Hydro Tasmania
the renewable energy business

3 March 2006

Mrs Roxane Le Guen
The Secretary
Senate Rural and Regional Affairs and Transport
Parliament House
CANBERRA ACT 2600
Email: rrat.sen@aph.gov.au

Dear Mrs Le Guen,

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

Thank you for the opportunity to provide input to the Senate Standing Committee for Rural and Regional Affairs and Transport Inquiry into Australia's future oil supply and alternative transport fuels. Please find enclosed Hydro Tasmania's submission to the Inquiry.

Hydro Tasmania commends the Committee on its decision to examine future oil supply and demand in Australia and globally, and welcomes its interest in alternative transport fuels as potential means of reducing Australia's future oil demand.

Hydro Tasmania raises the following key points in its submission:

- The world has been consuming more oil than it discovers every year for at least the last 15 years, and some experts expect global oil production to peak within the next decade, threatening global energy insecurity.

- Australian oil production has declined steadily in the last five years and is expected to plateau at around 30 000 million litres per annum.

- Australia is already a net oil importer, meaning that the gap between Australian oil production and oil consumption will widen as Australia's oil demand grows, threatening national energy security.

- Alternative transport fuels including hydrogen, biofuels and electricity (in hybrid vehicles) can supply a significant proportion of Australia's transport needs.

- The Australian Government should consider revising its energy policy to better utilise alternative transport fuels as a means of offsetting national oil demand.

- Increased use of alternative transport fuels, particularly biodiesel and hydrogen produced using renewable energy, will enable significant emissions abatement in the transport sector, reducing the contribution of transport to Australia's greenhouse gas emissions signature.

- Hydro Tasmania is developing a proposal for a full-scale, Tasmania-wide hydrogen transport system as a step towards the commercialisation of hydrogen energy technologies in Australia. Subject to assessment and approval by the Hydro Tasmania Board, a submission will be made under LETDF seeking a Commonwealth Government grant.

- The development of a complete hydrogen transport network in Tasmania will help facilitate the development of a national hydrogen economy and stimulate the nation's renewable energy industry, substantially reducing Australia's oil demand and greenhouse gas emissions.

Hydro Tasmania would also be pleased to participate in any public hearing held as part of the Inquiry. Our work on alternative fuel supplies and a proposed Tasmanian hydrogen transport system is ongoing, and Hydro Tasmania welcomes any questions or queries the Committee may have on these subjects.

Yours sincerely

Pat Lennon
General Manager, Business Development

HYDRO TASMANIA

Submission to

Senate Committee for Rural and Regional Affairs and Transport

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

March 2006

Table of Contents

Introduction

Australia, as a geographically large country with widely separated industry and population centres, is heavily dependent upon transport in both commercial and non-commercial applications. Australia's transport sector is powered almost entirely by oil-based fuels, and demand for these transport fuels is predicted to increase significantly in the immediate future.[1] Consumption of oil-based fuels in the transport sector is also a significant cause of Australia's high greenhouse gas emission signature. Transport contributes 14.5% of the nation's greenhouse gas emissions, which are currently the highest per capita in the world.[2]

Although well endowed with a range of energy resources, Australia is a net importer of crude oil, sourcing much of its oil from the Middle East and Indonesia. This reliance upon oil imports from politically unstable regions renders Australia vulnerable to fluctuations in global oil supplies, strategies and prices.[3] Long-term growth in Australia's oil consumption is expected to exceed growth in domestic oil production, increasing our reliance upon imported oil and our vulnerability to oil market shocks.[4]

Realising Australia's reliance upon its transport sector, the transport sector's role in Australia's high level of greenhouse gas emissions, and its exposure to volatile global oil markets, it is vital that opportunities to offset oil consumption and increase energy security in Australia are fully investigated and exploited. Hydro Tasmania commends the Senate Committee for Rural and Regional Affairs and Transport on its timely decision to conduct an Inquiry into Australia's future oil supply and potential deployment of alternative transport fuels, and is pleased to provide the following submission to the Committee for this purpose. The submission is structured according to the Inquiry's Terms of Reference.

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

1.1 Projected global oil production

Future global oil production is an inherently uncertain subject of much international debate. This lack of consensus is compounded by the divergent interests of different stakeholders in the oil industry. The International Energy Agency (IEA) put world oil production in 2002 at 77 million barrels per day, and predicted that this figure would rise steadily at a rate of 1.6% per annum, to 121.3 million barrels per day by 2030 (see Table 1).[5]

[1] Department of the Prime Minister and Cabinet (2004), *Securing Australia's Energy Future White Paper*, p 81.
[2] *Australian National Greenhouse Gas Inventory*, 2003.
[3] Australian Bureau of Agriculture and Resource Economics (ABARE) (2005) *Energy in Australia 2005*, p 20.
[4] ABARE (2005), *supra* note 3, p 25.
[5] IEA (2004) 2004 World Energy Outlook, p 106.

Table 1: World Oil Supply to 2030 (million barrels per day) (IEA 2004 World Energy Outlook)

	2002	2010	2020	2030	2002-2030*
Non-OPEC	**45.3**	**51.3**	**47.9**	**43.4**	**-0.2**
OECD Total	**21.1**	**20.1**	**16.3**	**12.7**	**-1.8**
OECD North America	13.7	14.8	12.6	10.0	-1.1
United States and Canada	*10.1*	*10.6*	*8.7*	*7.2*	*-1.2*
Mexico	*3.6*	*4.2*	*4.0*	*2.8*	*-0.9*
OECD Europe	6.6	4.8	3.1	2.2	-3.9
OECD Pacific	0.8	0.5	0.5	0.5	-2.0
Transition economies	**9.5**	**14.6**	**15.4**	**15.9**	**1.8**
Russia	7.7	10.4	10.6	10.8	1.2
Other transition economies	1.9	4.2	4.7	5.2	3.7
Developing countries	**14.6**	**16.6**	**16.2**	**14.8**	**0.0**
China	3.4	3.3	2.7	2.2	-1.5
India	0.8	0.7	0.6	0.5	-1.6
Other Asia	1.7	1.6	1.2	0.6	-3.4
Latin America	3.7	4.7	5.5	6.1	1.8
Brazil	*1.5*	*2.5*	*3.3*	*4.0*	*3.6*
Other Latin America	*2.2*	*2.2*	*2.2*	*2.1*	*-0.2*
Africa	3.0	4.6	4.9	4.4	1.4
Middle East	2.1	1.8	1.4	1.0	-2.7
OPEC	**28.2**	**33.3**	**49.8**	**64.8**	**3.0**
OPEC Middle East	19.0	22.5	37.4	51.8	3.6
Other OPEC	9.2	10.7	12.4	13.0	1.2
Non-conventional oil	**1.6**	**3.8**	**6.5**	**10.1**	**6.7**
of which GTL	*0.0*	*0.4*	*1.5*	*2.4*	*16.0*
Processing gains	1.8	2.0	2.5	3.0	1.9
World	**77.0**	**90.4**	**106.7**	**121.3**	**1.6**

* Average annual growth rate.

In the above IEA forecast, development of existing reserves makes up a large proportion of projected future oil production, with new discoveries and enhanced recovery techniques providing smaller but still significant increases (see Figure 1).

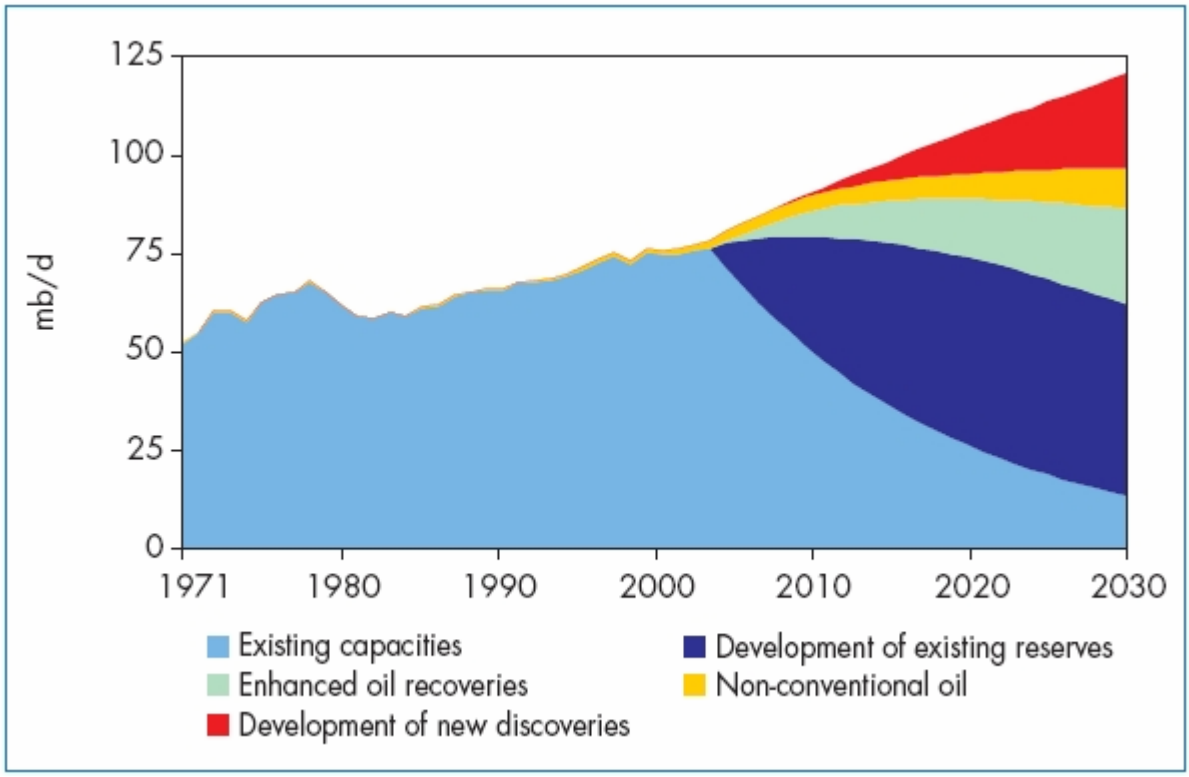

Figure 1: World Oil Production by Source (million barrels per day) (IEA 2004 World Energy Outlook)

The IEA's forecast is, however, at odds with predictions from a number of oil analysts that world oil production will peak at some point in the next 10 – 20 years at levels well below 120 million barrels a day. Although the variation among global oil production forecasts precludes confident endorsement of any one of them, it should be noted that oil production is now decreasing in 33 of the top 48 oil-producing countries, and that nine out of twelve oil experts surveyed by the United States Atlantic Council predicted that oil production could peak and begin to decline by 2012.[6]

1.2 Projected global oil demand

In contrast to the debate over future global oil production, there is a universal consensus that world oil demand will increase significantly in the immediate future. The most recent predictions from the IEA suggest that world energy demand will increase by 57% by 2030, and that 60% of this new demand will be for oil and natural gas. The United States Atlantic Council has similarly forecast a 50% increase in oil demand by 2025. This rapid growth in global oil demand to 2030 is clear in Figure 2, as is growth in demand for natural gas.

[6] Hirsch R (2005) "The Inevitable Peaking of World Oil Production", in *The United States Atlantic Council Bulletin* XVI (3), p 9.

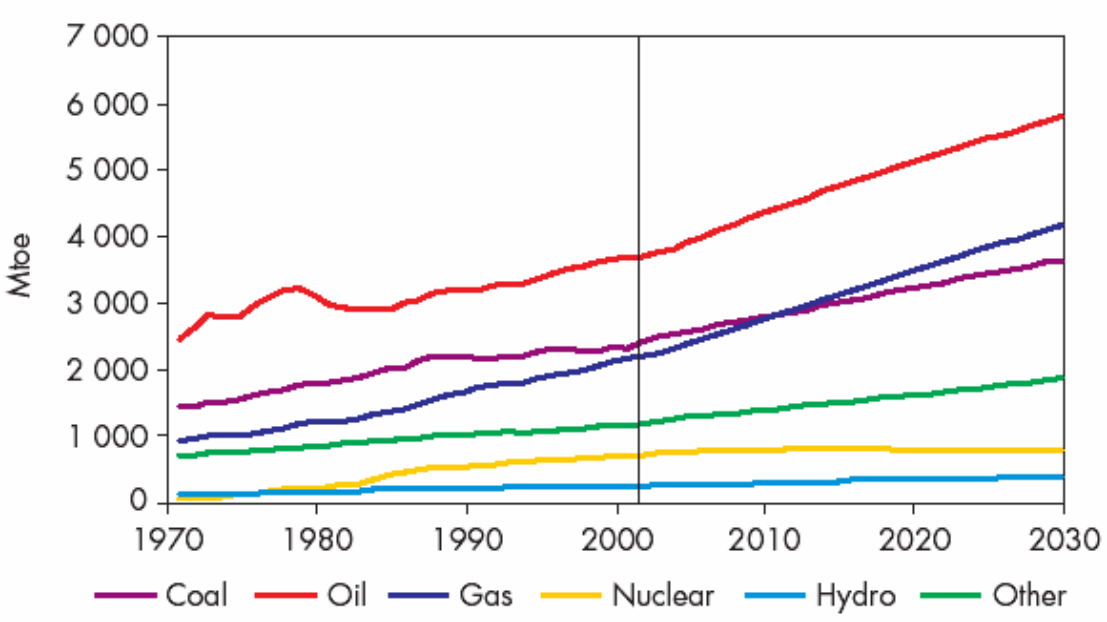

Figure 2: World Primary Energy Demand by Source to 2030 (million tons of oil equivalent) (IEA 2004 World Energy Outlook)

A major driver behind escalating global oil demand will be the particularly sharp demand increases expected in China and India (see Table 2). This detail is particularly relevant to Australia, as recent Commonwealth transport fuels policy has been premised on the continued availability of oil imports from Asia. Should oil demand in rapidly developing nations such as China reach the levels anticipated, global oil reserves may be strained to the point that Australia has difficulty competing against other nations for the oil imports necessary to meet its national energy demand.

Australia should revise its energy policies to better accommodate alternative fuel solutions that can offset demand for imported oil.

Table 2: Oil Import Dependence in Net Importing Regions (%) (IEA 2004 World Energy Outlook)

	2002	2010	2020	2030
OECD total	63	68	79	85
OECD North America	36	35	47	55
OECD Europe	54	68	80	86
OECD Pacific	90	94	94	95
Developing Asia	43	59	72	78
China	34	55	68	74
India	69	80	87	91
Other Asia	40	54	68	76
European Union	*76*	*85*	*91*	*94*

Note: Imports include non-conventional oil.

1.3 Projected Australian oil production

Australian oil production has declined steadily in the last 5 years (see Table 3).

Table 3: Australian Crude Oil and Condensate Production by Basin (ML)

(ABARE Energy in Australia 2005)

	2000-01 ML	2001-02 ML	2002-03 ML	2003-04 ML	2004-05 ML
Crude oil and condensate					
Adavale	0	0	3	0	0
Amadeus	80	72	59	58	60
Bonaparte	8 898	5 985	4 918	2 589	1 868
Bowen–Surat	63	53	40	44	47
Canning	6	4	4	3	2
Carnarvon	18 804	19 745	19 303	16 808	16 487
Cooper–Eromanga					
– Queensland	615	635	690	632	657
– South Australia	906	868	762	623	606
Gippsland	9 328	8 719	7 418	6 764	5 125
Otway	4	12	2	7	7
Perth	3	7	121	347	508
Total	38 705	36 100	33 320	27 876	25 367

The bulk of Australia's oil is produced from mature reserves, and despite speculation over possible undiscovered offshore reserves, Australian oil production is expected to plateau at around 30 000 million litres per annum, and not increase in the long-term (see Table 4).

Table 4: Medium-term Forecast of Australian Oil and Condensate Production (ML)

(ABARE Energy in Australia 2005)

		2005-06 z	2006-07 z	2007-08 z	2008-09 z	2009-10 z
Crude oil and condensate						
Production	ML	26 104	27 240	31 740	31 296	30 858

1.4 Projected Australian oil demand

Australian oil demand amounted to 1792 Petajoules of energy in 2004, and is expected to increase into the future at an average rate of 2% per annum.[7] In 2004-2005 Australia imported 26 055 megalitres (ML) of crude oil and other refinery feedstock valued at over AUS$7000 million.[8] More than half of this amount came

[7] ABARE (2005) *Australian Energy National and State Projections 2005*, p 26.
[8] ABARE (2005), *Australian Mineral Statistics- September Quarter 2005*.

from the Middle East and Indonesia, politically volatile regions with histories of unstable trade policies.

Given that Australia's oil imports already exceed Australian oil production, and that Australian oil production is expected to remain flat in the long-term, growth in Australia's oil demand will widen the gap between Australian oil production and oil consumption.

This gap between supply and demand will need to be filled if Australia's energy needs are to be met, either by successfully competing against other nations to increase oil imports, or by developing alternative energy supplies that can offset oil demand.

1.5 The Implications for Australian Transport Fuel Supply and Demand

Global oil demand is expected to rise by 50% by 2025, and significant uncertainty surrounds future global oil production capacity.[9] A number of experts believe that oil production will peak within the next decade. These predictions suggest that Australia could suffer significant adverse effects from a global oil shortage within the next 10 – 20 years.

The US Department of Energy commissioned a study during 2005 to consider the array of problems that might arise as a result of peaking oil production.[10] The study incorporated the following emerging fossil fuel technologies, deemed commercial or near commercial.

1. Fuel efficient transportation.
2. Heavy oil/oil sands.
3. Coal liquefaction.
4. Enhanced oil recovery.
5. Gas-to-liquids.

A fundamental conclusion of this study was that effective mitigation of the effects of peak oil depends upon the implementation of mega-projects and mega-changes at the highest possible rate.[11] Using this conclusion and assuming a crash program (the implementation of projects at the fastest rate humanly possible), scenario analyses were undertaken using the following three starting dates:

1. When peaking occurs;
2. Ten years before peaking occurs; and
3. Twenty years before peaking.

The key conclusions of these analyses were:

- Waiting until oil production peaks before implementing mitigation strategies will result in a significant global liquid fuels shortage that lasts more than two decades.

[9] Energy Information Administration, US Department of Energy (2004) *International Energy Outlook – 2004*.
[10] Hirsch RL, Bedzek R and Wendling R (2005) *Peaking of World Oil Production: Impacts, Mitigation and Risk Management*.
[11] Hirsch R (2005), *supra* note 6, p 6.

- Initiating a crash mitigation program 10 years before peak oil production is highly beneficial, but will still result in a global liquid fuels shortage that lasts for a decade after peaking occurs.
- Initiating a crash mitigation program 20 years before peaking will avoid a global liquid fuels shortage.[12]

If a mitigation program is implemented too late, balance between global supply and demand will only be restored after massive fuel shortages and extreme economic hardship.

From a risk management perspective, the authors of the study believe that the risks presented by peaking oil production and its mitigation are asymmetric. Premature implementation of mitigation measures was considered a relatively modest misallocation of resources, whereas a failure to take mitigative action will lead to severe economic repercussions.[13]

In Australia, where nearly seven of out ten residents in Australia own passenger vehicles, (a number which has steadily risen over the past 33 years),[14] and the transport sector is dominated by oil-based fuels, a liquid fuels shortage would cause severe hardship to businesses and private individuals alike.

In light of this, Hydro Tasmania encourages the Committee to strongly support measures to reduce Australia's reliance upon oil-based transport fuels in the immediate future. This could achieved by developing sustainable alternative fuel supplies and implementing fuel efficiency and demand management measures.

1.6 Future Australian Oil Supply and Demand and the Greenhouse Imperative

A further issue relevant to the ongoing use of oil-based fuels in Australia's transport sector is the significant contribution these fuels make to Australia's greenhouse gas emissions signature. Australia is currently the world's leading greenhouse gas emitter per capita, with the transport sector contributing 14.5% of the nation's emissions in 2003.[15] The widespread uptake of alternative transport fuels in Australia has the potential to substantially reduce Australia's greenhouse gas emissions, for example by using clean renewable energy to produce hydrogen fuel for internal combustion engines or charge electric motors in hybrid vehicles. The transport sector has not previously been a major target for emissions abatement. The development of low emission-intensity alternative transport fuels could open up the transport sector as a new and vast target for greenhouse gas emission reductions.

1.7 Opportunities to Secure Australia's Transport Fuel Supply

Australia's ability to rely on oil-based fuels to power its transport sector is threatened by dwindling domestic and international oil supplies in the face of rapidly growing global demand, and the need to reduce Australia's greenhouse gas emissions.

[12] Hirsch R (2005), *supra* note 6, p 6.
[13] Id, p 8.
[14] Australian Bureau of Statistics (2004) *Motor Vehicle Census, Australia 2004*.
[15] *Australian National Greenhouse Gas Inventory*, 2003.

Although these problems may not yet have reached "crisis stage", warning signs that oil and climate crises may be imminent, such as rising oil prices and disturbed global climate patterns, are becoming increasingly apparent.

Key international stakeholders have recognised the problems facing the transport sector, and using these as opportunities to generate environmental, social and economic benefits. British Petroleum (BP) recently announced a new division, BP Alternative Energy, to which it has committed US$1.8 billion over the next three years in order to develop solar, wind, hydrogen and gas technologies. Shell has spent US$1.5 billion over the last seven years on the development and deployment of renewable energy technologies, and is actively investing in solar, wind, hydrogen and biofuels technologies.

Hydro Tasmania realises the need for Australia to address the potential crises facing its transport sector as a result of its unsustainable oil consumption and greenhouse gas emissions, and has developed dedicated strategies and initiatives with which to do this. These strategies and initiatives are discussed, where relevant, in subsequent sections.

2 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

2.1 Potential new sources of oil globally and in Australia, and their ability to supply Australian transport fuel needs, taking into account environmental and economic costs

While there is no doubt that new oil fields will be discovered, that further technological advances will enable higher levels of oil recovery, and that unconventional sources such as oil sands will be exploited, the following facts must be considered:

- Oil is a finite resource.
- The world has been consuming more oil than it discovers every year for at least the last 15 years.[16]
- Oil production peaked in the USA (lower 48 states) in 1970, and despite significant price increases (by a factor of three in 1973-74 and a further factor of two in 1979-80), and dramatic improvements in geological understanding and drilling technology, production has continued to fall from 1970 onwards[17].

There is some possibility of future oil discoveries in all of Australia's major offshore basins, which include Gippsland in Victoria, Bonaparte in the Northern Territory, and the Browse and Carnarvon Basins in Western Australia. Despite this speculation, Australian oil production is expected to plateau at around 30 000 million litres, and not increase in the long-term (see Table 4). This indicates that any new Australian oil reserves that may be discovered in the future will only offset concurrent declines in

[16] Hirsch R (2005), *supra* note 6, p 4.
[17] Id, p 5.

production from Australia's existing reserves, and will not increase Australian oil production further into the future.

Given the uncertainty surrounding future global oil supply and the anticipated leveling off of domestic production, Australia should endeavour to reduce its oil demand from both domestic and international sources, or risk severe economic and social consequences.

2.2 Alternative transport fuels in Australia, and their potential to supply Australian transport fuel needs, taking into account environmental and economic costs

Alternative transport fuels including ethanol, biodiesel, hydrogen and electricity (in hybrid vehicles) have the potential to supply a significant proportion of Australia's transport needs. Increased penetration of the Australian market by these alternative fuels would generate substantial environmental and economic benefits. These include:

- reduced dependence on possibly waning domestic and global oil supplies;
- strengthened energy security;
- regional economic growth and infrastructure development;
- reduced greenhouse gas emissions; and
- strengthening of the Australian renewable energy industry.

Consumers in Australia and globally are increasingly willing to pay a premium for environmentally sound and sustainable energy. This suggests that the Australian market would welcome an increased share of alternative transport fuels, suitably developed and deployed. The various alternative fuels currently available to the Australia transport fuel market are discussed below.

2.2.1 Electric/hybrid

Hybrid Electric Vehicles (HEV's) are propelled using a combination of a mechanical engine and an electric motor. This combination makes HEV's significantly more fuel efficient than conventional fossil fueled vehicles. Efficiency is achieved in the following ways:

- using the electric motor at low speeds (where it is much more efficient than a mechanical engine); and
- capturing a portion of the energy required to slow the vehicle down in an onboard battery (a process called "regenerative braking").

The efficiency of HEVs depends on vehicle size, engine and electric motor configuration, and the duty cycle of the vehicle (highway or city driving). Typical efficiency gains are in the order of 20 – 50% relative to conventional vehicles. Oil-based fuels are currently used to power HEVs at higher speeds. Future technology and infrastructure developments could, however, see hybrid vehicles powered by renewable fuels such as hydrogen or biofuels.

HEVs at present remain relatively expensive due to their electric motors and batteries. Nonetheless, HEVs, which were first introduced in the late 1990s, are now fully commercial. Toyota is aiming to sell one million hybrid-electric vehicles worldwide by 2010, Ford is aiming to sell 250,000 vehicles per annum by 2010, and

numerous other major manufacturers also plan to significantly increase their production of HEVs.

In light of their current commercial success, Hydro Tasmania anticipates that HEVs will become an important mode of transport in the near future, in Australia and globally. This creates substantial potential for HEVs to displace conventional oil-based transport fuels. Realisation of this potential will depend upon further technological advances to improve performance and reduce costs, and the introduction of government incentives to encourage purchase of these vehicles.

2.2.2 Electric plug-in

Plug-In Electric Hybrid Vehicles (PHEVs) are a variation of HEVs that use a larger battery that can be "plugged-in" (re-charged), in order to provide a greater proportion of electrical energy for propulsion. Their larger batteries enables PHEVs to be propelled by the electric motor/battery combination at speeds of up to 50–60 km/h. This is substantially greater than the electric motor speeds of HEVs, which can only achieve 10–20 km/h. PHEVs are able to make significantly greater use of their electric motors than HEVs. This further improves the efficiency of the vehicle, as the electric motor is more than twice as efficient as the mechanical engine. A PHEV used predominantly in an urban environment requires up to 80% less fuel than a conventional vehicle.

PHEVs currently remain at the developmental stage, with DaimlerChrysler the only major manufacturer beginning to produce a commercial model (a variant of the Sprinter Van). Future commercialisation of these vehicles will depend on significant cost reductions and improvements in battery performance. Resolution of these technology issues will enable PHEVs to significantly offset long-term conventional transport fuel demand. PHEVs also have the potential to contribute to greenhouse gas emission abatement, if recharged using renewable energy.

2.2.3 Biofuels

Biofuels, particularly ethanol & biodiesel, demonstrate strong potential to offset Australia's demand for oil-based transport fuels. The *Report Of The Biofuels Taskforce to the Prime Minister* submitted by the Australian Biofuels Taskforce in August 2005 provides a thorough summary of the contribution biofuels could make to Australia's transport fuel demand.

Hydro Tasmania refers the Senate Committee for Regional and Rural Affairs and Transport to this document, whilst noting certain key conclusions from the report, and their significance in light of subsequent developments.

2.2.4 The Viability Biofuels of Australia

A key conclusion reached by the Biofuels Taskforce was that Australia could meet a Government-mandated aggregate production target of 350 ML of biofuels by 2010 if there was an operative mainstream market for biofuels in Australia. Although the Taskforce also concluded that the mainstream market necessary to achieve the 350 ML target does not exist in Australia, the Prime Minister John Howard issued a press

release in late December 2005 stating that the Australian biofuels industry expects to meet and exceed the target within the 2010 timeframe. This indicates that biofuels represent a viable source of alternative transport fuels in Australia.

The commercial viability of biofuels is supported by the following statistics, outlined by the Prime Minister in his press release:

- the current upper estimate of aggregate Australian biofuels production in 2010 is 532 ML, well in excess of the 350ML target;
- the current lower estimate of aggregate Australian biofuels production in 2010 is 403 ML, still substantially in excess of the 350 ML target;
- 400 service stations throughout Australia currently retail transport fuels blended with ethanol or biodiesel; and
- Shell Optimax Extreme, a super-high octane fuel comprising 5% ethanol, will be the official fuel of the 2006 V8 Supercars Championship.

The Australian Government has introduced a suite of measures to help ensure the above estimates are realised, including:

- collaboration with key stakeholders to develop a Biofuels Action Plan that will provide a strong framework and foundation upon which to build a sustainable Australian biofuels industry;
- a $37.6 million Biofuels Capital Grants Program to support new or expanded biofuels production capacity in order to reduce supply constraints;
- Commonwealth fleet use of ethanol blend fuels;
- an increase in the number of fuel quality compliance inspections to ensure motorists receive high quality fuel that is safe for their vehicles;
- vehicle testing of ethanol blend fuels; and
- conducting a study to assess the health benefits of E10 under Australian conditions.

2.2.5 The Benefits of Using Biofuels in Australia

The report of the Biofuels Taskforce identifies a number of benefits for Australia that would result from an increased market share for biofuels. These are discussed briefly below.

Regional Development

Increased production of biofuels in Australia will create increased demand for agricultural products as feedstocks from which to produce the fuels. Increased demand and competition for agricultural products will elevate the prices of these products, which will in turn increase earnings and economic growth in regional agricultural areas.

Increased biofuel production would also stimulate investment in new feedstock and production infrastructure in regional areas, further accelerating economic growth and employment. The Biofuels Taskforce estimated that achievement of the 350ML target by 2010 would create almost 650 new direct and indirect jobs in regional areas in South Australia and Victoria for biodiesel, and Queensland and New South Wales for ethanol.[18]

[18] *Report of the Biofuels Taskforce to the Prime Minister* (2005), p 3.

The Biofuels Taskforce considered the regional development benefits alone a sufficient justification for the costs involved in meeting the 350ML target. This development could significantly offset the negative economic and social impacts that Australia might suffer as a result of increased oil prices and reduced oil supply.

Greenhouse Gas Emission Reductions
Biofuels can make a significant contribution to Australia's efforts to reduce its greenhouse gas emissions, further enhancing the prospect of developing the transport sector as a new and vast target for emission abatement. Blending of biodiesel with conventional diesel can reduce emissions by 23-90% depending on feedstock, while blending of ethanol with conventional petroleum fuels can reduce emissions by approximately 2-12%, depending on production techniques.[19]

Although the Biofuels Taskforce did not consider these emission reductions as alone justifying the costs of achieving a 350ML biofuels target, they nonetheless represent a significant environmental benefit that reinforces arguments in favour of increased biofuel consumption in the transport sector.

Improved Energy Security
The Biofuels Taskforce supported the Australian Government's statement in its 2004 Energy White Paper conclusion that Australia enjoyed a high level of energy security. Developments since the publication of the biofuels report suggest, however, that this conclusion and the policies founded upon it may need to be revised. The reasons for this have been discussed above, and include:

- continued high oil prices; and
- rapidly growing energy demand and oil imports in Asia.

Given that Australia's energy security may be threatened in the near future by the above factors, the ability of biofuels to offset Australia's reliance on imported oil-based transport fuels should be noted, and considered a further reason to promote their role as an alternative transport fuel in Australia.

2.2.6 Biofuels – current and future governmental support

Hydro Tasmania believes that the Australian Government needs to provide further support to the biofuels industry in order to ensure that the technology is fully commercialised in Australia and its potential to offset oil demand completely realised. To this end, Hydro Tasmania recommends that the following incentives be implemented:

1. A five year delay in the introduction of the effective fuel tax on biofuels from the current period of July 2011 to July 2015, to July 2016 to July 2020. This delay would ensure that commercial production of biofuels is not compromised by uncertainty surrounding an insufficient payback period on the capital investment required to establish production.
2. The removal of the collection of fuel tax for biofuels used in vehicles of greater than 4.5 tonnes post 2015. This would allow greater use of biofuels in

[19] Id, p 7.

fleets and marine vessels where economy of scale distribution could be achieved and environmental benefits gained. For example, the use of pure biodiesel (B100) is highly desirable in marine vessels due to its biodegradability, but as many of these vessels are over 4.5 tonnes, there will currently be no incentive to use the fuel post 2015, whereas there will be an incentive for personal cars of 19.1 c/litre.

3. The Biofuels Capital Grants Program be extended to provide further funding grants for the establishment of biofuel production facilites.

2.2.7 Hydrogen

The National Hydrogen Study conducted during 2003 confirmed the long-term potential of hydrogen to "meet Australia's own and much of the world's energy needs for a very long time".[20] The study identified a number of potential applications for hydrogen energy, most notably as a transport fuel, but also in powering portable appliances and distributed generation in remote areas.

The emergence of hydrogen as an alternative transport fuel would represent a fundamental shift away from the oil-based fuel technologies that currently dominate the transport sector. This would enable a more secure and sustainable future for transport in Australia and globally, and enable efficient and sustainable use of both fossil fuel and renewable energy resources for hydrogen production.

There is a growing consensus that a hydrogen economy will evolve and ultimately replace the present oil economy. Hydro Tasmania has conducted detailed studies of emerging hydrogen technologies in order to identify potential areas for future business development. The conclusions and initiatives based on these studies are outlined below, in the context of future Australian oil demand and supply, and the development of alternative transport fuels.

2.2.8 Hydrogen fuel cells

Hydrogen fuel cells offer a cleaner, more efficient alternative to the combustion of oil-based fuels in conventional engines. Fuel cells are electrochemical devices that convert hydrogen and oxygen into energy and water.

Although fuel cell technology has developed significantly over the past few decades, fuel cell vehicles remain an infant technology, facing several barriers. Reliability, durability and maintainability are all critical parameters which have yet to be fully addressed by manufacturers. There is currently a shortage of the corporate expertise necessary to bring hydrogen fuel cell vehicles to market. A lack of thorough technology development combined with high development costs will likely prevent hydrogen fuel cells from making a significant contribution to a hydrogen economy before 2050.[21] Hydro Tasmania does, however, anticipate that hydrogen fuel cells will become a viable transport alternative in the longer term, and has accounted for their future commercialisation in its business and technology development strategies.

[20] ACIL Tasman (2003) *National Hydrogen Study*, p xviii.
[21] Ibid.

2.2.9 Internal combustion hydrogen engines

The use of hydrogen to fuel internal combustion engines (ICEs) captures all the key benefits of hydrogen fuel cell engines, but at significantly less cost. The following hydrogen ICE technologies are already available for commercial use:

- hydrogen ICE vehicles;
- sustainable hydrogen production technologies, using renewable energy;
- hydrogen storage technologies, including liquification, compression and metal hydride technologies; and
- hydrogen ICE vehicle refuelling technologies.

The comprehensive array of hydrogen ICE technologies currently available for demonstration and commercialisation represents an opportunity to develop an entirely new and sustainable transport sector. Hydro Tasmania has recognised this opportunity, and is currently developing a proposal to implement a full-scale, Tasmania-wide hydrogen transport system, using a cluster of readily available hydrogen energy technologies from around the world. This program, known as the "Hydrogen Transport Technology Initiative", involves the deployment of six hundred hydrogen ICE vehicles and seven hydrogen refuelling stations throughout Tasmania, to create a complete Tasmanian hydrogen transport network.

Being geographically compact, with its urban centres in relatively close proximity to one another, and completely dependent upon imported oil-based fuels, Tasmania is uniquely adapted to lead the global development of hydrogen as an alternative transport fuel. The abundant renewable energy available in Tasmania and harnessed by Hydro Tasmania will enable hydrogen fuel to be produced cleanly and sustainable, reinforcing the environmental integrity of the Hydrogen Transport Technology Initiative. The use of renewable energy to produce the hydrogen necessary to fuel the Hydrogen Transport Technology Initiative will ensure strong growth of the Tasmanian renewable energy market into the future. Shell Australia is currently working with Hydro Tasmania to implement the Hydrogen Transport Technology Initiative, and considers the program a "lighthouse initiative" in the commercialisation of hydrogen transport technologies.

The success of the Hydrogen Transport Technology Initiative will depend upon the provision of Commonwealth Government support through the Low Emissions Technology Demonstration Fund (LETDF). Hydro Tasmania is currently developing an application for an LETDF grant that will be submitted to the LETDF Review Panel at the end of March. Provided this application is successful, implementation of the Hydrogen Transport Technology Initiative will commence in September 2006, and continue for the 10 years necessary to bring hydrogen ICE technologies to commercialisation.

2.2.10 Benefits for Australia of the Hydrogen Transport Technology Initiative

The Hydrogen Transport Technology Initiative as a Means of Reducing Australia's Oil Demand

The Hydrogen Transport Technology Initiative will enable substantial reductions in oil demand within Tasmania, and ultimately facilitate broader oil demand reductions throughout the rest of Australia and the world.

ICEs fuelled by hydrogen have no need for oil-based fuels. The LETDF application criteria stipulate that proposals must reasonably expect to reduce Australia's greenhouse gas signature at 2030 by at least 2%. Hydro Tasmania is confident that its Hydrogen Transport Technology Initiative will reduce Australia's greenhouse gas emissions by at least this amount. The uptake of hydrogen ICE vehicles necessary to achieve the minimum 2% emission reduction would equate to an annual reduction in oil demand of approximately 25.6 million barrels per year by 2030 (see Figure 3). This statistic only represents the oil demand reductions forecast to be achieved within Australia. The global reduction in oil demand facilitated by the Hydrogen Transport Technology Initiative as an important step towards the development of a global hydrogen economy would likely be much greater.

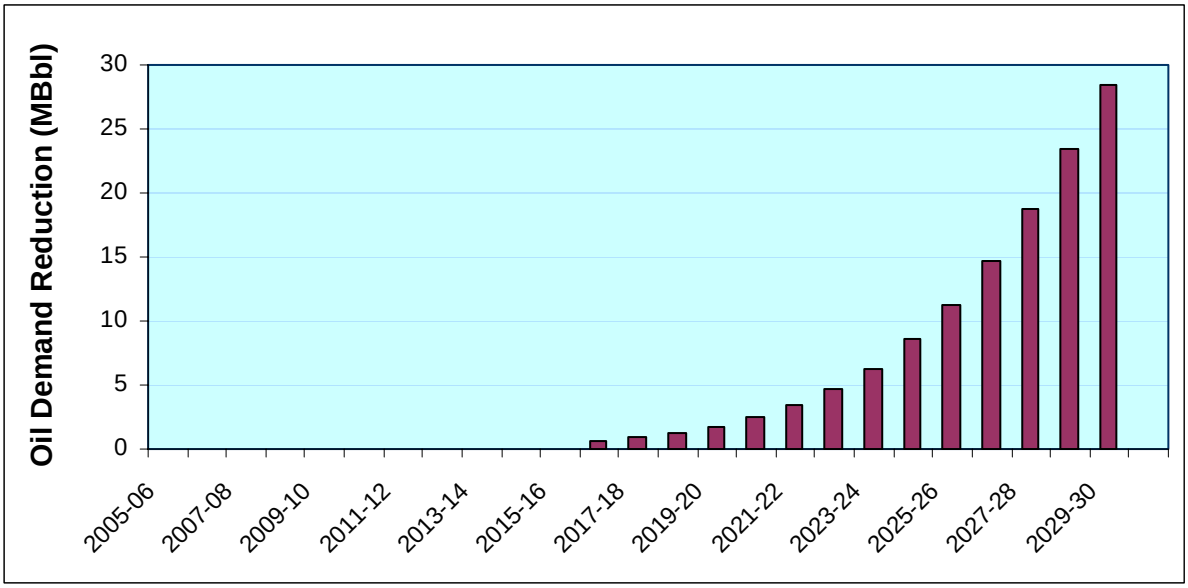

Figure 3: Oil Demand Reduction Achieved in Australia by the Hydrogen Transport Technology Initiative (Million Bbl)

The Hydrogen Transport Technology Initiative as a Means of Reducing Australia's Greenhouse Gas Emissions

Hydro Tasmania's Hydrogen Transport Technology Initiative will significantly reduce Australia's greenhouse gas emissions across a number of different sectors. These include:

- reduced vehicle emissions resulting from a reduction in the number of fossil fuel on-road vehicles (FFOVs);
- reduced emissions from the electricity sector as a result of reduced demand for electricity for petroleum production;
- reduced fugitive emissions from oil refining for petroleum production as a result of the replacement of FFOVs by hydrogen ICE vehicles (HICEVs); and
- reduced emissions from the transport of petroleum from its point of refining to point of supply, as a result of reduced petroleum demand.

The Hydrogen Transport Technology Initiative as a Catalyst for Global Commercialisation of Hydrogen Transport

The development and deployment of hydrogen transport technologies and evolution of a hydrogen economy will be determined by the cost reductions and technical improvements achieved through economies of scale and learning-by-doing effects. The market penetration necessary to generate these reductions and improvements will be driven primarily by hydrogen ICEs, as the most readily available and commercially viable hydrogen technology. For this reason, the Hydrogen Transport Technology Initiative is likely to have a significant worldwide impact, accelerating the widespread adoption of complete hydrogen transport systems throughout the rest of Australia and the world.

The advent of a hydrogen economy will be accelerated in the future by hydrogen fuel cell technologies and associated hybrids, once these technologies reach the levels of technical and cost competitiveness necessary for demonstration and commercialisation. The Hydrogen Transport Technology Initiative will assist these outcomes by building the hydrogen infrastructure necessary to fuel future fuel cell vehicles, and raising public awareness and acceptance of hydrogen transport.

The Hydrogen Transport Technology Initiative as a Stimulus for Australia's Renewable Energy Industry

The production of hydrogen to fuel the Hydrogen Transport Technology Initiative and the hydrogen economy entails significant electricity generation. Using Tasmanian renewable energy to drive this component of hydrogen transport systems will ensure that these systems are environmentally sound and sustainable in the long-term. Australian possesses a strong renewable energy technology portfolio capable of generating the electricity necessary to produce the hydrogen to fuel a national hydrogen economy. These include:

- wind power;
- hydropower;
- geothermal power;
- solar power; and
- bioenergy.

Although Australia has successfully established a national renewable energy industry with effective support from the Commonwealth government, industry growth has faltered recently due to the imminent expiry of these supporting regulations. The

renewable energy market expansion necessary to meet the needs of a new hydrogen economy will introduce a significant new market for renewable electricity generation. This will help consolidate and expand Australia's renewable energy industry, creating substantial investment, development and employment opportunities in both urban and regional areas.

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

3.1 Impacts of rising fuel prices and reduced fuel supply in Australia

The rising price of oil-based fuels in Australia has already had a significant economic impact upon Australian consumers across all sectors. Energy demand in the transport sector has become increasingly volatile in recent years, due to both rising oil prices and changing travel and tourism trends.[22]

The economic impacts in Australia of rising oil prices will become significantly more acute in the immediate future if ways are not found to abate Australia's oil consumption. As a net oil importer, Australia may experience a net reduction in economic growth as a result of rising oil prices. Slowed economic growth is likely to increase unemployment and associated social problems. Higher oil prices may also depress the Australian dollar, exacerbate inflation and weaken Australia's trade balance (the price of imports relative to the value of exports).[23]

3.2 The potential for development of alternative transport fuels in Australia to offset the impacts of rising fuel prices and reduced fuel supply

Alternative transport fuels have the potential to significantly offset the impacts in Australia of rising fuel prices and reduced fuel supply.

The uptake of alternative fuels combined with reduced fuel from hybrid vehicles will mitigate the negative impacts of rising oil prices by reducing Australia's oil demand and dependence on oil imports. Reduced oil demand and imports will moderate many of the negative economic effects of rising oil prices discussed above by limiting the effects of higher oil prices on Australia's economic growth, employment and exchange rate.

Expansion of Australia's supply of alternative fuels will enable fuels such as hydrogen and biodiesel to meet an increasingly large proportion of Australia's transport fuel needs. Australia's transport fuel demand is predicted to grow steadily at a rate of approximately 2% per annum through to 2030.[24] Alternative fuels can bridge any gap between Australia's transport fuel supply and demand that may develop as a result of faltering and/or costly oil supplies. This will guarantee the ongoing ability of Australian citizens and businesses to meet their transport

[22] ABARE (2005) *Energy Update June 2005*, p 3.
[23] ABARE (2005) *Impact of Oil Prices on Trade in the APEC Region* pp 49-50.
[24] ABARE (2005) *Australian Energy: National and State Projections to 2029-30*, p 30.

requirements, and avoid the development of a potentially dangerous state of energy insecurity.
The negative impacts of rising oil prices can be substantially offset by the benefits that will accrue from growth in Australia's alternative fuel and associated industries. The development of the national infrastructure necessary to support alternative fuel transport systems will generate considerable national and international investment, and create a large number of jobs throughout Australia. Growth in support industries such as renewable energy and manufacturing will similarly compensate for the repercussions of rising oil prices by driving increased investment and employment.

The development and deployment of alternative transport fuels such as hydrogen and biodiesel will thus alleviate the negative economic and social aspects of rising fuel prices and reduced supplies in multiple ways, including:

- reducing Australia's oil demand and imports;
- supplying Australia's growing transport fuel needs and promoting national energy security; and
- stimulating investment and employment through industry growth in alternative fuel and associated support sectors.

4 Options for reducing Australia's transport fuel demands

Many strategies are available to reduce Australia's transport fuel demand. The following is a list of potential strategies, with examples of the implementation of these strategies, and references providing full details of how these strategies could be implemented in Australia.

Increase the fuel efficiency of vehicles

Hybrid (petrol/electric or diesel/electric) vehicles represent one of the most promising technologies for increasing vehicle fuel efficiency, particularly in urban environments. As outlined above, hybrid vehicles have the potential to reduce fuel consumption by approximately 20 – 50%. The Toyota Prius (petrol/electric hybrid), for example, consumes 4.4 litres/100km, compared to other medium sized cars such as a Holden Vectra (8.2 litres/100 km) or a Mazda 6 (8.8 litres/100 km).[25] The USA has recently introduced a tax credit scheme to provide consumers with an incentive to purchase fuel efficient vehicles, with a car such as the Prius being eligible for a credit of approximately US$3000.

Vehicle fuel efficiency can also be increased by imposing mandatory standards upon manufacturers, such that the average fuel efficiency of vehicles produced must increase over time; or by linking fuel efficiency to registration payments.

Encourage public transport

Improvements to public transport networks, including discounted fares (particularly for groups such as students), and direct marketing of public transport to individuals and families, can increase public transport use and decrease total fuel consumption.

[25] Green Vehicle Guide, available at http://www.greenvehicleguide.gov.au.

In Perth the Travel Smart Program, which directly targets and informs households of alternatives to car transport, resulted in a 25% increase in public bus use when "rolled out" in the suburb of South Perth.[26]

Although demand reduction measures such as those discussed above represent a vital element in a plan to reduce Australia's transport fuel demand, it should be noted that the most important element of such a plan will be the development of a genuinely sustainable supply of alternative transport fuels.

In light of this, Hydro Tasmania would like to reiterate the ability of hydrogen and biofuels such as ethanol and biodiesel to provide viable sources of alternative transport fuels in Australia.

[26] TravelSmart Highlights, available at http://www.dpi.wa.gov.au/tsmart_highlights.pdf.