolitan highway networks connected to the ports. There is a need for new solutions combining increased transport productivity with possible dedicated land infrastructure to move container freight overland as quickly and efficiently as possible.

6. National outlook for the iron ore export sector

6.1 Background

Iron ore exports are the most nationally significant cargo sector in terms of tonnes handled at Australia's ports.

The iron ore market is governed by a whole-of-supply-chain approach from mine to export market and is highly competitive in terms of cost advantages of mine reserve sizes, the cost of mining, dedicated rail and port facilities, and the economies of scale in maritime transportation by using large (cape-size) bulk carrier vessels.

The Australian iron ore export market is highly linked to the economic development of China and the ability of both Australia and Brazil to keep up with Chinese demand. In the last ten years, Chinese steel production has expanded at the rate of around 25% per year driving the demand for iron ore imports. The core issue for future exports is therefore whether this will continue unabated or will it, in the longer term, be constrained by environmental factors and a maturing of the Chinese economy with less major development projects.

Australia's market share of the Chinese iron ore imports market is around 40% and this could, if it follows the trend of market penetration of the Taiwanese and Japanese markets, reach 50-60% in the next ten years. Australia's largest competitor in Brazil has the geographical disadvantage of being more distant than Australia to the key North Asian markets of China, Japan and Taiwan – Brazil, and its overseas buyers. However, it is attempting to make up for the geographical disadvantage by shipping iron ore in the world's largest bulk carrier vessels of over 300,000 deadweight tonnes.

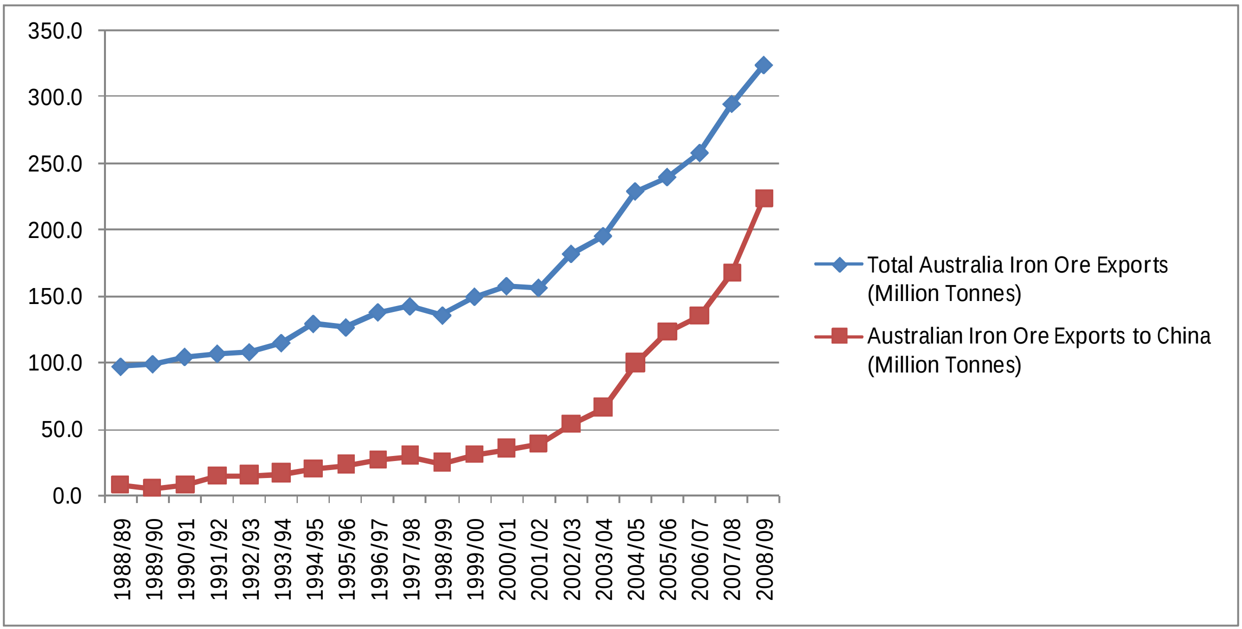
In terms of iron ore reserves, Australia is believed to have sufficient for several hundred years to come (most notably in the Pilbara region, other areas of Western Australia (WA), parts of South Australia, the Northern Territory and Tasmania). Traditionally, the WA's Pilbara has been the almost exclusive producer and exporter of iron ore, but minor reserves are now being developed and exported through other WA, NT and SA ports.

The Pilbara ports of Dampier, Port Hedland and Cape Lambert (Port Walcott) still remain as Australia's leading iron ore ports with a fourth large port of Oakajee in WA under development to cater for common-user expansion. The port of Darwin in the NT is also expanding its iron ore exports (albeit minor / niche market compared with the Pilbara) as are other ports in SA.

6.2 Past trends

In the last 20 years, Australian iron exports (using ABARE statistics) have tripled from 97 MT in 1988/89 to 324 MT in 2008/09 with records continuing to be broken at the Pilbara ports even with the advent of the GFC. Over the last 20 years, the compound annual growth rate (CAGR) has averaged 6%, but this has accelerated in the last ten years to an average CAGR of 9%. Figure 4 shows this development.

Figure 4 Development of Australian iron ore exports, 20 years (1988-2008)



Of particular significance is the role of China which now accounts for almost 70% of Australian exports of iron ore. In 1988, the Chinese share of Australian iron ore exports was a mere 8%. Over the last 20 years, Chinese imports of Australian iron ore have grown at an average annual rate of 18%, increasing to 25% over the last ten years. This increasing Chinese demand for iron ore has been the single largest driver of Australian iron ore exports in the last ten years.

6.3 Possible future market scenarios and capacity requirements

» A low CAGR of 2.5% would see iron ore exports grow to almost 500 MT by 2030 and 1,000 MT by 2060

» A medium CAGR of 5% would see iron ore exports grow to almost 800 MT by 2030 and 3,400 MT by 2060

» A high CAGR of 10% would see iron ore exports grow to almost 2,100 MT by 2030 and 37,000 MT by 2060 (the later numbers would appear in practice to be unrealistic to achieve).

In terms of required numbers of iron ore berths, assuming a constant berth productivity of 30 MT of iron ore per year, the various scenarios would result in:

» For low CAGR of 2.5%, an extra six berths by 2030 and an extra 20+ berths by 2060

» For medium CAGR of 5%, an extra sixteen berths by 2030 and an extra 100+ berths by 2060

» For high CAGR of 10%, an extra 60 berths by 2030 and an extra 1,200+ berths by 2060 (the later numbers would appear in practice to be unrealistic to achieve).

Each new berth cluster (or port) would require an equivalent multiple capacity increase of connecting inland rail infrastructure from mine to port. Depending on the ownership of the mines and government infrastructure access policy, the new port and rail infrastructure could be a combination of common- and private- user operations.

6.4 Conclusions

It is expected that the reserves of iron will not be a problem in terms of supply over the next 50 years, but it should be noted that reserves are a finite quantity which can be challenged when growth remains exponential.

However, the fundamental question will be to determine when development in China will reach a level at which iron ore demand reduces back to low growth/replacement levels. This may not occur in the next 50 years but the sustainability of business-as-usual economic growth may bring this time forward significantly.

In terms of port planning, it is clear that the long-term reservation of maritime and land access, and connecting rail corridors, for new iron ore ports and/or major expansions will be critical when dealing with future scenarios showing the possible need to expand by an extra 16-60 berths (or three to 20 ports assuming five berths per port) in the coming 20 years.

7. National outlook for the coal export sector

7.1 Background

The coal export sector is Australia's second largest bulk commodity export in terms of tonnage (after iron ore) but number one is terms of value (2008/09). Coal exports are concentrated on Australia's Eastern seaboard at NSW and Queensland ports.

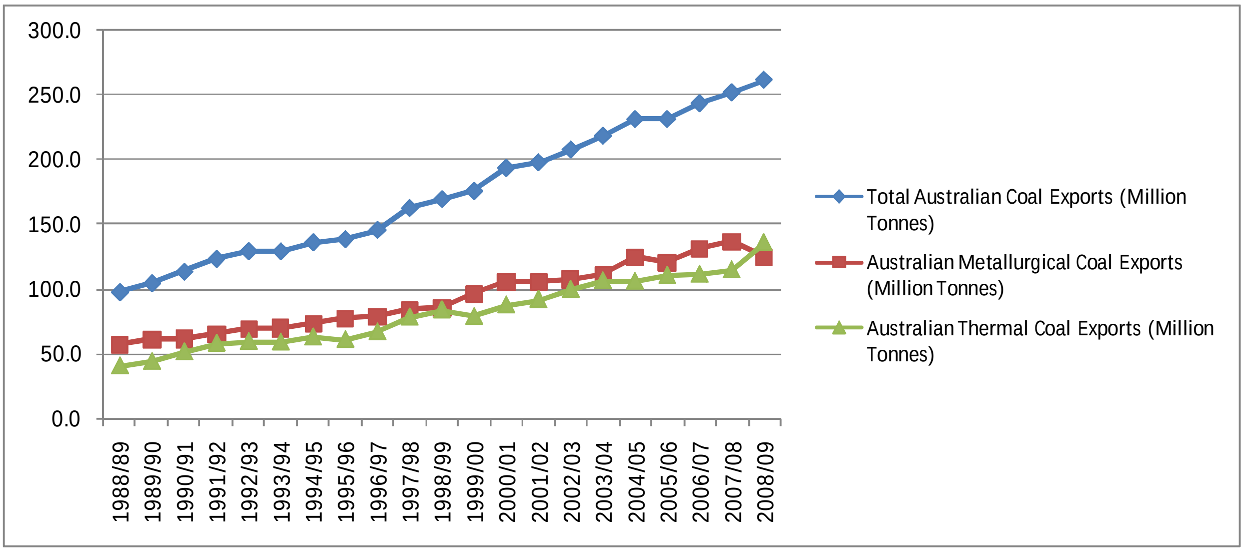
The Australian coal export sector comprises two distinct sub-markets with differing overseas clients (with the exception of Japan) – the metallurgical (or coking) coal sector used for steel-making, and the thermal coal sector used for power generation. Although there are exceptions, in general, the type of coal exported from NSW ports supplies the thermal market and the type from Queensland ports the metallurgical market. Thermal coal exports were historically slightly less than metallurgical coal exports, but this has changed recently with thermal coal exports, driven by demand from India, surpassing metallurgical coal exports.

Ships used in the Australian coal export trade are typically controlled overseas (with coal sold free-on-board) with sizes used generally varying from Panamax (50-80,000 deadweight tonnes) to Capesize (90-200,000+ deadweight tonnes). There are also ships (bulk carriers) which have been specially designed to optimise access to the port of Newcastle.

7.2 Past trends

In the last 20 years, Australian coal exports (using ABARE statistics) have more than doubled from 98 MT in 1988/89 to 262 MT in 2008/09. Over the last 20 years, the compound annual growth rate (CAGR) has averaged around 5%. Figure 5 shows this development.

Figure 5 Development of Australian coal exports, 20 years (1988-2008)



On average, metallurgical coal exports have had a 54% share of the total Australian exports with the main markets being Japan, (recently) India, and the European Union.

Thermal coal exports have had an average share of 46% of the total Australian exports with the main markets being Japan, Korea and Taiwan.

As China is the world's largest coal producer, it has not been the driver of Australian coal exports in the same way it has been for Australian iron ore exports. However, China's demand for coal has recently outstripped domestic supply, and exports to China may become more important in the future.

7.3 Possible future market scenarios and capacity requirements

The future scenarios for Australian coal exports are somewhat variable.

One scenario could see higher than previous growth driven by increasing demand from India and China.

Another long-term scenario could see thermal coal losing market share to other sources of energy production as a result of global environmental pressures and carbon emission trading/pricing.

Possible future scenarios:

» A low CAGR of 2.5% would see coal exports grow to over 400 MT by 2030 and over 900 MT by 2060

» A medium (continued) CAGR of 5% would see coal exports grow to over 700 MT by 2030 and over 3,000 MT by 2060

» A higher CAGR of 7.5% would see coal exports grow to 1,200 MT by 2030 and almost 11,000 MT by 2060 (the later numbers would appear in practice to be unrealistic to achieve).

In terms of required numbers of coal berths, assuming a constant berth productivity of 20 MT of coal per year, the various scenarios would result in:

» For low CAGR of 2.5%, an extra eight berths by 2030 and an extra 30+ berths by 2060

» For medium (continued) CAGR of 5%, an extra 20+ berths by 2030 and an extra 150+ berths by 2060

» For higher CAGR of 7.5%, an extra 40+ berths by 2030 and an extra 500+ berths by 2060 (the later numbers would appear in practice to be unrealistic to achieve).

Each new berth cluster (or port) would require an equivalent multiple capacity increase of connecting inland rail infrastructure from mine to port. Depending on the ownership of the mines and government infrastructure access policy, the new port and rail infrastructure could be a combination of common- and private- user operations.

7.4 Conclusions

It is expected that reserves of coal will not be a problem in terms of supply over the next 50 years, but it should be noted that reserves are a finite quantity which can be challenged when growth becomes exponential. However, the drivers to watch will be the future development of the Indian economy and the possible future global operation of a carbon pricing system aimed at stimulating alternative sources of energy (other than oil and coal).

In terms of port planning, it is clear that the long-term reservation of maritime and land access, and connecting rail corridors, for new coal ports and/or major expansions will be important when dealing with future scenarios showing the possible need to expand by an extra 20-40 berths (or five to ten ports assuming four berths per port) in the coming 20 years.

8. National outlook for some other bulk export sectors

8.1 Background

It is not the intention of this paper to be exhaustive in its coverage of all cargoes. However, it is worthwhile considering in short two other bulk export sectors which are relevant to the nation but for different reasons – the long established agricultural grain export sector, and the fast emerging LNG export sector.

8.2 Grain export sector

8.2.1 Past and future

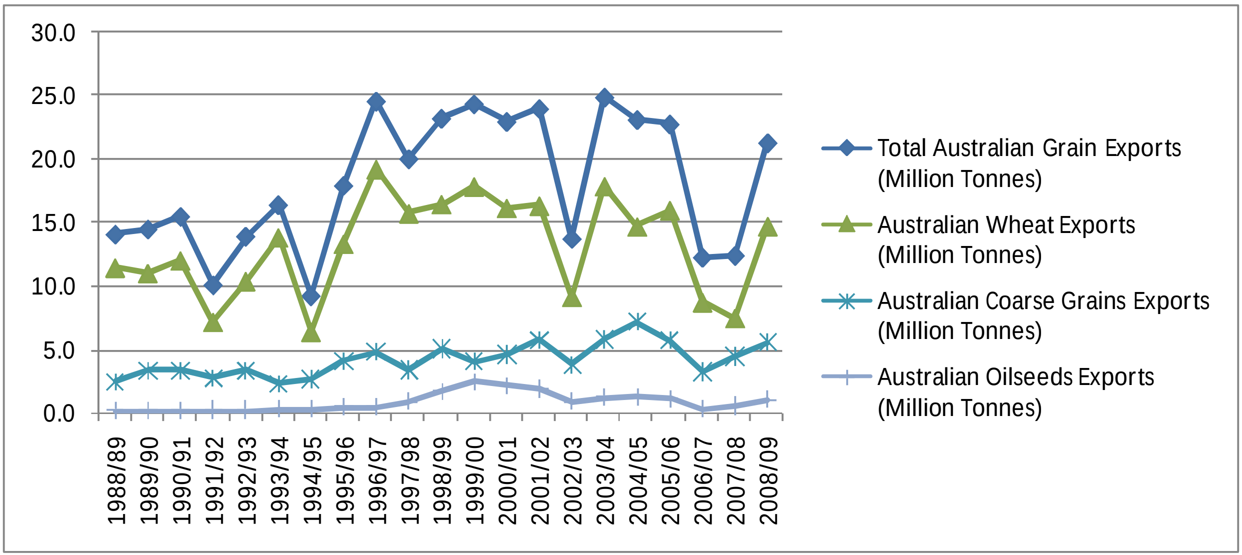
The Australian grain export sector is long established with exports, fluctuating with the level of harvests, for the last 40 years plus.

The grain export sector comprises a number of sub-sectors – wheat, coarse grains, and oilseeds. Wheat is the most important sub-sector.

The grain exports are spread around a number of ports across the country (with the exception of the Northern Territory and Tasmania). Often more than one port is called at by ships to obtain a full load prior to sailing to the export markets – the main export markets being the Middle East and SE Asia. The size of the vessels involved is relatively small – handysize (20-45,000 deadweight tonnes) and Panamax (50-80,000 deadweight tonnes) bulk carriers.

The Australia grain export sector has fluctuated over the last 20 years from lows of 9-10 MT to highs of 20-25 MT in times of plentiful harvest (source ABARE statistics). Figure 6 shows this development.

Figure 6 Development of Australian grain exports, 20 years (1988-2008)



The volatility of the Australian grain export sector, caused by differing levels of harvest through changes in climatic conditions, and its seasonality, make it hard to dedicate and efficiently use the required port and landside infrastructure (rail, storage facilities, etc.).

The future of the Australian grain export sector will be very dependent on the production side of the market, which in turn will be governed by factors such as the long-term climate situation for Australia, sustainability of soils, existence of rural farming communities, amongst other factors. On the demand side, future increases in world population, feed-stocks for cattle, and the newly emerging bio-diesel market will drive the market in grain.

If domestic grain production becomes problematic in the future in Australia, then there is also a possible scenario of the requirement for grain imports over and above historic levels which have traditionally supplemented poor domestic harvests and the increasing demand for grain as a livestock feedstuff.

8.2.2 Conclusions

Future scenarios may see Australian grain exports continuing to fluctuate around historical levels but the locations of origins and port exits may alter or be reduced. This export sector is probably one of the hardest to plan for beyond 5-10 years, suggesting a greater need for scenario and contingency planning with regard to future infrastructure requirements.

In general, it can be said that a future shortage in port capacity for the grain sector is not a significant national issue. However, there may well be a need to modernise, and improve the productivity of existing facilities (which may include some rationalisation). In addition, there may be a possibility of more grain being used domestically which would mean more shipping around the coast requiring possibly new or expanded handling and storage facilities in Australian ports not currently involved in the grain trades.

8.3 LNG export sector

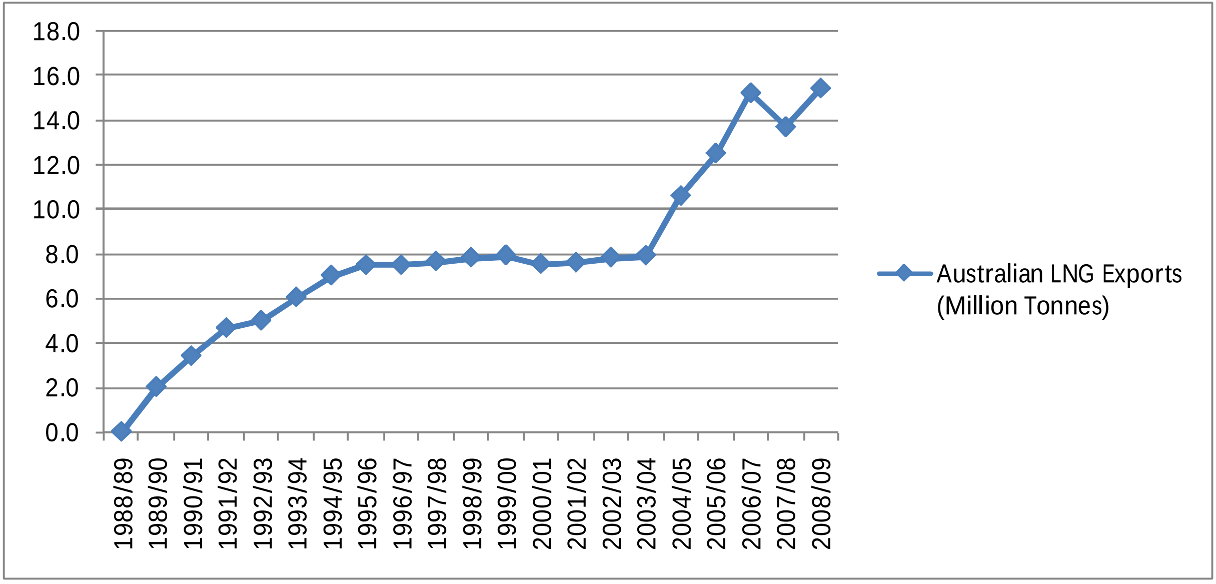
8.3.1 Past and future

The Liquified Natural Gas (LNG) export sector commenced operations in 1989 and has grown to a current (2008/09) level of around 15 MT of exports (ABARE statistics) – an average CAGR of around 11%. Figure 7 shows this development.

The gas originates offshore and is processed in facilities for export in Western Australia (Dampier) and the Northern Territories (Darwin). Asia is the largest importer of Australian LNG with a number of the key overseas oil companies involved in its production and export.

The terminals and shipping are specialised and highly capital intensive as well as requiring high levels of design safety. The levels of investments involved require long-term supply (off-take) contracts with industry owning and managing most of the infrastructure involved.

Figure 7 Development of Australian LNG exports, 20 years (1988-2008)



The world, and in particular Asia (including India), has a growing demand for cleaner energy as provided by LNG. Rapidly increasing demand, together with increased levels of exploration and the ongoing discovery of economically viable reserves, means that Australia is at a start of an unprecedented surge in LNG production.

If all the known projects are deemed technically, economically and environmentally feasible, then in the next five years alone there is the possibility of LNG production and exports increasing by an extra 130 MT[8] with new processing and export facilities required in Western Australia, Northern Territory and Queensland (Gladstone area).

Growth is typically in steps as new off- and on- shore reserves and processing facilities start producing with a typical one to two year ramp-up. A number of these new projects will include investments by Chinese and Indian resource companies who intend to secure long-term supplies. The projects in North Western Australia are in remote areas and also offer the potential for significant economic development of the region.

Growth prospects for the foreseeable future are strong. However, as with other resources, reserves are finite and there will eventually be a scenario with declining production.

8.3.2 Conclusions

The future long-term development of the LNG export sector will most likely see this sector as the leading export sector in terms of value.

It is also worth noting that the location of the gas reserves and the various proposed processing and export facility sites, together with the associated shipping channels, are often in environmentally sensitive areas which are requiring, and will require, extended and complex environmental impact assessments together with the possible need for impact mitigation strategies. These aspects will be a challenge for the sector.

[8] Source – ABARE major minerals & petroleum development projects (October 2009 listing).

With a typical berth throughput of 5 MT of LNG per year, a future scenario of say 100-150 MT of LNG exports may require some 20-30 new berths. Assuming terminals or ports having three berths, this could mean an additional 7-10 ports or new port precincts in existing ports.

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