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24 February 2006

The Secretary
Rural and Regional Affairs and Transport Committee
Parliament House
Canberra ACT 2600

By email: rrat.sen@aph.gov.au

Dear Sir / Madam

Re: Inquiry into Australia's future oil supply and alternative transport fuels

We are writing in response to your request for submissions to the above Inquiry.

Monash Energy Holdings Limited (Monash Energy), a wholly owned subsidiary of the major multinational resource company Anglo American plc (Anglo), owns and manages the Monash Energy Project (MEP).

The MEP is proposed as a world-scale coal to liquids plant (about A$5 billion) incorporating Carbon Capture and Storage (CCS). The project will take advantage of the location of Victoria's vast Latrobe Valley coal fields close to the high storage potential Bass Strait oil and gas fields. Monash Energy is committed to CCS to make the project acceptable to investors and the community. Monash Energy and Anglo by mandating CCS for the project are taking a lead position in achieving global sustainability.

The key technical step in the project is to demonstrate the selected combination of coal drying & gasification on Latrobe Valley coal at a commercial scale. The likely technology combination will be equally suitable as a front end to a wide range of production processes producing transport fuels, low emissions electricity, fertilisers and chemicals.

Modelling by the International Energy Agency has shown that CCS has a major role to play in reducing carbon dioxide emissions and further that coal IGCC based liquids/power cogeneration associated with depleted oil & gas fields is the most likely early implementation strategy. We believe the MEP is the only project currently proposed in Australia or elsewhere with this configuration.

Monash Energy has a unique perspective on the issues raised by the Inquiry as it is not currently involved in the production of transport fuels (although through Anglo it is a major fuel user both within Australia and globally) but is actively considering large scale investment in a non conventional fuel source: coal to liquids.

The main points in the submission are as follows:

- Australian oil production is considered to have peaked and will continue to decline even while demand growth will result in increasing oil imports. Although the macroeconomic impact of this deficit will be hedged by escalating coal and LNG exports. The fundamentals of world oil supply suggest that the era of cheap oil is likely to have passed and future oil is likely to be much more expensive. Ultimately we need to develop and implement a transport system which is totally sustainable.
- Australia has the resources to begin to develop substantial non-conventional oil supplies, particularly coal to liquids (incorporating carbon capture) and bio-fuels. Ultimately, if the technology for hydrogen fuel cells achieves its promise in terms of cost and performance Australia can be totally energy independent.
- Rising oil demand, decreasing non-OPEC production, increasing political tensions and finite conventional oil resources have the potential to significantly disrupt the world economy. This risk can be mitigated by taking early action to conserve energy and develop non-conventional oil supplies. Normal energy market processes are unlikely to deliver such a timely solution. Governments will need to set clear and aggressive targets and provide targeted incentives. A disruptive oil shock can be avoided but only through effective long sighted political leadership.
- Reductions in transport fuel usage are possible through changes in transport mode and through technological improvement. The former is seen to be a significant challenge with savings of 10% unlikely to be achieved without major expenditure and behavioural change. Technology change has yielded at least a 15% improvement in fuel efficiency over the last 20 years. A reduction in transport fuel usage, by this means, of at least 30% appear is achievable over the medium to long term facilitated by the natural vehicle replacement cycle. However these efficiency improvements will be partially offset by demand growth. A move to hydrogen fuel cell vehicles holds the promise of major further efficiency improvements but the technology and infrastructure challenges are significant.

- The Monash Energy Project has the potential to reduce Australia's reliance on oil imports as well as to provide technologies for reducing carbon dioxide emissions in the power industry. Ultimately it can be a gateway to a fully sustainable hydrogen economy.

We would welcome the opportunity to present our views to the Inquiry Committee. Our contact person is Executive Manager Public and Government Affairs, Scott Hargreaves, who can be reached on (03) 9868 7812.

Yours sincerely

Stuart Lund
Acting Chief Executive Officer

monash energy

Inquiry Into Australia's Future Oil Supply and Alternative Transport Fuels

Submission by Monash Energy
February 24, 2006

Introduction

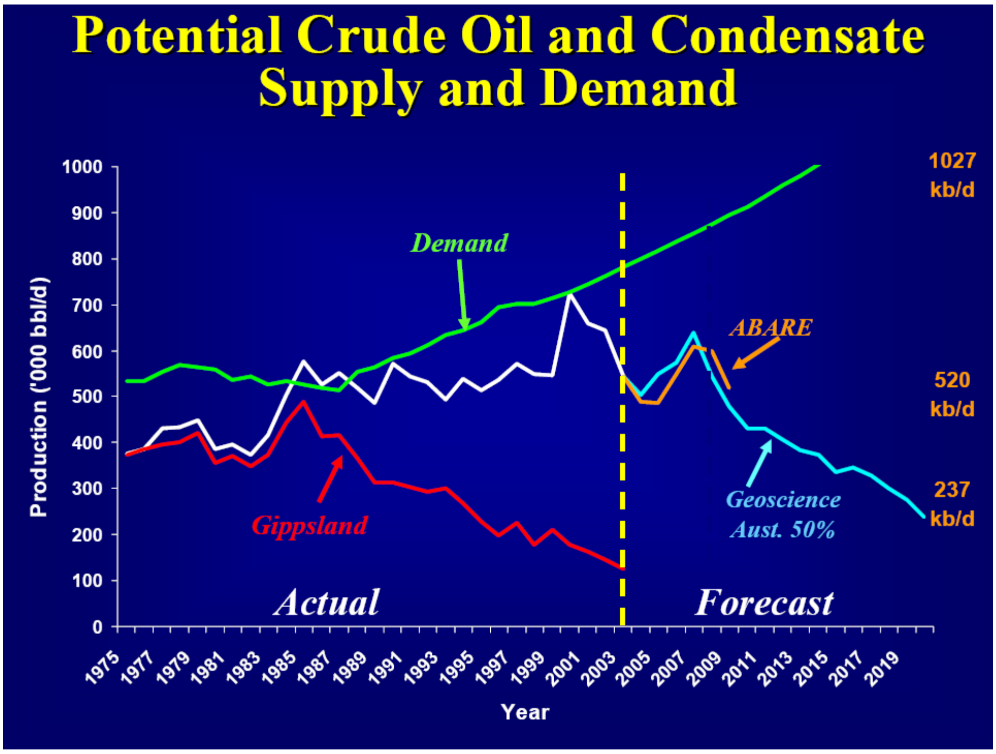
This submission was prepared for the Senate Rural and Regional Affairs and Transport Committee's Inquiry into *Australia's future oil supply and alternative transport fuels.*

The information contained herein has been gathered in the course of the feasibility investigations for the Monash Energy project and is provided for the benefit of the Committee: it should not be relied upon for any other purpose and the opinions expressed should not be taken as representative of any entity other than Monash Energy Holdings Limited.

Section 1: Terms of Reference (a)

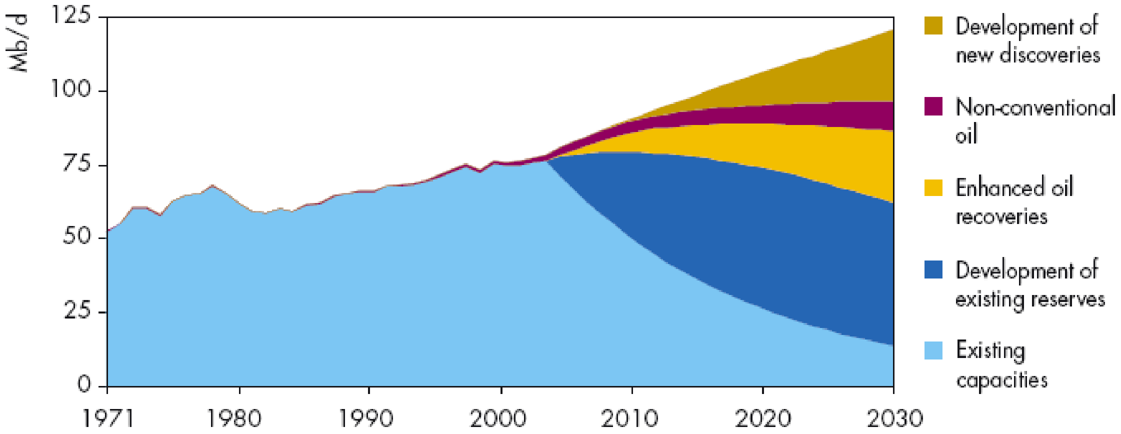
"Projections of oil production and demand in Australia and globally and the implications for availability and pricing of transport fuels in Australia"

The picture of Australian oil demand and supply is clearly evident from the following chart taken from the APPEA website:



ABARE's latest energy forecasts[1] show a more optimistic maintenance of production but still have imports growing from a current level of 250,000 barrels per day (b/d) to over 700,000 b/d by around 2030. At current oil prices these imports would cost over A$20 billion annually. At a macroeconomic level any price risk associated with these imports is well hedged by the forecast growth in coal and LNG exports. Nevertheless this decreasing level of self sufficiency represents a potential supply security risk as global demand for oil increases and supply comes under more pressure.

At the global level the following IEA forecast[2] shows the expected sources of global oil supply over the coming decades:



Source: WEO-2004, IEA.

Of the existing reserves category nearly 60% is located in OPEC Middle Eastern countries (OPEC ME). While a number of energy analysts have criticised the IEA for being too optimistic[3] there are a number of clear points which emerge from this forecast:

1. The OPEC production will need to increase significantly over the coming decades from around 30 Mb/d currently to about 47 Mb/d by 2030. Note that this represents around 75% of the production from existing reserves and capacity. Most of this incremental capacity will need to come from the Middle East. Whether there is the necessary geological, technical or political capacity to support this level of production increase is a matter of conjecture.

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[1] Akmal, M. and Riwoe, D. 2005, *Australian Energy: National and State Projections to 2029-30*, ABARE eReport 05.9

[2] Resources to Reserves *Oil & Gas Technologies for the Energy Markets of the Future,* IEA/OECD 2005

[3] The Countdown for the Peak of Oil Production has Begun – but what are the Views of the Most Important International Energy Agencies by W. Zittel, J. Schindler, L-B-Systemtechn *Published on 15 Oct 2004 by* EnergyBulletin.net / EnergieKrise.de.

2. By 2030 all the new oil supply (about 60 Mb/d) comes from sources which currently are either undiscovered or contribute a negligible amount to oil supply. These supplies are likely to be remotely located or have poor productivity or have significant environmental challenges or a combination of all these factors. The task of bringing these new supplies to market in a timely manner is daunting.

The recent periods of low cost oil have been characterised by a surplus of supply over demand. At times during the mid 1980's this surplus capacity was about 18 Mb/d as world oil demand dropped towards 55 Mb/d. During such times the oil price approached the short term marginal supply cost (<US$10 /bbl). The situation over 2004 and 2005 has seen that in a market where supply and demand are tight prices escalate to well above the full long term cost of new capacity. There is nothing in the above data or in the IEA (or any other) analysis that suggests that a significant surplus of supply over demand will occur except if there is a significant world wide recession.

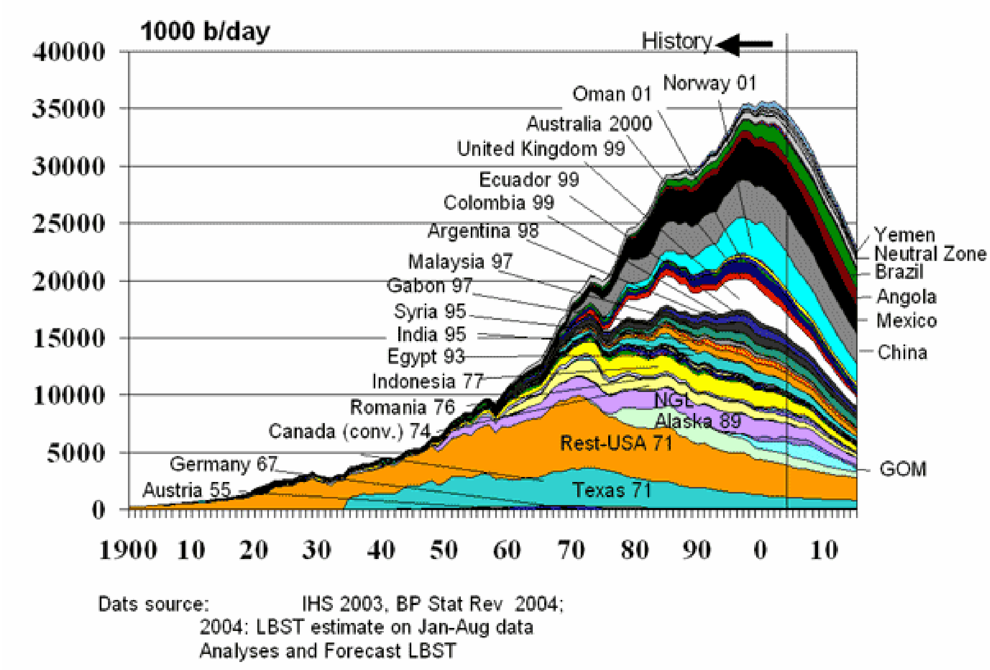
Most attempts to forecast the future oil price assume the market will settle at the long term cost of the marginal source of supply and that technological improvements will drive this cost down. However, observation of many commodity markets suggests that this is rarely the case. Instead prices oscillate between well below the equilibrium cost during times of surplus capacity to well above it during times of supply tightness. Generally the latter situation is of short duration as reduced demand and accelerated capacity building restores the surplus and prices drop.

However, the composite of largely non-OPEC and non-FSU oil production which appears below (see diagram next page) suggests that most of the "easy" oil (geologically, geographically and politically) has been developed. The rapid expansion of this oil capacity over the last four decades enabled the supply surpluses of the 80's and 90's; now it appears that only "difficult oil" remains.

It seems unlikely that this difficult oil will be able to be developed at a similar rate as the "easy" oil. And yet the IEA assumption is that these new oil supply sources will build from virtually nothing to 60 Mb/d over a period of 25 years. This is approximately four times the historic rate of non-OPEC capacity building over the last quarter of the 20th Century.

It is interesting to observe that the official sources of government analysis and data on future energy supply (including the IEA) focus on looking at reserves and have not published any analysis of the practicality of the required rate of capacity build up (producability). The IEA does comment that if OPEC does not invest in new production capacity that oil prices will be much higher than their forecast. It is the rate at which new capacity can be bought on line to replace the rapidly depleting "easy" oil and the expected demand growth which will determine the likely supply / demand balance and hence oil prices. The fundamentals suggest that supply is likely to stay tight and prices high over the next few decades. The December 2005 US DOE / EIA price forecast of

US$57 /bbl in 2030 reflects this situation for the first time[4].



Even the most optimistic forecasts suggest that the world was endowed with about 3 trillion barrels of conventional oil. Of this the first trillion has already been used while the second trillion will be used by about 2030. This puts the conventional oil peak at between 2015 and 2020. Assuming only modest growth the last trillion would be depleted by about 2050. By then we will be reliant on non-conventional oil sources. Ultimately all of society's energy needs will need to be supplied from sustainable sources. It is axiomatic that this transition from a fossil fuel based economy to a truly sustainable economy will be challenging, expensive and lengthy. If the risk of economic and social dislocation is to be minimised then the journey needs to commence earlier rather than later.

Summary

Australian oil production is considered to have peaked and future demand growth will result in increasing oil imports. The macroeconomic impact of these imports will be hedged by growing coal and LNG exports. The fundamentals of world oil supply suggest that the era of cheap oil is likely to have passed and future oil is likely to be much more expensive. Ultimately we need to develop and implement a transport system which is totally sustainable.

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[4] EIA, Annual Energy Outlook 2006 with Projections to 2030 (Early Release) – Overview, December 2005

Section 2: Terms of Reference (b)

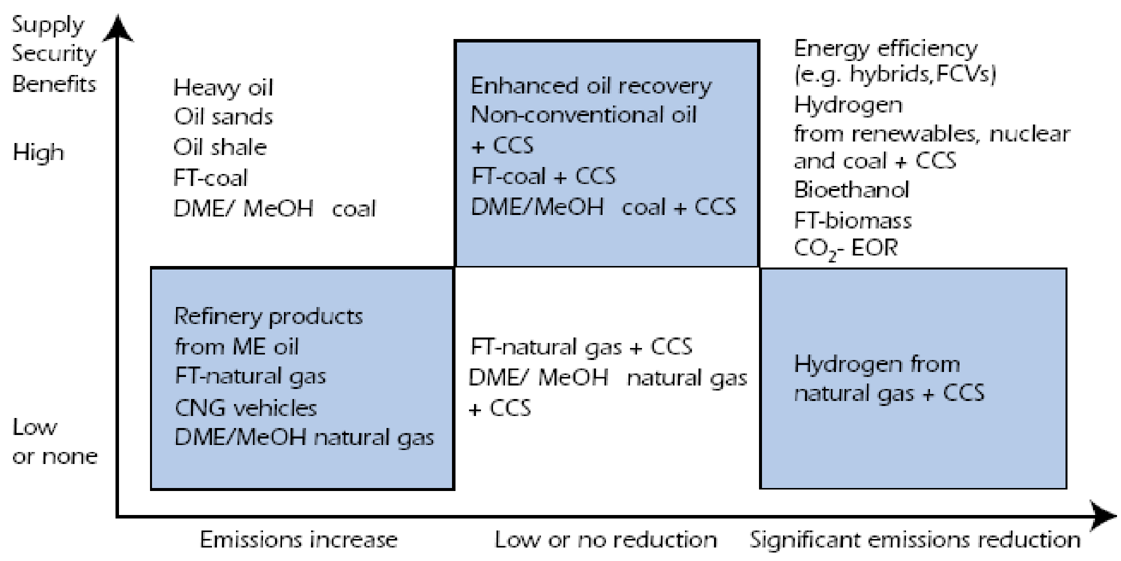
"Potential of new sources of oil and alternative transport fuels to meet a significant share of Australia's fuel demands, taking into account technological developments and environmental and economic costs"

The potential options for the replacement of conventional oil are outlined in the IEA report *Fuel Cells and Other Hydrogen End-Use Technologies*[5]. This report emphasises the inter-related challenges of providing for;

1. Increasing world demand for energy;
2. Decreasing supply of conventional oil, and
3. The need to stabilise atmospheric concentrations of greenhouse gases to limit the adverse effects of climate change.

The global fuel options which the IEA Report identified are shown in the following matrix:

Transportation fuel supply options and their contribution to energy policy goals



Source: IEA.

5 Fuel Cells and Other Hydrogen End-Use Technologies, IEA/OECD 2005

Using this matrix as a useful strategic summary the following comments relate to the application of this approach in the Australian context. Given the need to achieve better environmental outcomes as well as fuel sustainability any option which increases emissions should not be considered. Therefore, the options in the two left hand boxes have been ignored. Also the DME/MeOH options have been discounted as the strategic case for developing new energy carriers requiring substantial new infrastructure has not yet been made. The exception to this point is hydrogen which is considered to have the potential to warrant such development in the longer term as it represents the ultimate sustainable transport energy system.

In the Australian context the natural gas to transport fuel options are not considered to be of long-term strategic value as world wide demand for natural gas will ensue that it has its highest value use in the local domestic, commercial, industrial and power markets and in the export LNG market. The production of Fischer – Tropsch fuels from natural gas including carbon capture and storage (CCS) (FT-natural gas+CCS in the Figure above) may become preferred in Australia if there is a favourable shift in the relative production costs and product prices, although this seems unlikely. ABARE Energy Forecast 2005 does not predict that this will occur during their forecast period (to 2030).

Further, based upon ABARE's predictions of supply demand it can be shown that Australia's natural gas reserves will be substantially depleted by around 2050 (largely due to large scale exports of LNG). However, one option not considered by ABARE (due to time scale and current policy limitations) is the distributed production of hydrogen from natural gas as part of a hydrogen economy implementation plan (see also "Hydrogen", page 8).

Enhanced Oil Recovery (EOR)

Refers to methods of stimulating increased oil recovery from conventional oil reservoirs. Carbon dioxide flooding (CO2-EOR) is one of the favoured techniques which also may have a beneficial side effect of sequestering the CO2 (depending upon its source). The effectiveness of this technique depends upon the reservoir characteristics, location and cost of the CO2. We understand that the characteristics of Australia's largest depleting oil fields (Bass Strait) are unlikely to be favourable to CO2-EOR. Australia's other oil resources are largely in remote locations where it is unlikely that existing CO2 sources are available.

Biofuels

Biofuels are a suitable substitute for conventional oil although the quantum which can be economically grown and the social economic and environmental impacts need to be carefully studied. The prestigious Rocky Mountain Institute (RMI) has reported that the USA could produce up to 3 Mb/d at about US$50 /bbl using current processes without compromising the environment or agricultural production[6]. They predict that this number could increase to 4.0 Mb/d at about US$30 /bbl using the new high efficiency lignocellulosic production technologies (once proven). In association with a move to higher efficiency vehicles (hybrid engines, advanced materials) such a move is believed to be capable of leading to a significant reduction in the reliance on conventional oil. While a Taskforce has studied the implications of the Australian 2010 biofuels target of 350 Ml/a (~6Kb/d) [7] the analysis had a short term and limited focus. A full long term strategic study of Australia's capacity to sustainably produce biofuels is needed as a prelude to developing a comprehensive long term biofuels strategy.

Hydrogen

Hydrogen has significant promise as the ultimate energy carrier as it can be produced from many sources, including renewable sources and emits no harmful emissions at the point of use. In conjunction with advanced fuel cells it has the potential to play a major role as the long term sustainable energy carrier in both stationary and transport roles. IEA modelling indicated that given aggressive implementation strategies hydrogen could fuel about 30% of the world's passenger vehicles and light/medium trucks by 2050 (although they predict only 10% in Australia)[8]. RMI has pointed out that the key to the successful roll out of hydrogen as a transport fuel is the production of ultra light weight transport fuel cell powered vehicles whose energy efficiency could be 4 to 5 times that of current vehicles. The concept design for such a vehicle already exists. Such efficient vehicles would facilitate the implementation of a hydrogen energy system by reducing the volume to be produced and distributed and the amount needed to be carried by the vehicle to give acceptable range and performance (4 kg of hydrogen produces the same performance as 70 litres of petrol in a current conventional vehicle).

During the initial role out phase RMI suggest that hydrogen could be generated from natural gas at distributed fuelling stations. Although some CO2 would still be emitted it would only be a small fraction of that from current vehicles due to the increased fuel efficiency. The amount of natural gas needed to achieve an initial 10% market penetration (sufficient to achieve scale efficiency and technology "lift-off") is small compared to existing demand and resources. Larger volumes of hydrogen could also be produced from coal (with CCS) at competitive costs.

Currently hydrogen fuelled vehicles are considerably more costly than conventional vehicles. Major cost reductions in the fuel tank and fuel cell components will be needed if they are to achieve significant market penetration.

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[6] Winning the Oil Endgame; Innovation for Profits, Jobs, and Security, Amory B. Lovins, E. Kyle Datta,, Odd-Even Bustnes, Jonathan G. Koomey,and Nathan J. Glasgow, Forewords by George P. Schultz and Sir Mark Moody-Stuart, Rocky Mountain Institute 2004
[7] Report of the Biofuels Taskforce to the Prime Minister, August 2005
[8] *Ibid*

Coal to Liquids / Hydrogen / Low Emissions Electricity

The technology for making transport fuels from coal via gasification and Fischer-Tropsch (FT) synthesis has been operated at commercial scale in South Africa for about 50 years. This coal to liquids (CTL) process, as currently implemented, results in very high well to wheels CO2 emissions compared to conventional oil. This is a result of CO2 being produced as a by-product of the gasification process, in the shift reaction to produce hydrogen and in the combustion of waste gases. However, the process has the advantage that CO2 removal is already part of the process, as it is a requirement for the FT synthesis (and if oxygen rather than air is used for the gasification then CO2 capture and compression becomes more feasible). If this captured CO2 is stored in deep, secure geological structures (known as geosequestration or Carbon Capture and Storage (CCS)) then the well to wheels emissions become less than or comparable with conventional oil. Thus, CTL+CCS is a suitable process to replace conventional oil.

The CTL process produces hydrogen in order to produce the correct molecular ratio with carbon to produce liquids (about 2:1 H2:C). However, the shift reaction can be intensified to produce virtually all hydrogen. This hydrogen can be purified for use in fuel cells or combusted in a gas turbine. When combined with CCS the resulting product is very low emission transport fuel or electricity (or both in a co-production facility). Hydrogen produced from such a process is much cheaper than that produced from other processes (with the exception of steam reforming of low cost natural gas).

No CTL plants have been built on a commercial basis (setting aside those build for energy security), however coal gasification plants are beginning to replace oil fed chemical plants in China, demonstration integrated gasification combined cycle power plants (IGCC) have been built in the USA and EU, and FT plants using stranded natural gas are being built in the Middle East and Africa. These developments will lead to lower cost and commercialisation of the main components of the CTL process. Given the right location (low cost coal, secure CCS site) and the right oil price CTL is regarded as having the potential to be commercially viable. The Monash Energy Project is based upon this premise.

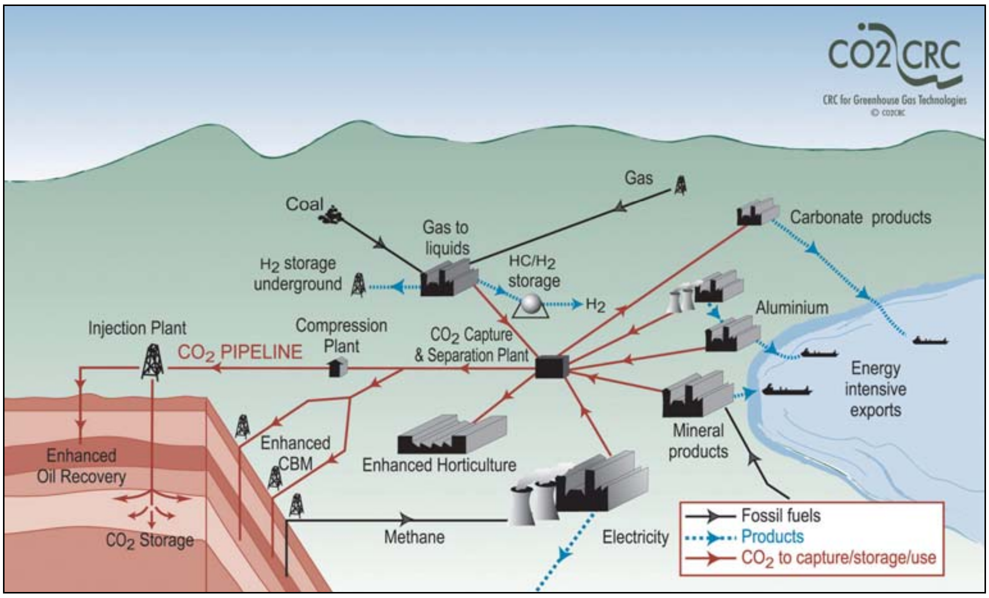
The Monash Energy Project.

The Monash Energy Project (the Project) is planned to be the worlds first coal to liquids project predicated on including carbon capture and storage. Key aspects of the project are as follows:

1. The Project is based upon accessing two world class resources; Victoria's vast reserves of low cost brown coal for feedstock and the depleting oil and gas reservoirs in the nearby Bass Strait to store CO2. Critically, their proximity reduces the cost of CO2 transport, as seen in the following diagram.

2. The first stage Commercial Plant will produce about 60,000b/d of synthetic hydrocarbon liquids of which 80% would be ultra low sulphur high quality automotive diesel, commissioning of the plant is targeted for 2016

3. The Project will facilitate the opening up of the Bass Strait sedimentary basin as a secure site for the storage of CO2 from future low emissions electricity, chemicals, fertiliser and hydrogen production, with scope for a regional "hub" (see diagram below[9]).

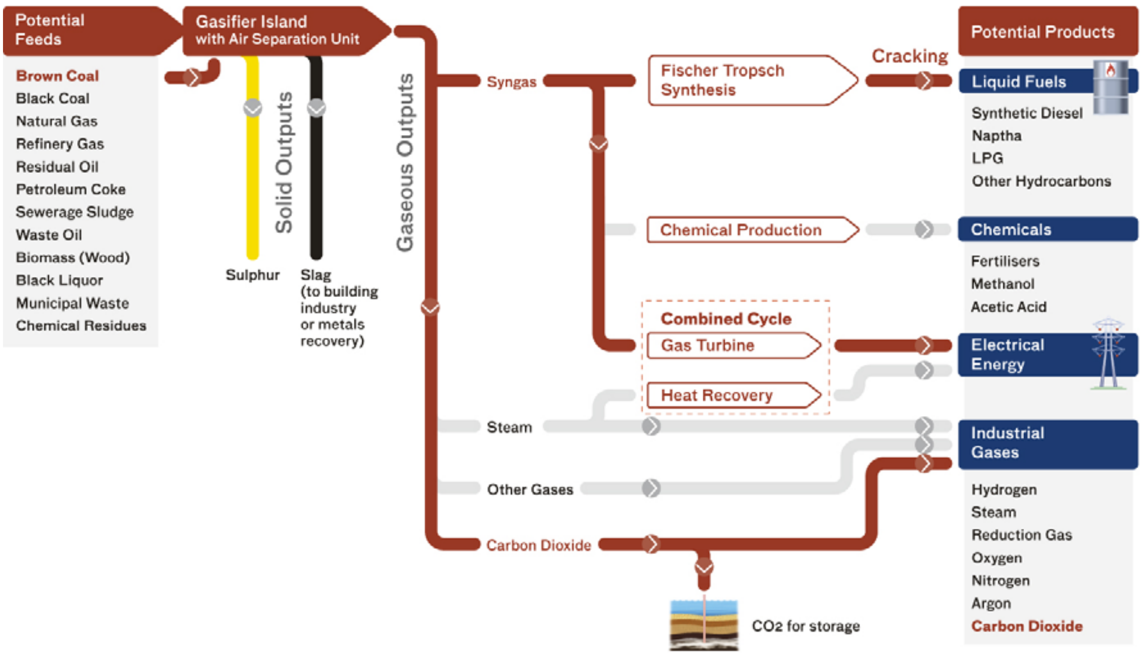


[9] Indicative image courtesy of CO2CRC, www.co2crc.com.au

4. An independent study conceived by Monash Energy and funded by the Australian Government (DOTARS) and the CO2CRC has demonstrated, at a strategic level, the potential for Bass Strait to be a long term, secure and low cost repository for large amounts of carbon dioxide[10]

5. While the Commercial Plant will be a First of a Kind in respect of the combination of technologies, the individual technologies required are either proven and demonstrated at commercial scale or will be within the next 5 years

6. The core technologies which will be commercially established in combination by the Project (brown coal drying, entrained flow oxygen blown gasification, hydrogen production, carbon capture and storage) are identical to those required to produce low emissions synthetic gasoline, electricity, chemicals, fertiliser and hydrogen. The flexibility of production (and feedstock) enabled by gasification is illustrated in the following diagram.



10 Hooper, B, Murray, L and Gibson-Poole, C (eds.), 2005. The Latrobe Valley CO2 Storage Assessment. Cooperative Research Centre for Greenhouse Gas Technologies, Canberra. CO2CRC Publication No RPT05-0220, November 2005. 15pp

7. Analysis conducted during the pre-feasibility process - assuming a conventional crude oil price of $US50 /bbl– indicates the project would have the following broad economic benefits

    a. Avoid $80 billion in oil imports over 50 years

    b. Spend $20 billion on goods and services (mainly within Australia)

    c. Pay $15 billion in corporate income tax

8. The coal resource in Victoria is sufficient to underpin several such plants each operating for 50 years as well as low emissions electricity and future hydrogen production facilities

Summary

Australia has the resources to begin to develop substantial non-conventional oil supplies; particularly Coal to Liquids (including carbon capture) and bio-fuels. Ultimately, if the technology for hydrogen fuel cells achieves its promise in terms of cost and performance Australia can be totally energy independent.

Section 3: Terms of Reference (c)

"Flow-on economic and social impacts in Australia from continuing rises in the price of transport fuel and potential reductions in oil supply"

Monash Energy is not in a position to comment in detail upon this aspect in any specific terms however we can make some general comments. The Hirsch Report[11] contemplated this situation and essentially concluded that the impacts on the world economy will range from relatively benign (if we effectively plan for and manage the implementation in a timely manner) to highly disruptive (if we do not take any action to transform the energy systems). Hirsch points out that this is the world's first forced energy transition. As such there is no experience on which to base the planning for such a transition.

It should be noted that Hirsch's proposed response effectively ignores climate change and the availability of the more advanced technologies which might be around the corner. By focusing on heavy oil, tar sands, shale oil, GTL and CTL but ignoring biofuels and CCS the solution there described must increase carbon emissions.

The market economy is not well equipped to respond autonomously to such a new challenge. The corporations with the skills and resources to invest in large scale energy projects are necessarily risk averse, and typically do not have the capacity to capture the externalities associated with moving new capital-intensive technologies along the experience curve (and hence down the long run cost curve). Hence individual corporations can show leadership but it is inevitable that the bulk of their investments will be in conventional technologies unless there are countervailing incentives. Moreover, history has shown that periods of high energy prices are followed by recessions and price collapses, reinforcing a conservative bias in forecasting oil prices (e.g. US$20 -25 /bbl oil) in framing investment decisions although oil is currently above US$60 /bbl.

Government agencies (ABARE, IEA, EIA) have up until now been assuming US$30 (or lower) oil in all their base forecasts. These forecasts appear to assume no change in climate policies over time and that conventional oil will still be plentiful. There is a disconnect between the fundamentals (rapidly rising demand, decreasing non-OPEC production, increasing world political tension) and the assumed long-term oil price. This approach implies a level of complacency which could have grave consequences if it is the basis on which Governments and corporations continue to act. However, as observed previously the US EIA has just substantially changed their view on future oil prices.

11 Peaking of World Oil Production, Impacts, Mitigation, Risk Management, Robert L. Hirsch, SAIC Roger Bezdek, MISI, Robert Wendling, MISI, May 2005

In addition to the energy price risk there is the carbon price risk. There is currently no basis for estimating the future price of carbon or even if there will be a carbon price. Carbon price is a function of the rate at which carbon emissions are constrained and the cost of the processes (technology) to achieve the constraint. There are currently few countries with reduction targets beyond the Kyoto period, no consensus on what form any post Kyoto targets might take and, realistically, the effectiveness of carbon trading as a mitigation mechanism is unproven.

It will take at least 20 to 30 years for new technologies and non-conventional oil sources to go through the stages of initial deployment, capacity build-up through to making a significant contribution to energy supply. By any realistic assumption about conventional oil resources it is essential that the implementation planning starts now. Faced with the needs to meet short-term shareholder expectations and the uncertainty of energy and carbon prices it is not surprising that companies still act conservatively. The new challenge needs a new way of thinking about investment facilitation if action is to be taken in a sufficiently timely manner to mitigate the risks of economic disruption.

Governments, in cooperation with industry, need to facilitate strategic investments in new technologies that meet climate change and oil replacement objectives. Programs of direct support for R&D and Demonstration projects are important and welcome, but represent only part of the solution. New ways of sharing the investment risk need to be developed. An example of appropriate risk sharing might be an oil price subsidy which phases in below a crude oil price equivalent to, say, US$50 /bbl. Thus, the Government ameliorates the oil price risk while the company takes all technical and other commercial risks. Such an approach would contain a compensating affect to stabilise Government revenue as economic activity and taxation would be expected to increase on lowering oil prices. The Government also shares in the high oil price reward through taxation gains. Such a risk sharing could be justified on the basis that it facilitates the timely construction of plant which mitigates the oil supply risk. As such investments will also avoid the need to import oil they boost the economy, create jobs and increase taxation revenue. Note that the US Government has already enacted a number of incentives for CTL including tax credits and loan guarantees in the 2005 Energy Bill. A federal highway bill enacted in August 2005 contains a 50¢-per-gallon (US$21/bbl) tax credit for diesel fuel produced from coal using the Fischer-Tropsch process.

More aggressive goals need to be set for each of the potential new fuel supply technologies. However care needs to be taken with the timing of such goals and the provision of incentives if there is the prospect of major technology improvements in the near term. However, while moving too early can have risks it is much preferable, in this instance, to moving too late. A prudent risk minimisation strategy would need to target at least 10% market share for the selected technologies by 2020 if a platform for accelerated development is to be achieved.

Australia represents about 1% of the world's economy and therefore, regardless of what action is taken cannot insulate itself from the fallout if the rest of the world does not take appropriate action. However, by developing and implementing clear and far sighted strategies which focus on both the climate and energy challenges it can provide a leadership role.

Summary

Rising oil demand, decreasing non-OPEC production, increasing political tensions and finite conventional oil resources have the potential to significantly disrupt the world's economy. This risk can be mitigated by taking early action to conserve energy and develop non-conventional oil supplies. Normal energy market processes are unlikely to deliver such a timely solution; Governments will need to set clear and aggressive targets and provide targeted incentives. A disruptive oil shock can be avoided but only through effective long sighted political leadership.

Section 4: Terms of Reference (d)

"Options for reducing Australia's transport fuel demands"

Before looking at the options for reducing transport fuel demand it is useful to understand the nature of this demand[12]. A few high level statistics are useful in this regard[13 14] :

1. Of the total transport fuel consumed 37% is automotive diesel (mainly used in business activity) and 11% is aviation fuel
2. Of the automotive diesel fuel consumed 40% is used off road (agriculture, mining, power generation), about 30% in urban transport, and 30% in interregional and interstate transport
3. Of the 52% automotive gasoline and LPG used in travel about 30% involves business activity, 23% travel to work and 47% personal use;
4. Of the 52% automotive gasoline approaching 30% involves interregional and interstate travel
5. Of those travelling to work and study less than 1 in 5 chose public transport, bicycling or walking
6. Since 1950 Australia's population has grown by 150%; the infrastructure supporting this 60% of the population has largely been optimised around motor vehicle transportation (as also has their preferred life style).

The options for reducing transport fuel consumption fall broadly into two categories, namely;

1. **Changes of transport mode; private to public, road freight to rail etc**;
   While there are many advocates of such changes the reality is that they have gained limited momentum. Barriers to such change are both physical (sprawling cities, spoke and hub public transport networks, infrequent services, slow, not door to door etc) and social (lack of convenience / flexibility, poor match to daily travel tasks, concerns over safety, high variable cost etc). Making significant changes in the existing patterns of use is a major economic and social challenge given that three generations of Australians have built their

[12] For the purposes of this submission transport fuels include all products which can power road and aviation transport equipment, namely; LPG, Automotive Gasoline, Aviation Turbine Fuel and Automotive Diesel. While the largest proportion of these fuels (~85%) is used in transport the balance is used in other off-road uses e.g. mining, agriculture.

[13] ABS 1301.0 - Year Book Australia, 2006

[14] ABARE, *Energy in Australia* 2005

businesses, lifestyle and quality of life around on demand, point to point travel.

2. **Improving the efficiency of the various transport modes**
   Ultimately all on road and off-road vehicles which use transport fuel will be replaced; virtually twice over by 2050. The motor vehicle industry has proven that over time it can produce huge changes in technology without huge cost increases (compare the FJ Holden to today's Commodore). Prudent standard setting by Governments have ensured major advances in vehicle safety even when it was unclear that this was a major consumer concern. An appropriate mix of regulation, education and innovation can transform the efficiency of transport vehicles over the coming generations at an acceptable cost.

The broad relative potential for saving transport fuel energy use by the different options is outlined below. These numbers are quoted relative to today's transport task; rising population and economic growth will offset any savings which can be made.

1. While much publicity is given to increasing public transport use, particularly for commuting, the potential energy savings appear relatively small. Doubling public transport usage, a very challenging target, appears to lead to an overall saving of about 3% of the total transport fuels energy usage (reduces private vehicle travel to work by 25%)

2. Only a proportion of the inter-regional and interstate freight travel can be realistically transferred to rail given route availability, time and cost constraints. Assuming 30% of this was possible it would save about 3% of the total transport fuels energy usage

3. The majority of the automotive diesel consumption which comprises 37% of total current transport fuels energy usage is used in relatively efficient diesel engines (38%). However it is projected that diesel efficiency could improve to 60% within a decade[15]. However given the high average age of the main trucking fleet (12 years) it will take some time for this to translate to significant energy savings. In the longer term a saving of 10 to 12% of current total transport fuels energy usage may be possible

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[15] Engine Maturity, Efficiency, and Potential Improvements, John W. Fairbanks
Office of FreedomCAR and Vehicle Technologies, US Department of Energy, Washington, D.C.
Diesel Engine Emission Reduction Conference, Coronado, California, August 30, 2004

4. Currently available engine technologies (advanced diesels, gasoline hybrids, diesel hybrids) combined with advanced weight saving designs have been shown to be able to deliver significant fuel savings such that a halving of the economy rate is clearly feasible. Average total fleet efficiency dropped from 12.0 in 1985 to 11.0 l/100 km in 1995 while the average efficiency of new passenger vehicles sold (National Average Fleet Efficiency (NAFC)) dropped from 9.3 to 8.8 l/100km respectively[16]. The current total fleet efficiency is estimated at about 10.0 l/100km. The voluntary industry NAFC target for 2010 is 6.8 l/100km. Vehicle sales tends over the last year have, under the influence of high oil prices, shown a move away from larger vehicles to small vehicles and towards high efficiency engines (hybrids and advanced diesels) although availability of the latter was limited. In the longer term a saving of 20 to 25% of current total transport fuels energy usage may be possible (average fleet efficiency of 5 l/100km)

5. In the long term advanced light weight, hydrogen fuel cell vehicles could achieve at least a further doubling of efficiency in the passenger vehicle market down to the about 2.5 l/100km gasoline equivalent. However this goal will require substantial improvements in the cost and performance of fuel cells and fuel tanks as well as significant investments in new re-fuelling infrastructure

Summary

Reductions in transport fuel usage are possible through changes in transport mode and through technological improvement. The former is seen to be a significant challenge with savings of 10% unlikely to be achieved without major expenditure and behavioural change. Technology change has yielded at least a 15% improvement in fuel efficiency over the last 20 years. Reductions in transport fuel usage, by this means, of at least 30% appear achievable over the medium to long term facilitated by the natural vehicle replacement cycle. However these efficiency improvements will be partially offset by demand growth. A move to hydrogen fuel cell vehicles holds the promise of major further efficiency improvements but the technology and infrastructure challenges are significant.

End

[16] Study on Factors Impacting on Australia's National Average Fuel Consumption Levels to 2010
A Report to the Australian Greenhouse Office, June 1999