Future Oil Supply and Alternative Transport Fuels

ABARE submission to Senate Rural and Regional Affairs and Transport References Committee Inquiry into Future Oil Supply and Alternative Transport Fuels

Background

The Senate Rural and Regional Affairs and Transport References Committee is conducting an inquiry into Australia's future oil supply and alternative transport fuels, with particular reference to:

- Projections of oil production and demand in Australia and globally and the implications for availability and pricing of transport fuels in Australia;
- Potential of new sources of oil and alternative transport fuels to meet a significant share of Australia's fuel demands, taking into account technological developments and environmental and economic costs;
- Flow-on economic and social impacts in Australia from continuing rises in the price of transport fuel and potential reductions in oil supply; and
- Options for reducing Australia's transport fuel demands.

This submission summarises key results from recent ABARE research into issues in the liquid fuels sector of the energy market, together with relevant key research findings from other organisations such as the International Energy Agency (IEA). The published research used in this submission covers issues such as the long term projections for Australia's energy production and consumption; the economic viability of alternative fuels such as biofuels; the impact of oil prices on APEC regional trade; and the costs of energy supply disruptions in the APEC region.

Projections of oil production and consumption

Australian trends

ABARE annually prepares long term projections of Australian energy consumption at both the primary and final consumption stages. Total primary energy consumption refers to the consumption of each primary fuel in both the conversion and end use sectors. It includes the use of primary fuels in conversion activities – notably the consumption of fuels used to produced electricity – as well as own use and losses in the conversion sector. Total final consumption is the sum of consumption by the different end-use sectors, the main ones of which are agriculture, mining, manufacturing, transport, commercial and services, and residential.

Liquid fossil-based fuels such as oil and refined products provide a significant proportion of the energy consumed in Australia. Consumption of these fuels has increased steadily through time as Australia's economy and population has grown, and is projected to continue to increase in the future.

At the primary energy stage, oil accounted for 34 per cent of the energy consumed in Australia in 2003-04. In its most recent set of long term energy projections released in October 2005, ABARE projects that Australia's oil consumption will increase at an average annual rate of 2.0 per cent over the period 2003-04 to 2029-30, equivalent to a rise of 66 per cent in absolute terms over the period (Akmal and Riwoe 2005). With total primary energy consumption projected to rise at an average rate of 1.9 per cent a year, oil's share of primary energy consumption is expected to remain relatively stable within Australia's primary energy mix.

At the final energy stage, refined petroleum products (largely petrol and diesel) accounted for 48 per cent of final energy consumed. ABARE projects consumption of refined products will rise by 1.9 per cent a year to 2029-30. With total final energy consumption projected to rise by an average of 2.1 per cent a year, refined petroleum products are projected to remain a large component of the final energy mix.

Australia produces a large proportion of both the oil and refined products it consumes. Self-sufficiency in these products was estimated at 78 per cent in 2003-04. Domestic oil production has been declining in the recent past, but this decline is expected to be reversed over the next few years as several new projects, principally Santos's Mutineer/Exeter project and Woodside's Enfield project, reach full production.

Beyond this, oil production will be influenced by the rate of exploration and new development, which is influenced in turn by a number of geological and economic factors, including prospects for world oil prices. Moving beyond the known projects mentioned above, crude oil production is projected to trend downward by 0.5 per cent a year on average to 2029-30. However, production of condensate (the smaller of the two main components in total oil production) is projected to trend upward by around 1.5 per cent a year, largely offsetting the projected downtrend in crude oil production and resulting in an essentially flat outlook for aggregate oil production to 2029-30.

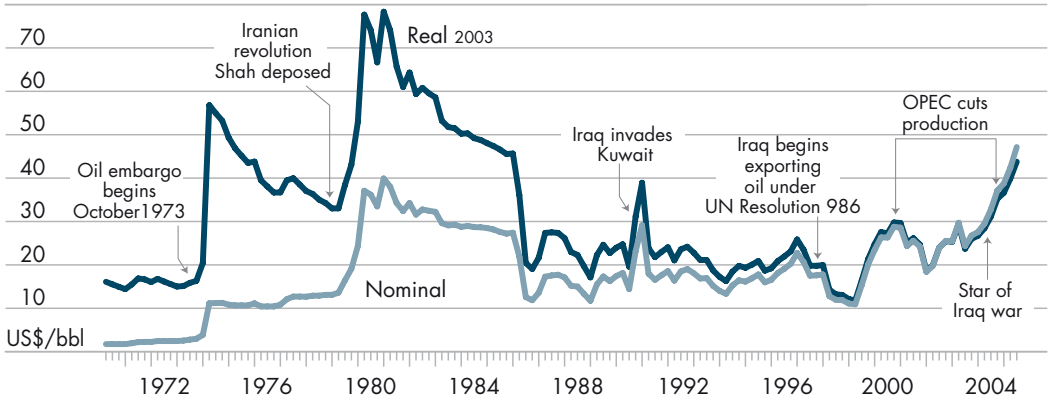
A modest rise in the output of refined products from Australian refineries is also projected over the long term. However, with domestic consumption of both oil and refined products projected to outpace domestic production, Australia's self-sufficiency in petroleum products is projected fall to around 50 per cent by 2029-30 (Akmal and Riwoe 2005).

Global trends

Global trends and prospects for energy are reviewed each year in detail by agencies such as the International Energy Agency (IEA) in its World Energy Outlook (WEO), and the Energy Information Administration of the US Department of Energy. The IEA's most recent WEO released in late 2005 draws attention to the importance of the Middle East and North African producers (referred to by the IEA as MENA) in global oil and gas markets. The dependence of the OECD countries and oil and gas importers such as China and India on MENA production is projected to grow as MENA's share in global oil production rises from its current 35 per cent to an estimated 44 per cent by 2030 (IEA 2005a).

In recent years the global oil market has been characterised by extreme tightness. This has been due in part to a lack of investment in upstream and downstream capacity. Factors such as burgeoning oil demand in China, India and the United States, problems with Russian output, declining North Sea production, Middle East tensions, and Nigerian unrest, have also played a part in pushing petroleum prices to recent nominal highs (IEA 2005b). The recent rise in world oil prices needs to be kept in perspective, however, as current trade weighted average oil

1 World trade weighted average oil price
Quarterly, ended June 2005



prices are still lower in real terms than during either of the previous world oil crises in the early to mid-1970s and the late 1970s to early 1980s (McDonald et al. 2005) (figure 1).

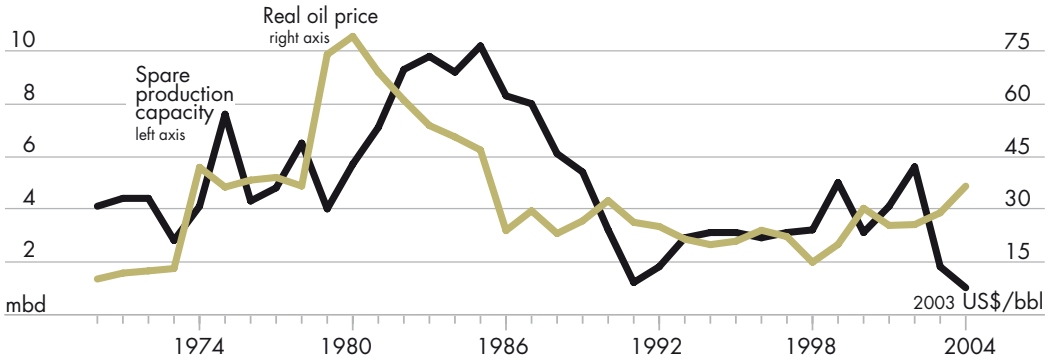
In the WEO reference scenario, the IEA crude oil import price is projected to ease from its September 2005 peak of US$65 a barrel to around US$35 a barrel (in 2004 dollars) by 2010, before rising slowly to near US$39 a barrel by 2030. The IEA considers that there is considerable upside risk in this oil price projection. To meet growing global oil demand, the IEA estimates that the countries of the Middle East and North Africa will need to invest, on average, US$56 billion a year in energy infrastructure to 2030. This would be more than twice the level of investment that prevailed during the past decade. The IEA estimates that if the new required investment in the producing countries were to be delayed, world oil prices could be closer to US$52 a barrel (in 2004 dollars) in 2030.

Noting that OPEC crude capacity is beginning to rebound after limited additions from 2001 to 2004, and that several large OPEC gas to liquids projects are expected to come on stream before 2010, the IEA expects production capacity to increase in the medium term. Annual growth of 500-700 thousand barrels a day is projected for the Caspian region, while resumed growth of 500-800 thousand barrels a day is expected from the rest of non-OPEC, centred on Brazil, Angola and Canadian oil sands. As most of these projects were initiated during the late 1990s phase of lower oil prices, the IEA suggests that it is delays in, rather than an absolute lack of, upstream investment that has been squeezing spare upstream capacity in the market since 2003. This expansion in capacity should allow world oil supply to keep pace in the next few years with growing world oil demand, which is projected by the IEA to increase at a relatively robust annual rate of 1.8 to 2.0 million barrels a day from 2007 to 2010 (IEA 2005b).

In its most recent set of detailed long term energy projections, the Energy Information Administration of the US Department of Energy explores various scenarios in which the long term real world oil price (in 2020) is projected in the range US$28.50 to US$37 a barrel (EIA 2005). The EIA considers that growth in global oil production capacity is likely to remain low in the short term, as current plans for expansion and replacement projects are forecast to just keep pace with demand. Historically, low spare production capacity has been associated with high real oil prices, and vice versa (McDonald et al. 2005) (figure 2).

In ABARE's most recent medium term commodity price projections, released in March 2006, global oil prices are forecast to remain high in 2006, averaging around US$53 a barrel in trade weighted terms and US$60 a barrel in West Texas Intermediate terms. However,

2 OPEC spare production capacity vs oil price indicators



global oil prices are forecast to average lower in 2007, mainly as a result of expected larger increases in both world oil production and spare production capacity by that time. Reflecting an assumed easing of world economic growth, growth in oil demand is also forecast to moderate in 2007. In the medium term, world oil prices, in 2006 dollar terms, are projected to decline in response to higher global oil production and a substantial increase in oil stocks by that time. In real terms, global oil prices are projected to average around US$34 a barrel in trade weighted terms and US$39 a barrel in West Texas Intermediate terms in 2011 (Kinsella et al. 2006).

In summary, market analysis by agencies such as the IEA, the EIA and ABARE suggests that adjustments to global oil demand and supply in response to the current higher oil prices are expected to result in some easing in real oil prices from current levels in the medium term.

Implications for the availability and pricing of transport fuels in Australia

Australia's consumption and production of oil is small relative to world levels and Australian producers and consumers are price takers in the global oil market. Changes in the price of petroleum products in Australia (ex refinery) mainly reflect changes in the world price of crude oil and exchange rates (Short and Riwoe 2005). As discussed above, the IEA expects world oil prices to ease from current high levels in the medium term as new OPEC and non-OPEC capacity comes on stream. Barring unexpected disruptions to physical oil supply, it would appear that Australian consumers will continue to have access to domestic and imported oil at prevailing world market prices.

Potential new Australian sources of oil and alternative transport fuels

Oil and gas

Much of Australia's current oil production is sourced from mature oil and gas provinces. However, more than half of Australia's offshore basins that show signs of petroleum potential remain unexplored. Geoscience data point to a range of frontier areas offshore that could hold substantial deposits of petroleum, including oil (Commonwealth of Australia 2004). In its most recent assessment of domestic petroleum exploration, development and production prospects published in *Oil and Gas Resources of Australia* in April 2005, Geoscience Australia proj-

ects production of crude oil and condensate from identified accumulations and undiscovered accumulations in the 'traditional' onshore and offshore basins to decline in the medium term (Geoscience Australia 2003). It is possible, however, that the higher oil prices expected to stimulate global oil exploration and development (as discussed in the previous section) could also stimulate additional exploration and development in Australia.

Aside from the continued development of offshore resources, gas-to-liquids (GTL) technology may offer another avenue of producing liquid fuels in Australia. SasolChevron has recently indicated an interest in developing a project in Australia's north west that would commence with 30-40 thousand barrels a day (bpd) from a startup plant and increase to more than 200 thousand bpd by 2015-16. If developed, a project of this type could provide more than half of projected petroleum imports in 2015-16 (Akmal and Riwoe 2005). Technology also exists to produce oil from nonconventional sources, such as tar sands and oil shales (McDonald et al. 2005).

Coal

Technologies also exist that can be used to produce liquid fuels from coal. Some countries, including the United States, Japan and China have either begun construction of coal-to-liquids plants or devoted resources to study the viability for commercialisation of such technologies. The two main technologies in this regard are direct coal liquefaction (DCL) which involves making a partially refined synthetic crude oil from coal which is then further refined into synthetic gasoline and diesel as well as LPG, and indirect coal liquefaction (ICL), which involves first gasifying coal to make synthesis gas (syngas) and then making synthetic fuels from this (McDonald et al. 2005).

Alternative transport fuels

The main alternative fuels currently used in Australia are LPG, natural gas, and biofuels such as ethanol and biodiesel. LPG currently supplies about 6 per cent of transport fuel requirements by volume and 5 per cent by energy content. The significance of LPG is that, unlike crude oil, Australia produces more LPG than is currently domestically consumed. However, other alternative fuels such as compressed natural gas (CNG) and biofuels contribute less than 1 per cent in total by volume or energy content to fuel supplies (Commonwealth of Australia 2004). Gasoline powered vehicles can be converted to run on compressed natural gas but the market penetration of CNG has been limited by factors such as the lack of refuelling infrastructure and the low energy content of CNG. Biofuels on the other hand can be used in conventional vehicles in petroleum fuel blends, in many cases with no modification required to engines.

The prospects for biofuels in Australia have recently been examined in detail by the Prime Minister's Biofuels Taskforce (Commonwealth of Australia 2005a). In its final report released in September 2005, the Taskforce concluded that current government policy settings should be sufficient to encourage biofuels production in Australia to expand to 350 ML by 2010. However, there were real commercial risks impeding the development of an operating mainstream market for fuel ethanol blends. Not the least of these was that there appeared to be almost no consumer demand for ethanol blends, other than in minor market segments supplied by independents and small market trials by the oil majors. The Taskforce concluded that consumer confidence in ethanol blends remained poor despite action by the government on labelling and regulating the maximum ethanol content in blends. The Taskforce suggested a number of actions the government could take to help build consumer confidence, including further changes to labelling, and the provision of consumer information.

An ABARE study undertaken for the Biofuels Taskforce (Short and Riwoe 2005) concluded that, given current high oil prices and the current effective excise-free status of biofuels, the production of biofuels such as ethanol and biodiesel in Australia should be commercially viable at present. However, if world oil prices were to ease in the medium term, this, along with the changes to domestic fuel taxation arrangements scheduled to take place from 2006 to 2015, could progressively reduce the commercial viability of biofuels production over the next ten years.

As noted in the Energy White Paper, the government's approach to biofuels reflects the regional and other benefits that would arise from the development of a commercially viable biofuels industry in Australia, while recognising that all fuels needs to compete on their commercial merits in the longer term. While the government has provided a policy framework under which the alternative fuels sector may develop, ultimately, biofuels will need to compete in the market on their commercial merits (Commonwealth of Australia 2004).

Economic and social impacts of high fuel prices and/or supply disruption

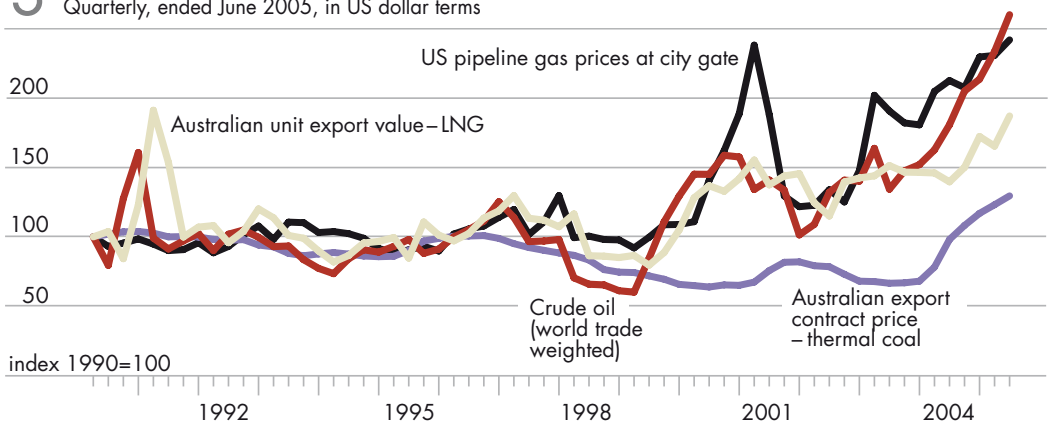
With three quarters of the petroleum products consumed in Australia used for transport, any prolonged spike in prices and/or disruption of supplies could have significant economic and social impacts. Because of the trend toward the increasing concentration of oil production in the MENA region, and the growing dependence on imported oil in the OECD and many non-OECD countries, governments are concerned about the consequences of any interruption to global oil supplies – not the least of which could be a period of sustained high oil prices. ABARE has analysed both the potential impact of high oil prices on trade in the APEC region (McDonald et al. 2005), and the potential costs of energy supply disruptions to the APEC economies (Hogan et al. 2005).

In model simulations conducted for the first-mentioned study, it was found that the gross national product (GNP) in all of the APEC net oil importing economies, including Australia, would be adversely affected if the world oil price were to remain at significantly higher levels over the period 2005 to 2010 than assumed in a reference or business as usual case in which the real price of West Texas Intermediate oil is assumed to fall from US$56/bbl in 2005 to around US$31/bbl in 2015 (in 2003 dollars). In this study it was concluded that if all other things (including other energy commodity prices) were held equal over the period and oil prices were assumed to be 30 per cent higher, Australia's GNP would average an estimated 0.8 per cent lower than in the reference case at 2010. When oil prices were assumed to be 60 per cent higher than in the reference case, GNP was estimated to average 1.2 per cent lower than in the reference case at 2010.

However historically, world coal and gas prices have moved in a similar direction to world oil prices (figure 3). When coal and gas prices were allowed to rise in the model simulations the negative impact of higher oil prices on the economy was estimated to be less than when these prices were held constant. This was because the value of Australian coal and gas exports rose, and thus offset some of the negative effect of higher oil, coal and gas prices on the domestic economy (McDonald et al. 2005).

In the second-mentioned study, ABARE analysed the impact of possible energy supply disruptions on APEC economies. The potential supply disruption scenarios examined were a three month disruption in oil production in the Middle East, a six month disruption in liquefied natural gas (LNG) production in the Middle East, and a disruption of shipping through the Malacca Strait for five weeks. In the model simulations, APEC's most oil import dependent economies

3 Energy commodity prices
Quarterly, ended June 2005, in US dollar terms



experienced the largest relative estimated declines in GNP relative to the reference case in which it was assumed that no energy supply disruption occurred, while the economies of APEC oil exporters such as Indonesia, Vietnam and the Russian Federation benefited from the temporarily higher prices that prevailed as a consequence of the supply disruptions (Hogan et al. 2005). In each of the scenarios, Australia's GNP was also estimated to decline relative to the reference case, although as in the McDonald et al. study, the decline in Australia's GNP was not as large as the declines in GNP estimated for some of the more oil-dependent APEC economies.

Options for reducing Australia's transport fuel demands

In the June 2004 Energy White Paper it was noted that Australia's heavy reliance on petroleum fuels for transport is expected to continue in the foreseeable future due to a lack of competitively priced alternatives, the long life expectancy of existing fuel production and distribution infrastructure and the fuel requirements of the existing stock of vehicles. The next generation of vehicles, which will include some hybrids, is not expected to significantly change this, and alternative transport fuels such as hydrogen are some time away from being price-competitive or ready for mass application (Commonwealth of Australia 2004).

The rate of growth in fuel consumption by the largest user of liquid fuels, the road transport sector, has eased steadily over the past thirty years, having declined from an annual rate of growth of around 5 per cent in the 1970s to its current level of around 2 per cent. However, even after factoring in an expected continued increase in the fuel efficiency of the Australian fleet, projected increases in total vehicle kilometres traveled are expected to remain the dominant driver of fuel consumption, and the road transport sector's consumption of fuel is projected to increase by an average of 1.6 per cent a year to 2029-30 (Commonwealth of Australia 2005b).

In ABARE's study on the impact of higher oil prices on the APEC economies, estimates were also made of the potential effect of the more rapid uptake of transport technologies that offer fuel efficiency advantages, including more efficient internal combustion engines, and electric or hybrid electric vehicles. In a scenario in which it was assumed that 20 per cent of new vehicles in all APEC economies were hybrids that were 40 per cent more fuel efficient than new nonhybrid vehicles, the estimated growth in total consumption of petroleum products by the transport sector in APEC in the period 2006 to 2015 was around 28 per cent, compared with 42 per

cent in the reference case (McDonald et al. 2005). While this calculation was based on very general assumptions about fuel efficiency trends and the uptake of hybrid vehicles, it does serve to indicate the significant potential for new transport technologies – even ones for which the technology is available today – to reduce fuel consumption growth in the transport sector.

On energy security in the APEC countries more generally, the APEC Energy Working Group proposed a set of longer term policy responses that any APEC country could adopt to reduce its dependence on particular transport fuels. These included researching and developing new technologies to facilitate energy exploration and production, the development of alternative processing technologies such as gas to liquid plants, the use of new technologies to increase the efficiency of energy use, and the use of new energy substitution or switching technologies to increase the flexibility of energy markets to adjust to supply disruptions. The removal of impediments to the efficient operation of energy markets was also considered important, along with government support for the collection, dissemination and analysis of relevant energy market information (Hogan et al. 2005).

Summary of main points

- With domestic consumption of both oil and refined petroleum products projected to outpace domestic production in the long term, Australia's self-sufficiency in petroleum products is projected fall from its current level of 78 per cent to around 50 per cent by 2029-30.
- The recent rise in world oil prices needs to be kept in perspective, as current trade weighted average oil prices are still lower in real terms than during either of the previous world oil crises in the early to mid-1970s and the late 1970s to early 1980s.
- Analysis by agencies such as the IEA, the EIA and ABARE suggests that adjustments to global oil demand and supply in response to the current higher oil prices could result in some easing in real oil prices from current levels in the medium term.
- Barring unexpected disruptions to physical oil supply, Australian consumers will continue to have access to domestic and imported oil at prevailing world market prices.
- Although much of Australia's oil production is currently sourced from mature oil and gas provinces, more than half of the offshore basins that show signs of petroleum potential remain unexplored, and the higher oil prices expected to stimulate global oil exploration and development could also stimulate additional exploration and development in Australia.
- Aside from the continued development of offshore resources, gas-to-liquids technology may offer another avenue of producing liquid fuels in Australia. Technologies also exist for producing liquid fuels from coal, and some countries, have either begun construction of coal-to-liquids plants or are devoting resources to study the viability for commercialisation of such technologies.
- Australia's main 'alternative fuel', currently supplying around 6 per cent of transport fuel requirements by volume, is LPG, with other alternative fuels such as compressed natural gas and biofuels contributing less than 1 per cent to transport fuel supplies in total. The government has provided a policy framework under which these alternative fuels may develop, but ultimately, they will need to compete in the market on their commercial merits.
- Research undertaken by ABARE indicates that the production of biofuels such as ethanol and biodiesel should be commercially viable at present, but expected trends in world oil prices and changes to domestic fuel taxation arrangements scheduled to take place from

2006 to 2015 could progressively reduce the commercial viability of biofuels production over this period.

- The trend toward the increasing concentration of world oil production in the Middle East and North African regions region, together with the growing dependence on imported oil in the OECD and many non-OECD countries, has increased the concern of many governments about the consequences of any interruption to global oil supplies.
- Model simulations undertaken by ABARE suggest that economic activity in the APEC net oil importing economies could be adversely affected by any significant oil supply disruption.
- The model simulations also suggested that the more rapid uptake of transport technologies that offer fuel efficiency advantages, including more efficient internal combustion engines, and electric or hybrid electric vehicles, could significantly reduce the expected rate of growth in consumption of petroleum products in the APEC economies
- The APEC Energy Working Group has proposed a set of longer term policy responses that any APEC country could adopt to reduce its dependence on particular transport fuels, which include researching and developing new technologies to facilitate energy exploration and production, developing alternative processing technologies such as gas to liquid plants, using new technologies to increase the efficiency of energy use, and substitution or switching technologies to increase the flexibility of energy markets to adjust to supply disruptions.
- The APEC Energy Working Group has also drawn attention to the importance of removing impediments to the efficient operation of energy markets, and the role of governments in supporting the collection, dissemination and analysis of energy market information.

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