See Distribution

Alternative Transport Fuels Strategy Development
Template for Provision of Input

Please Note:

The intent of this template is to collect individual member's opinions on the current state of play in the alternative transport fuels market. Information obtained from this questionnaire will be used to inform the strategy assessment documents in a manner non-attributable to its source. Please clearly indicate any in-confidence information provided in your response.

1. Drivers of Alternative Fuels:

What do you consider as the main drivers, and community benefits from, the increased uptake of alternative fuels?

The Energy Security Imperative

A recent report by the Department of Resources, Energy and Tourism describes energy security in an Australian context as 'the adequate, reliable and affordable supply of energy to support the functioning of the economy and social development' (DRET 2009).

Australia's oil self-sufficiency has been declining rapidly over the past decade due to the combined effect of dwindling domestic production and rising demand. Even with supplementation of resources from known domestic alternatives, 70% of Australia's transport energy demand is expected to come from imports by 2030 (Figure 1). The projected cost is expected to climb from $20 billion to $100 billion per year, leading to a significant imbalance of trade. This looming fall in self-sufficiency is likely to be triggered by the fact that:

Australia's demand for oil is predicted to increase by 50% between 2000 and 2030 (ACIL Tasman et al. 2009);

national oil production is simultaneously forecast to decline sharply; and

within the Australian transport sector, annual demand for transport energy could rise by as much as 35% by 2030 – from around 345 million barrels of oil equivalent in 2007, to more than 470 million barrels of oil equivalent by 2030 (ACIL Tasman et al. 2009).

If the global oil outlook is one that is characterised by abundant and affordable oil-based fuels, this decline in oil self-sufficiency is in itself not necessarily a cause for alarm.

Unfortunately, the outlook for the affordable supply of conventional fuels is characterised by a high level of uncertainty and strong suggestions that global oil-based fuels are likely to be increasingly scarce over the next 20 years, with significant risk of dramatic cost increases. The magnitude of this decline in oil self-sufficiency begs the question 'how will Australia manage its economy in the face of a looming transport energy deficit?

The net effect of this significant decline in Australia's national oil self-sufficiency suggests reduced transport fuel independence; increased vulnerability to fuel supply interruption; decreased competitiveness of Australian business and industry; and price flow-on effects in terms of the cost of goods and services for all Australian consumers.

The Greenhouse Imperative

Under a Business As Usual (BAU) scenario, Australia's GHG emissions are predicted to double by 2050 (Treasury 2008). After stationary energy and agriculture, transport is the third largest contributor to Australia's GHG emissions, accounting for around 14% of all GHG emissions in 2008 (DCC 2010).

In the Australian domestic transport sector, emissions grew by 16.8% in the ten years from 1997–98 to 2007–08 (CTEE 2010).

Road transport is currently (and is expected to remain) the most significant source of GHG emissions in the Australian transport sector. In 2007–2008 it accounted for 84% of GHG emissions, with annual emissions projected to grow by 12.5% by 2017–2018 (CTEE 2010).

In light of the above, the role of alternative fuels in fulfilling Australia's international obligations to reduce GHG emissions, and improving the outlook for energy security, should also be considered (Figure 2).

- What are the prospects for various alternative fuels and technologies (eg LPG, LNG, CNG, biofuels, electric and fuel cells) between now and 2030?

The Role for Alternative Fuels

In the past, Australia's transport fleet has been almost entirely dependent on GHG-intensive conventional oil-based fuels, which are increasingly sourced from imports. When considered on an energy basis, these fuels produce the most GHG emissions when combusted.

As shown in Figure 3, analysis of the projected fuel mix to 2030 forecasts significant growth in annual diesel demand, and hence diesel imports. It can also be seen that there is a significant increase in LPG production with the expansion of LNG projects from 2013. Although there is some uncertainty surrounding the projected consumption of both Traditional and Autogas LPG, there remains a significant projected surplus of LPG. Given Australia's forecast reliance on imported fuels and the

projected increase in GHG emissions from the transport sector, alternative fuels represent an attractive opportunity to reduce the degree to which these occur.

Enhancing the position of alternative fuels in the Australian market can play a role in offsetting the increasing level of diesel (and other fuel) imports and subsequent risk to Australia's energy independence. In addition, a number of alternative fuels represent an opportunity to reduce Australia's transport sector GHG emissions when considered on a life cycle basis.

- What technologies are likely to be commercialised by 2020 and by 2030?

The Automotive and Component Industry

The automotive industry in Australia is a significant contributor to the manufacturing sector, and the Australian economy. The industry represents around 6% of Australia's total value added manufacturing and contributes around 1% of national gross domestic product. It includes the retail, service and repair sectors of the industry, and is estimated to produce more than $50 billion in annual turnover and employment for over 400,000 people (FCAI 2008).

The industry comprises three key segments:

***Motor vehicle manufacturing**: three Australian-based manufacturers employing over 60,000 people.*

***Component producers**: more than 200 organisations producing automotive components, and approximately 500 firms supporting these organisations and their tooling requirements.*

***Retail, service and repair**: employing around 300,000 people, includes vehicle repair and main(y)-7(5)7(5)7(5)7(5)24 373.78 Tm1 a reo a4(d)ort*

(DFAT 2009). Although there is significant potential for the industry to capitalise on its strong grounding and global recognition, there is a need to reverse the decline of recent years by repositioning and improving the industry in the short term

- What technologies do you consider to be the most advanced in their development towards commercialisation and why?

LPG ....

An Indigenous Fuel

With abundant supplies of LPG, Australia has a significant opportunity to increase the role of LPG within the transport sector. The forecast increase in LNG production from 2013 (Figure 4), will reduce Australia's reliance on imported liquid fuels.

Domestic supply of LPG is expected to exceed 6500 kilotonnes by 2018, while domestic demand (under a BAU scenario) is not expected to exceed 2000 kilotonnes – suggesting a net surplus of around 4500 kilotonnes (LPGA 2008). In addition, naturally occurring reserves are able to continue to meet the domestic needs beyond 2030, even with increases in demand beyond BAU (Anyon 2003).

Indeed, even with no further increases in LPG production capacity from 2020, there is still the potential to meet a 200% increase in domestic LPG demand by 2030. The projected consumption of both traditional and Autogas LPG is likely to reduce the LPG surplus by up to 15% between 2020 and 2030.

While the above supply/demand outlook illustrates the potential role of LPG in reducing Australia's dependence on foreign transport fuels, it is important to consider this role in light of the ongoing debate surrounding other alternative fuels available to the market. Figure 5 illustrates the characteristics of fuels currently being promoted as alternatives to petrol in the Australian light vehicle road transport market.

A number of fuels present an opportunity to capitalise on Australia's indigenous fuel resources. However, as shown, very few also constitute a greenhouse-positive alternative to petrol. In light of the greater global focus on climate change, this is a key consideration in the alternative fuels debate and one that is well-addressed by LPG

A Greenhouse Positive Solution

When considered on a life cycle basis, LPG powered vehicles deliver a GHG reduction relative to petrol, both now and into the future, with the optimisation of engine technologies.

The use of LPG in lieu of ULP in passenger vehicles in Australia has the potential to decrease GHG emissions by up to 13% over the full life cycle, assuming adoption of advanced LPG combustion technologies. Looking forward, the carbon benefit offered by LPG as a transport fuel has the potential to grow as indigenous supplies become increasingly focused on natural gas fields (as opposed to refinery-sourced LPG) and as the emissions from production are reduced.

Forecasts suggest that LPG extracted from natural gas (GHG intensity of 0.186 kg CO_2-e per kilogram LPG produced) is likely to double over the next ten years, while LPG from refineries (0.364 kg CO_2-e per kilogram) is projected to remain static or decline slightly (LPGA 2008).

The net effect of this increase in gas field sourced LPG, combined with the market entry of advanced LPG technologies suggests that the use of LPG in passenger vehicles delivers significant GHG savings, as shown in Table 2

A Market Ready Alternative

LPG stands alongside a number of alternative fuels in terms of domestic availability and GHG positive outcomes. However, there are a number of significant barriers surrounding the availability and cost to the consumer of alternatives to petrol that have received considerable attention in recent years,

promoting the continued development of LPG vehicle technologies in Australia. The revitalisation of the industry is likely to bring short-and long-term benefits to the Australian economy, in terms of both job growth and international recognition of the domestic automotive and components industry

The Potential Community Dividends

The primary strategic objective of this roadmap is to enable the realisation of the economic and community dividends of increased LPG use. The main areas where benefits will be realised are:

balance of trade benefits (owing to avoided importation of oil);

reduction of Australia's transport sector GHG emissions;

benefits of an affordable fuel to Australian households; and

revitalising the Australian automotive industry.

The degree to which these benefits are realised will be dependent on the ability to increase the market share of LPG in Australia's light duty fuel mix. Based on existing forecasts (LPG reference scenario developed by Rare [2010b]) the LPG Autogas industry faces a significant challenge in maintaining existing market share in the light duty fuel mix, unless barriers to market adoption can be adequately addressed. In the short term the removal of the LPG vehicle scheme rebate and imposition of excise will dramatically reduce growth in the LPG vehicle fleet.

Without support, it is likely that LPG use in the light duty vehicle fleet will decline to around 6% by 2030. This estimate is driven by the following principal observations.

LPG fumigation systems will continue to be the predominant technology used owing to their lower overall cost (and absence of the rebate);

The attractiveness of LPG fumigation systems relative to emerging alternative fuels, such as electric vehicles and petrol-electric hybrids, will be reduced; and

There will be limited OEM product availability.

Performance uncertainty, market relevance and legislative uncertainty are significant barriers that inhibit LPG growth in the market. Performance uncertainty has been driven by variability in conversion standards and LPG engine technologies, while market relevance has suffered due to the increased profile of competing technologies (e.g. hybrids) and poor consumer knowledge regarding performance, safety, cost and environmental benefits. Legislative uncertainty with excise has only recently featured in the decision making of fleet and private buyers.

In recognition of these barriers, there are two clear strategies that can be pursued independently to increase the market share of LPG in Australia's light duty fuel mix beyond 6% in 2030. An expected LPG uptake scenario has been developed for each strategy. The first scenario represents LPG achieving approximately 10% of market share through support of OEM LPG sales. The second

scenario corresponds to an extended transition to full excise, but delivers only a short-term impact with virtually no difference in the 2030 fuel mix

- What do you see as the most effective roles for the following in advancing the development of alternative fuels:

  - Government (Federal, state and local/regional);

  Within the context of alternative transport fuels, to provide leadership in relation to energy security, carbon reduction and industry consultation.

  To establish a strategic policy framework that provides for relevant and tangible policy outcomes; public, industry and government, that will provide long-term confidence and assurance for industry to invest in the development of the fuel, infrastructure, technology and its people.

  To provide government funding and tax concessions to assist industry with capital funding (investment in infrastructure and product development).

  - Industry;

  To establish (Government aligned) a long-term industry strategic 'Road Map' that clearly indentifies the key objectives and direction (supporting strategies) of the industry, and outlines the opportunities, challenges and barriers to be engaged as the industry, in concert with Government, moves forward into the alternative fuels policy debate. To include the need for market education and public incentive (to move to alternative fuels) and joint capital funding.

  - Feedstock producers/suppliers;
  - Researchers and technologists;
  - Investors and venture (patient) capitalists; and
  - End users.

2. Barriers to development and better uptake of alternative fuels:

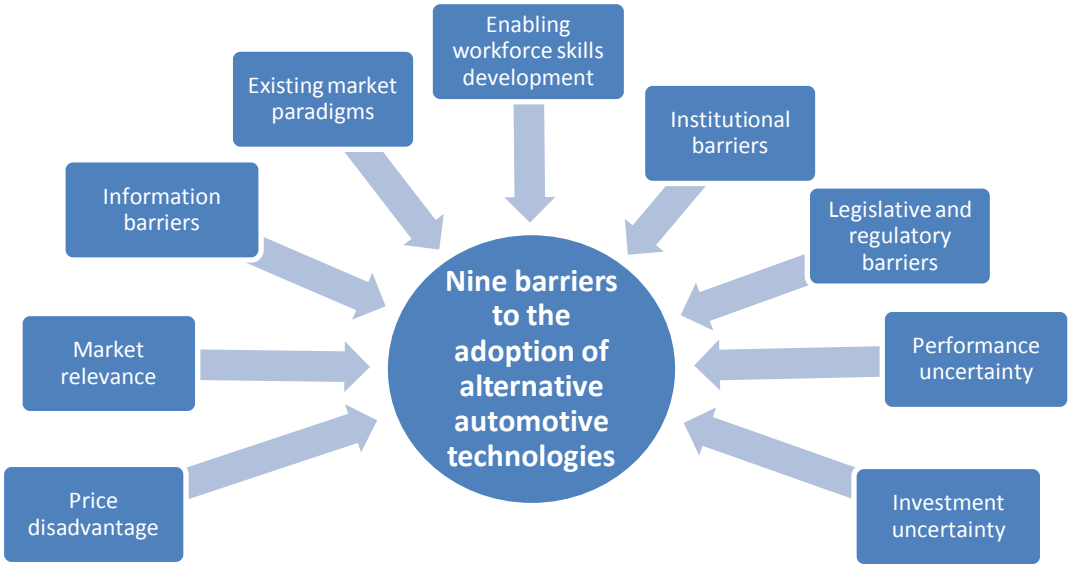
- What do you see as the main barriers to the development and use of alternative fuels?

  Suggested headings to structure your response:
  - Existing market paradigms
  - Institutional barriers
  - Price disadvantage
  - Market relevance
  - Legislative and regulatory barriers

- Performance uncertainty
- Investment uncertainty
- Enabling workforce skills development
- Information barriers

Current Market Barriers

The adoption of any new automotive technology in the presence of incumbent technologies typically requires navigation of nine groups of market barriers (Figure 9). While some of these barriers are more critical than others, each barrier must be systematically addressed if the potential economic and community benefits of the technology are to be fully realised by the national community.
An examination of the market position of LPG in the Australian automotive market in light of the nine strategic barriers provides an indication to the strategic directions that will need to be pursued.



Price Disadvantage

LPG vehicles are typically delivered to the market by way of an additional fuel system fitted to the vehicle (i.e. dual-fuel operation) which comes at an additional expense to that of a conventionally fuelled vehicle. In addition, the smaller volumes of LPG vehicles introduced into the market (either as new vehicles or conversions of existing vehicles) mean that suppliers are required to amortise their product development and engineering costs over a smaller number of annual vehicles sales – producing a higher cost premium than would otherwise be the case.

The net effect of these two characteristics is that LPG vehicles are generally more expensive to purchase than conventionally fuelled vehicles – creating a consumer barrier to the increased market penetration of LPG vehicles.

The quantum of this price disadvantage varies from $1800 to $4500 per vehicle depending on the system and whether the vehicle is purchased new or converted to LPG operation.
While it has historically been reasoned that the consumer recoups the additional expenditure from reduced fuel costs over the life of the vehicle, consumers are generally capital sensitive and do not usually consider vehicle purchases on the basis of whole-of-vehicle life economics.

Market Relevance

Market relevance is typically a measure of the strategic fit of a new fuel (or technology) with the core requirements of the market – considered at both a community aspiration level and a consumer level.

As highlighted earlier, LPG provides a good level of fit with Australia's national aspirations for improved transport energy security and reduced GHG emissions. As such, this fuel is directly relevant to the contemporary economic and environmental aspirations of Australian society.

The level of fit of LPG at the consumer level tends to be sporadic. Essentially, the consumer relevance of LPG appears to wax and wane in proportion to the rise and fall in the cost of conventional transport fuels (and consumer perceptions of price volatility). This phenomenon creates significant challenges for ensuring continuous investment in the development and refinement of LPG technologies for automotive application in Australia. To some extent, this barrier is expected to be resolved by expected increases in the cost of conventional transport fuels in the near term, relative to LPG.

At the consumer level, there appear to be opportunities for the industry to better market LPG vehicles. As evidenced in this paper, increased use of advanced LPG technologies for passenger vehicles will deliver environmental benefits such as reduced GHG emissions. The emergence of the carbon constrained economy therefore creates a new product attribute that could be marketed to fleet buyers and private buyers alike

The traditional approach to this barrier has been for government to provide rebates for the capital purchase of LPG vehicles. Care is needed in terms of the design of these schemes, however, as schemes that require the consumer to pay up front (with a view to a rebate being returned following purchase) tend to be less effective than those that provide the rebate at the time of purchase.
In the near term, the continued provision of up-front rebate schemes is likely to be the most effective means of redressing the price disadvantage barrier.
As the number of annual sales of LPG vehicles grow, the industry is likely to reach a point where the incremental capital cost of LPG vehicles becomes insignificant and the rebate is no longer required. The achievement of this 'tipping point' could be accelerated if R&D assistance were provided to industry to reduce the costs associated with the commercialisation of advanced LPG vehicle systems

Information Barriers

The development of the LPG vehicles agenda in Australia requires coordination of the total supply chain. The relatively immature nature of the market means that information processes are poor and that industry development activities are predominantly being advanced by largely disconnected industry stakeholders.

Analysis of the current state of the industry suggests that there are currently a number of information failures in the LPG vehicle industry. Key information failures include:

- *incomplete information on the current capacity and nature of the national LPG refuelling asset;*
- *incomplete information on the actual number of LPG vehicles in operation, given the varied registration requirements for LPG vehicles in Australia's states and territories;*
- *conflicting information on the indigenous LPG supply outlook in Australia.*

In order for the industry to continue to grow and attract investment, there is a need to assemble a comprehensive and credible fact base surrounding all aspects of the current and likely future market. In some cases, the resolution of this issue will require cooperation between industry and government to improve data collection processes such as registration requirements for LPG vehicles.

Once assembled, this data then needs to be made available to industry and government to assist with the development of market and public policy responses that will help Australia to realise the significant potential benefit of continued investment in LPG vehicle technologies

Existing market Paradigms

Previous work conducted by industry and government has revealed that the market adoption of LPG vehicles is also being constrained by adverse market perceptions.

Market research and anecdotal evidence suggest that LPG vehicles are a victim of their long tenure in the alternative fuels market, with alternatives such as hybrid vehicles and electric vehicles being considered as more contemporary (or 'sexier') alternatives. In addition, the historical delivery of LPG vehicles via 'local garage' conversions has resulted in consumer perceptions that LPG technology is not a mainstream technology being pursued by the serious elements (i.e. manufacturers) of the Australian automotive industry.

In short, LPG vehicles are often perceived as the cheap alternative that often comes at the cost of vehicle performance. Consumers currently appear to fail to appreciate the significant developments that have been made in producing advanced LPG systems that deliver substantial environmental and energy security benefits when used in lieu of conventional fuels.

The reality of LPG vehicles is markedly different, and there appears to be a need for the LPG vehicle industry to reinvent itself by focusing on the performance and near-term market availability of advanced LPG systems

Clearly, there is a need to correct these adverse consumer perceptions by articulating the broader benefits and performance of advanced LPG vehicles (Figure 10). Such an approach needs to be measured and credible, and be designed to cut ties with the past legacy of being a cheap alternative to conventional fuels

Enabling Workforce Development

In some ways, the significant past tenure of the Australian LPG vehicle industry means that it has already developed the workforce skills required to support the continued growth of the market. The development of these workforce skills, however, has largely occurred on an ad hoc basis, resulting in varied levels of technical expertise and workforce skill levels.

The continued growth of the industry and market introduction of advanced LPG systems signals a need for a more structured approach to the future development of the enabling skills of the workforce in areas such as gas kit installation, gas vehicle maintenance, and safe working practices for gas vehicles.

One approach would be for the industry to develop training and certification programs designed to lift workforce skill levels and prepare the workforce for the near-term introduction of advanced LPG powered vehicles

Institutional Barriers

Institutional barriers typically relate to the structure of the industry and the coordination issues that can often arise between different elements (or 'silos') of industry. In the case of the LPG industry, given the long tenure of market presence in the Australian automotive industry, there are very few institutional barriers.

One area that needs to be addressed in respect of this barrier relates to the apparent disconnect between the management of the national LPG refuelling asset and the emergence of advanced LPG vehicle technologies. Analysis of the needs of LPG vehicle consumers (in respect of refuelling convenience) and the requirements of advanced LPG systems highlights an urgent need for improvement in existing LPG refuelling infrastructure

Legislative and Regulatory Barriers

One of the key barriers in this area relates to differences in Australian state/territory vehicle registration authorities in respect of vehicle registration requirements. Some states and territories require that vehicles fitted with LPG systems are nominated and fitted with a plate delineating use of LPG while others do not.

Review of related practices in relation to workplace design (and safety) and installation oversight also reveals significant variance between different Australian states and territories.
The development of the LPG vehicle industry in Australia beyond its current infant state suggests that there is a need to identify and then rectify inconsistencies in current regulations to ensure that LPG vehicle consumers across Australia are treated similarly, irrespective of the state or territory in which they live.

A further area for investigation relates to the current Australian fuel quality standard for LPG sold in Australia. Industry and consumer feedback suggests that variation in the composition of LPG can significantly affect fuel consumption and vehicle performance, despite the fuel being compliant with the requirements of the LPG Fuel Determination (2004) of the Australian Fuel Quality Standards Act 2000. At the time of writing this paper, the Australian Government was working on the revision of the 2004 Fuel Quality Standard Determination for LPG, and the LPG vehicle industry was providing strong support to this process

Performance Uncertainly

Performance uncertainty relates to the unpredictability of economic and environmental outcomes associated with the operation of a given fuel or vehicle technology. This uncertainty can be a factor of different drive cycles, component quality and durability, or a combination of both. In the case of LPG, there are currently a range of different LPG technologies available in the Australian marketplace. The cost, fuel consumption and emissions performance of these products varies markedly.

While gaseous vehicles are widely acknowledged as delivering a 'well to wheel' GHG benefit in the order of 10% relative to conventional petrol powered vehicles (see Figure 6), different LPG system technologies deliver mixed results. As a consequence, there is a need to ensure that only the systems that deliver GHG positive results and satisfy applicable emission design standards are funded under any future program.

The quality of gas kit installation can also have a significant bearing on the real-world environmental and economic performance of a gas powered vehicle. Incorrect installations can also present a safety risk to the vehicle user and the general public.

The result of these two observations is that consumers tend to experience mixed outcomes from fitting LPG systems to their vehicles (or purchasing a new LPG vehicle). Left unaddressed, these issues will likely generate market uncertainty about the real-world performance of LPG vehicles thereby creating a barrier to the wider market adoption of advanced LPG vehicle systems.

There is need for the industry to provide improved consumer guidance on the selection of LPG vehicle systems and to work with component suppliers and equipment installers to improve the quality of LPG installations. This action might extend to the development of a rating system for LPG systems (that is developed along similar lines to the energy efficiency and water efficiency ratings used for household appliances) and the introduction of a training and certification scheme for LPG kit installers

Investment Uncertainty

The final barrier relates to the investment made by consumers towards the purchase of an LPG vehicle. Most vehicle consumers are prepared to countenance a small increase in the capital cost if they believe that such an investment will deliver fuel savings that offset this cost over the life of the vehicle.

The variable performance of different LPG systems (and varying costs of these systems) means that consumers are often confused as to the total quantum of economic benefit derived from an investment in an LPG vehicle. This confusion is often compounded by the fact that the use of some dual-fuel technologies means that the fuel savings are not locked in (i.e. the driver can elect not to use LPG) and the price of both LPG and conventional fuels is volatile. It should be noted, however, that the emergence of automatic controls on some of the more recent dual fuel vehicles has revealed that the level of LPG use can be substantially increased.

There appears to be an opportunity for the industry to address this issue by improving the quality of economic information available to the consumer (i.e. price calculators, information on the historical movements in the price differential). While some of this information exists on industry websites, there is a need to make credible information available to prospective consumers at the point of LPG vehicle sale or LPG vehicle conversion.

Care would need to be taken to ensure that all information provided is appropriately vetted and does not risk misleading customers, suggesting that this information would need to be centrally controlled (and periodically updated) by an industry organisation such as LPG Australia

3. Recommended Solutions/Policy Response:

Supply and demand side issues:

- List what you consider to be the most critical actions required to kick start the development and roll out of alternative fuels in the following areas:
  - Research and development related actions
  - Investment related actions
  - Production related actions
  - Distribution related actions

- Consumption related actions

- Are there any particular types of Government regulatory and policy approaches which should be avoided, and are there instances of best practice which do not involve large Government funding outlays?

Excise and Taxation

Government must stop the introduction and legislation of excise and carbon tax on alternative fuels until there is Policy in relation to the Energy White Paper, Alternative Fuels and within context; Gaseous Transport Fuels.

National Standards

Government must play a proactive and potentially regulatory role in the review and establishment of select National Standards relating to alternative fuels, including the National Fuel Standard in relation to LPG (fuel quality and composition).

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