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4. STAKEHOLDER LIAISON

This chapter describes the outcome of a programme of stakeholder liaison to identifiy the key issues relating to transport fuel quality in Australia.

Chapters 2 and 3 of this report outline the relationship between fuel quality parameters, motor vehicle technology and the emissions from motor vehicles based. Background is also provided to the Australian government policy setting, and the existing international regulations for motor vehicle emissions and fuel quality. The objective of this study was to build on this information and undertake a comprehensive review of possible new fuel specifications for Australia, designed to reduce emissions of greenhouse gases and air pollutants from Australian road transport.

In order to assess the potential impacts of new fuel quality specifications on Australian refineries, vehicle manufactures and consumers, and taking into account the objectives of the regulators, it was necessary to obtain a high level of cooperation from the stakeholders.

The stakeholder consultation process commenced with the circulation of a letter to the stakeholders, informing them that a series of scenarios were to be developed to represent the range of likely changes in fuel quality over the next ten years. Comment was sought from the stakeholders regarding the key issues to be considered in the fuel quality scenarios. The stakeholders included in the consultation process are listed in Appendix 4-A.

Written responses were received from 28 stakeholders. A Coffey representative also attended meetings with 30 of the major stakeholders, including state government agencies, petroleum companies and motor vehicle manufacturers. The stakeholder consultation process continued throughout 1999, with the stakeholders providing comment on the draft scenarios, particularly in relation to the incorporation of the Prime Minister's commitments under the *'Measures for a Better Environment'* element of the *'Tax Package Agreement'* (discussed further in Chapter 5).

4.1 Issues Discussed with Stakeholders

Suggested issues for discussion were circulated to Stakeholders prior to each meeting. These were provided to prompt (rather than constrain) discussion. The suggested issues were generally as follows –

Objectives of the meetings

- To identify issues that may impact on fuel quality requirements over the period to 2010 (with a look to 2020).
- To identify the range of scenarios which should be considered for evaluation.

Policy Settings/Issues

- Air Quality and NEPC Ambient Air National Environment Protection Measure (NEPM)
- Greenhouse commitments
- Emission standards harmonisation
- Reduction in National Average Fuel Consumption (NAFC) for passenger cars, 4WDs and light commercial vehicles (LCVs)
- Phase out of leaded petrol
- Petrol research octane number (RON)
- Industry Policy
- Other Policy Issues

Technical Issues

- Euro emission standards and technologies
- Fuel quality requirements

Baseline and Scenarios for Evaluation

- Emission standards/NAFC
- Fuel specifications

Brief notes of each meeting were made and circulated to the Stakeholder for agreement or amendment as appropriate. The final agreed notes were presented as an attachment to Coffey (1999).

4.2 Issues Raised By Stakeholders

4.2.1 Policy Settings

Air Quality and NEPC Ambient Air NEPM
All State and Commonwealth Agencies indicated strong Government commitment to achieving and maintaining compliance with the ambient air quality standards specified in the NEPM. The major non-compliant pollutants are particles (PM_{10}), PC smog (ozone) and to a lesser extent NO_2. Motor vehicles are a major source of these pollutants (or their precursors) in all jurisdictions.

Diesel exhaust particulate is especially a concern. In Australia, PM_{10} typically contains a high proportion of particles in the $PM_{2.5}$ fraction, which is the main health and environmental concern. Diesel particulate comprises 80 to 90% $PM_{2.5}$ and contains some toxic and carcinogenic compounds.

The agencies identified reduction of petrol Reid Vapour Pressure (RVP) as a cost-effective means of controlling vehicle evaporative hydrocarbons. NSW has negotiated a Memorandum of Understanding with the Petroleum Industry for phased

reductions in RVP to 67 kPa (pool average) for summer 1999/2000 and 62 kPa for summer 2000/2001. The petroleum industry indicated satisfaction with the process of negotiation, and the result. Other State agencies are pursuing similar negotiations with the industry.

Concerns were expressed that projected growth in vehicle kilometres travelled (VKT) will erode the benefits of vehicle emission standards introduced to date, and this (along with emissions from non-vehicle sources) will lead to increasing non-compliance with the NEPM. More stringent new vehicle emission standards are viewed as an essential strategy to combat future growth. Most Government agencies support introduction of Euro 2 and/or Euro 3 standards for air pollution control reasons. Some advocated introduction of Euro 4 emission standards, especially for diesel vehicles.

The Automobile Associations and the Australian Trucking Association strongly supported early introduction of Euro 2, 3 and 4 emission standards, more as a means to force adoption of latest technologies than for air quality reasons.

Other stakeholders were less strong in their views, considering Australia does not have a significant air pollution problem and that introduction of Euro 3 and 4 emission standards may not be justified in the 5 to 10 year term.

The Federal Chamber of Automotive Industries (FCAI) considers Euro 3 standards should only be considered for introduction in Australia once the resulting air quality benefits of Euro 2 implementation have been studied (i.e., in the latter part of the next decade). Stakeholders in the motor industry expressed the view that inspection/maintenance programs (as are being introduced in NSW and are under consideration in other States) should be given priority over introduction of more stringent vehicle emission standards.

The Australian Institute of Petroleum (AIP) considers that while local fuel quality hikes in-line with overseas trends are inevitable, a lag of at least 2 to 3 years is appropriate as Australian pollution problems are much less than in Europe, USA or Asia.

Greenhouse Commitments

Commonwealth and State agencies indicated a strong commitment by all Governments to meet the greenhouse gas (GHG) emissions targets set in the Kyoto Protocol, and that this may well become a main driving force in transport policy.

- In 1997, the transport sector accounted for about 17%, or 72 million tones of total national net greenhouse gas emissions.

- VKT is growing at about 1.5%/year.

- The transport sector emissions are estimated to increase by 25% from 1997 levels by 2010, against Australia's overall greenhouse gas commitment of only 8% increase.

All agencies consider substantial improvement in vehicle fuel efficiency is therefore most important, and that adoption of world's best technologies is one strategy that should be pursued. The agencies identified other strategies that Governments must consider –

- vehicle fuel consumption standards and incentives.
- incentives for accelerated adoption of new engine technologies (such as petrol/diesel-electric hybrids, and fuel cells).
- incentives for 'clean' petrol and diesel.
- incentives for less GH-intensive fuels (such as compressed natural gas (CNG), liquefied petroleum gas (LPG) and methanol), and renewable fuels (such as ethanol).
- encouragement for use of public transport.

The FCAI believe that high octane fuel (98 RON) is essential to optimise fuel consumption, in conjunction with meeting the stringent emission standards called for in the Euro 4 specifications.

Emission Standards Harmonisation

Commonwealth agencies and the National Road Transport Commission (NRTC) indicated the Government's total commitment to harmonisation of vehicle emission standards with International Standards (i.e. those of the United Nations Economic Commission for Europe (UNECE), which are technically equivalent to standards adopted in the European Union - i.e. the 'Euro' Standards). The Commonwealth Government's *'Environmental Strategy for the Motor Vehicle Industry'* indicates intent to achieve 'full' harmonisation by 2006.

- The Commonwealth has indicated this commitment within the World Trade Organisation, the Asia-Pacific Economic Cooperation forum, and in the Trans Tasman Mutual Recognition Agreement.
- The Commonwealth intends to sign the 'Treaty 58' agreement during 1999.
- Japan signed the 'Treaty 58' agreement in late 1998.
- Japan/MITI has agreed to adopt Euro 3 for diesels in 2003/4, and has proposed Euro 4 as a global standard for cars.
- The US has a project to assess harmonisation with UNECE standards.
- There is increasing focus around the world on the UNECE standards as future 'world' standards.

Most stakeholders consider harmonisation is inevitable. There are though, considerable differences in view as to what 'full' harmonisation might mean.

- DOTC/FORS consider harmonisation with UNECE technical procedures is achievable, but that harmonisation of standards on schedule with the European Union is unrealistic. Most stakeholders in government and industry share this view.

- Some state agencies (particularly in NSW) and the Automobile Associations consider full harmonisation on schedule with the EU is achievable and desirable as this will force adoption of world's best vehicle technologies.

- NRTC and NEPC/SC indicated MVEC's view was that harmonisation to Euro 3 for both petrol and diesel vehicles should be accomplished as soon as practicable. MVEC had not yet considered Euro 4.

- Many stakeholders pointed out that introduction of Euro 2, 3 and 4 vehicle emission standards in Europe are underpinned by concurrent quality standards for market fuels, upon which continuing compliance with the emission standards is dependent.

- The FCAI supports harmonisation to Euro 2 levels only, with consideration of Euro 3 at a later date. The FCAI considers availability of fuel to the equivalent Euro standards to be a prerequisite for introduction of any Euro emission standard in Australia.

- Vehicle importers, while supporting the FCAI's position, are more comfortable with harmonisation on a schedule following the EU more closely. Some imported Euro 2-technology (petrol and diesel) vehicles, and a few Euro 3-technology vehicles are already in the Australian market. (Some US-sourced heavy diesel vehicles have engines with US 1998/9 certification, which is equivalent to Euro 2+ standards.) It is probable that Euro 3-technology vehicles (both petrol and diesel) will not achieve designed emission levels, fuel efficiency or performance durability on current quality, Australian market fuels.

- The Australian motor manufacturers have some difficulty with introduction of Euro 3 standards for cars with locally manufactured engines. These difficulties would be significantly reduced if introduction could be synchronized with model change cycles (approximately 2006/7). Too early an introduction date for Euro 3 standards would have significant implications for local engine manufacture.

- The Society of Engineers considers that delaying implementation of Euro 3 emission standards to 2006, would allow time for advanced engine and emission control technologies to mature, and would likely produce a better result. This would be especially so for local manufacturers, who would be able to transfer corporate technology at lower cost.

- Overall, the automotive industry considers Australian fuel quality (as opposed to vehicle emission standards) should be harmonised with Euro fuel quality, as soon as practicable. This would –

  - support adoption of developing engine/emission control technologies in a commercially competitive time frame.
  - allow cost-effective reductions in emissions and fuel consumption.

  Sulfur in both diesel and petrol, and RON/MON in petrol, are the important parameters.

  The motor industry considers urban air quality in Australia is improving, and that introduction of vehicle emission standards beyond Euro 2, is not justified.

- The petroleum refiners accept the need to supply fuel of a quality that will support future vehicle technologies. They question the need for fuel quality standards to be as stringent as mandated in Europe. The refiners expressed very strong concerns that the high level of investments required in Australian refineries to produce Euro 4 grade fuels (especially), would not be recoverable in the market in competition with overseas suppliers. Adoption of such stringent fuel quality standards may add pressures for refinery restructuring, and may lead to closures.

- The automotive industry, the petroleum industry, and the automobile associations indicated a strong view that future fuel quality standards (whatever may be agreed) should be mandated and enforced. This view was also put by some government agencies, which indicated there had already been some discussion of a possible fuel quality NEPM, possibly to be implemented through an agreement (MOU) with the petroleum industry.

Reduction in NAFC for passenger cars, 4WDs and LCVs

Commonwealth agencies indicated strong Government commitment to achieving a 15% reduction in National Average Fuel Consumption (NAFC) for new cars, over 'business as usual' by 2010 (as stated in the *'Environmental Strategy for the Motor vehicle Industry'*). It is expected that the Commonwealth will negotiate a new NAFC agreement with the motor industry during 2000.

The Commonwealth agencies regard 'business as usual' to be a reduction in NAFC of 1% per year from 2000 to 2010 (building on the previous NAFC agreement which is equivalent to a 10% reduction from 1990 levels, to 8.2 L/100kms for calendar year 2000). A further reduction of 15% implies the Government will seek a total reduction in NAFC of 23½ % by 2010, to 6.3 L/100kms (over the current Australian Standard test procedure).

State government agencies, and the Automobile Associations indicated support for adoption of these targets, and consider –

- they are achievable given rapidly developing technologies, and the European industry's commitment to achieve 25% reduction in a similar time period.

- they are necessary in the context of achievement of Australia's overall greenhouse gas reduction commitments under the Kyoto Protocol.

The motor vehicle industry indicated that while it does not necessarily accept these targets are achievable, it is keen to negotiate a NAFC agreement that would be practicable, though challenging. Concerns were expressed that stringent fuel consumption targets would severely disadvantage locally manufactured vehicles.

Whatever agreement is reached on future NAFC targets, the motor vehicle industry considers availability of low (500 ppm) (or ultra low (50 ppm)) sulfur, 98 RON petrol is essential to achieve the lower fuel consumption potential of new, and developing technologies. The industry cites 30 ppm sulfur (as indicated in its *'World-Wide Fuel Charter'*) as the maximum desirable for performance durability of advanced engine/emission control systems, in the long term.

Phase-out of Leaded Petrol
The Commonwealth Government's commitment to early phase-out of leaded petrol is stated in its *'Environmental Strategy for the Motor vehicle Industry'.*

There was no suggestion among stakeholders that this was a significant policy issue.

The petroleum industry and other stakeholders considered early phase-out is appropriate given that suitable lead replacement additives are available. Also, early phase-out would enable terminal and service station storage tanks to be converted to support increasing volumes of 95 Research Octane Number (RON) ULP.

Petrol RON
Most stakeholders felt that introduction of Euro standards would inevitably result in increasing demand for 95 RON ULP (PULP) for new vehicles. This would be consistent with the Commonwealth's *'Environmental Strategy for the Motor vehicle Industry'*.

- Government agencies in particular were concerned that this would put pressure on refiners to increase benzene, aromatics and olefins in order to achieve higher pool octane. On the other hand, the refiners were concerned that limits on these compounds would substantially increase the investment required to make higher-octane petrol.

- Some stakeholders, including government agencies, indicated concerns that there may be demand for use of MTBE and/or other octane enhancement additives that would have uncertain environmental effects. The refiners indicated they would seek to open debate on the environmental effects of MTBE (methyl tertiary butyl ether) and MMT (methylcyclopentadienyl manganese tricarbonyl).

- Many stakeholders were concerned that increased refinery energy and greenhouse emissions through production of higher-octane petrol, should be taken into account in this study. Some expressed the view that PULP use should somehow be limited to current and future vehicles having engines optimised for 95 RON.

- Government agencies, the motor industry and the automobile associations expressed concerns about the future relative market price for PULP versus ULP. The motor manufacturers indicated a strong preference to supply vehicles optimised for PULP but provided no firm guidance for the rate of uptake, which would depend greatly on the relative market price. The refiners indicated the equivalent import parity price differential for PULP vs ULP is currently around 2 cents/L, and agreed this differential should be factored into the scenarios to be evaluated.

Some stakeholders in the motor industry expressed a preference to have the freedom to import or locally manufacture vehicles with engines optimised for 98 RON ULP. Other stakeholders expressed no enthusiasm for this.

- The refiners consider 98 RON to be well beyond the optimum fuel efficiency of the overall refinery/vehicle system, and not feasible using conventional refinery configurations. Nevertheless, the refiners consider the effects of a 98 RON ULP as a niche market grade, should be considered in the scenarios.

Industry Policy
Many stakeholders referred to the Commonwealth Government's *'Environmental Strategy for the Motor Vehicle Industry'* as indicative of the Government's overall industry policy. Most felt that this strategy (together with probable future tariff reductions) would encourage (or should force) the local motor industry to become progressively even more integrated with global product design and manufacture.

Some government agencies were concerned that the competitive viability of local manufacture may be doubtful in the longer term, if the pace of adoption of international 'state of the art' technologies is too slow. Others were concerned that the viability of local engine design/manufacture might be threatened if forced changes are too rapid. All of these concerns were reflected in various views expressed by the local vehicle manufacturers/importers.

Stakeholders expressed similar concerns in relation to the petroleum refining industry. On the one hand, the long term viability of refiners will depend on their competitive ability to provide high quality market fuels that will support future vehicle technologies. On the other hand, viability of (some) refineries might be threatened by imposition of stringent fuel quality standards.

The refiners indicated that the 'Downstream Petroleum Industry Action Agenda' is currently considering a number of related issues, including –

- competition policy and future industry structure.

- environmental issues.
- taxation and microeconomic issues.

Other Issues

Dual Grade Diesel Fuel

Commonwealth and some state agencies considered availability of diesel fuel with 500 ppm maximum sulfur level to be a minimum requirement to support Euro 2 vehicles in the field. Some expressed the view that it may be practical to have low sulfur diesel provided in major city regions only, with country levels somewhat higher during an interim period.

Also, it was considered that very low sulfur diesel, trending to 50 ppm, might be supplied in major city regions to support introduction of vehicles with Euro 3/4 emission controls, again with higher sulfur in country areas for an interim period.

The motor vehicle industry expressed concerns for dual grade 'city/country' diesel distribution, as city vehicles fuelling in country areas would risk catalyst and OBD failures. The supply of low sulfur diesel for 'onroad' (registered) vehicles and higher sulfur diesel for 'off-road' (unregistered) vehicles was considered a more practical approach.

Octane Enhancement Additives

The FCAI indicated the use of MTBE as a fuel extender/octane enhancer should be avoided on the basis of degradation of fuel efficiency performance, adverse emission impacts and potential environmental problems. Other additives, such as methanol, can pose problems by attacking fuel system component materials and may cause increased emissions of reactive or toxic compounds. The FCAI strongly advise against the use of MMT, based on Canadian experience where MMT has been shown to adversely affect catalyst performance, spark plug durability and oxygen sensors in exhaust systems.

Some other stakeholders (in passing) mentioned MTBE as a possible useful additive to petrol, albeit with some environmental effects.

NSW EPA indicated there might be value in considering the refinery effects of MTBE in the scenarios.

The AIP advised that refiners are examining all safe options to restore and boost octane, particularly in the face of tightening standards for benzene and other high-octane components.

Some refiners might choose to use MMT and/or MTBE, given the necessary approval from Government to do so, and they seek to open debate on relevant issues. Refiners noted that MTBE has proven very useful in producing 'clean' fuels, as it is a high octane blend stock with low volatility, no benzene, aromatics or olefins. It was noted that MTBE has been an important ingredient for US refiners in meeting stringent Californian fuel specifications, and that the production of 'clean' fuels will

require significantly more investment and energy usage by refineries if MTBE use is prohibited. It was also noted that the use of additives such as MMT provides refiners with increased flexibility, allowing time for technological improvements to occur and also allowing investments to be undertaken in conjunction with others in the refinery.

Incentives for Green Fuels and Vehicles

A number of stakeholders in government, the motor industry and the petroleum industry indicated a view that government excise differentials and other financial incentives should be considered –

- incentives for accelerated adoption of new engine technologies (such as petrol/diesel-electric hybrids, and fuel cells).
- incentives for 'green' petrol and diesel.
- incentives for less GH-intensive fuels (such as CNG, LPG and methanol), and renewable fuels (such as ethanol).
- encouragement for use of public transport.

Some stakeholders expressed the view that these incentives should flow (at least in part) to the industries concerned, rather than to the consumer.

4.2.2 Technical Issues

Euro Emission Standards and Technologies

The FCAI and the individual vehicle manufacturers/importers provided much relevant information in discussion and in various technical papers. In particular, they provided views on generic vehicle/engine/emission control technologies that are currently available or under development within their corporations to meet Euro (and equivalent Japanese and US) standards. These views are summarised below.

Designing for the Euro standards is primarily a NO_x reduction task for petrol vehicles, and a combined NO_x/particulate reduction task for diesel vehicles. NO_x reduction has an inherent fuel penalty, which will slightly reduce the fuel efficiency benefits achievable with rapidly developing technologies.

The technology packages are aimed to provide emission reductions to meet each Euro standard as it is introduced, together with substantial fuel consumption reductions to meet corporate objectives in response to community and government demands.

These technologies will be adopted in Australia in due course, as new vehicle models are introduced and updated. This will occur whether or not Australian emission standards demand it.

Adoption of new technology comes at a cost, which for the local suppliers may be –

- significantly reduced over time, with corporate design/manufacturing experience overseas.

- significantly reduced if accomplished within the manufacturer's model change cycle (which may be different for each model, and for imported vs locally manufactured models).

- substantially increased if driven too quickly by introduction of emission standards.

For petrol vehicles –

- Implementation of Euro 2 emission standards in Australia would present little problem for imported vehicles in the 2002/4 timeframe indicated in MVEC's *'Preferred Option'*. For some locally manufactured vehicles the next model change is already committed for 2003/4, and earlier introduction would be difficult.

- Euro 2 standards may require –

    - revised catalyst specifications.

    - addition of a pre-catalyst.

    - addition of exhaust gas recirculation (EGR).

    - revised engine management systems.

- Implementation of Euro 3/4 (and equivalent US and Japanese) standards is a huge task, on which world-wide technology development is now fully focused.

- Even though Euro 3 vehicles are now being introduced in Europe (ahead of their formal introduction during 2000/2001), there are many uncertainties. Frequent running changes are likely to be made as the technologies mature. Mature Euro 3-technologies may not be readily available from the corporate catalogues for several more years.

- Euro 3 engines will mostly be optimised for 95 RON, some to 98 RON. Some will have a degree of RON tolerance. Designs will incorporate advanced engine and emission control systems, which will include several of the following features –

    - Petrol (gasoline) direct injection (GDI).

    - very high compression ratios (up to 12:1).

    - ultra-lean-burn combustion (A:F out to 50:1).

    - close-coupled pre-catalysts.

- larger, perhaps multiple catalysts.
- advanced lean NO_x catalysts.
- on-board diagnostic (OBD) systems.
- positive EGR.
- advanced engine management systems.
- advanced evaporative control systems.
- knock detection.
- variable cam timing.

- Vehicles/engines with Euro 3-technology will be progressively introduced in Australia over the next several years, as the range of complying corporate designs expands. For locally manufactured engines, technology adoption ahead of the model change cycle in about 2006/7 may be difficult and costly.

- Euro 4-technology would likely comprise mainly incremental developments beyond Euro 3. It may also include some more radical engine design changes.

All diesel vehicles/engines are imported –

- The smaller vehicles are almost entirely sourced from Japan. Current Japanese diesel emission standards are less stringent than Euro 2, but this will change with introduction of new standards from 2001. Japan/MITI has agreed to adopt Euro 3 for diesels in 2003/4. Meeting Euro 2 or 3 in the time frame of MVEC's *'Preferred Option'* is therefore achievable, but at a cost. There may be some difficulties with particular vehicles –

  - Some vehicles supplied in Australia are unique to satisfy local performance and durability requirements. Whilst they have engines specified for Japanese or Euro requirements, they have combinations of body, engine, transmission and suspension systems that differ from those supplied in Japan or Europe (or USA).

  - Such vehicles will require development/re-specification, and re-certification.

- For smaller diesel vehicles, Euro 2 will require catalysts. Some vehicles will also have electronic engine management. Euro 3/4 engines may include –

  - common rail injection systems.

- electronic engine management.
- advanced catalyst systems.
- on-board diagnostics.
- some may be fitted with particulate traps.
- some may have turbocharged/intercooled engines.

- For heavy diesel vehicles, there is little problem in complying with Euro 2 or 3 (or equivalent US) requirements, since almost all engines/vehicles are imported from USA or Europe. Some recently imported vehicles/engines are already to Euro 2 specification. By 2005/6 all heavy diesel importers will have access to Euro 4 engines (or the equivalent US).

- For heavy diesel vehicles, Euro 2 standards may require revisions to engine management and fuel injection systems. Most heavy vehicle engines are already turbocharged and intercooled. Euro 3/4 engines may include

  - common rail injection systems.
  - Advanced electronic engine management.
  - advanced catalyst systems.
  - on-board diagnostics
  - some may be fitted with particulate traps.

The industry is very actively developing engines with improved performance on alternative fuels, in particular –

- LPG has up to 20% greenhouse gas emission advantage over petrol. LPG technology is immature and currently still expensive. CNG has a 16% greenhouse advantage over petrol.

- CNG and LNG are considered potential replacement fuels for heavy diesels. In the main, the technology is not yet sufficiently well developed for long distance use, and cannot yet compete with heavy diesel efficiency and durability. Caterpillar has developed advanced spark-ignition CNG and LNG technologies, and compression-ignition (diesel pilot) CNG and LNG technologies for its engines, which show considerable promise. These engines have considerably lower particulate, NO_x and CO_2 emission levels, and are close to meeting the proposed US 2004 emission requirements. A few are now running in Australia.

- The use of ethanol is not considered economical, compared to petrol or diesel.

The industry is developing a number of more radical vehicle/engine technologies, the most promising of which are –

- Diesel-electric or petrol-electric hybrids show good promise. Toyota has recently introduced a production vehicle, the 'Prius', on the Japanese, European and US markets. The 'Prius' incorporates hybrid technology having a petrol engine, which includes petrol (gasoline) direct injection, lean O_2 sensor, and advanced NO_x storage catalyst. The 'Prius' has not been specified for the ADRs and cannot (at least for some time) be offered in Australia. Other manufacturers have similar hybrid designs in prototype or pre-production versions.

- Fuel cell developments have been very rapid. Pre-production models are likely to be trialled during the next few years. Designs may well be commercial during the mid to latter part of the next decade with perhaps 50% new vehicle penetration by 2020.

Fuel Quality Requirements
The automotive industry and all other stakeholders consider there is an urgent need to upgrade Australian fuel quality standards.

For diesel fuel, stakeholders consider sulfur to be the main quality issue having immediate and growing impacts on vehicle performance and durability.

- Sulfur has a direct impact on diesel exhaust particulate. Reducing diesel sulfur will therefore immediately reduce particulate emissions from the entire diesel fleet.

- Several stakeholders in government and in the automotive industries considered high sulfur diesel might have significant engine maintenance disbenefits. One vehicle supplier reported that the current quality of Australian diesel compromises engine selection and causes durability problems in EFI systems, fuel pumps and injectors, which can lead to reduced performance and higher smoke emissions. More frequent servicing is required to support a 3-year warranty period (eg oil change intervals at 5000 kms in Australia vs 15000 km in Europe).

- Some in the automotive industry cautioned that for older engines, ultra-low sulfur diesel may lead to higher wear rates in fuel injection systems, which in part rely upon sulfur for lubricity. Ultra-low sulfur diesel will require a lubricity additive.

- Euro 2 diesel vehicle emission standards are based upon 500 ppm maximum fuel sulfur (compared to current Australian pool average of around 1300 ppm reported by the AIP). An increasing number of heavy diesel vehicles with Euro 2 technologies, are now being imported. Many stakeholders are concerned these vehicles will not achieve their designed low particulate (or perhaps NO_x) levels on current Australian fuel.

- Some smaller Euro 2 technology vehicles require catalysts, primarily for NO_x reduction. Catalyst activity may quickly deteriorate if fuel sulfur levels are too high. Most stakeholders were of the view that 500 ppm maximum sulfur diesel is required to support introduction of Euro 2 standards in Australia.

- Euro 3/4-technology for diesel vehicles includes advanced catalyst and on-board diagnostic systems, and may include particulate traps. Information provided by stakeholders indicates these systems may be deactivated by fuel sulfur significantly higher than the equivalent Euro fuel standards, with consequent increase in emission levels and failure of OBD systems. The automotive industry considers sulfur levels need to be reduced through the equivalent Euro 3 (350 ppm) and Euro 4 (50 ppm) levels to support these technologies. The automotive industry considers 30 ppm maximum sulfur is desirable to provide full protection for Euro 4 technology and beyond. Other stakeholders, particularly in the petroleum industry, question the need for sulfur to be reduced as low as 50 ppm, especially in view of the high refinery investment and energy requirements in deep hydrodesulfurisation.

- Very few stakeholders expressed a view on any other diesel quality parameters.

For petrol, stakeholder concerns relate primarily to future rather than current market quality. Volatility, RON and sulfur are the main issues but there are some concerns within governments, relating to benzene and other components.

- Most stakeholders indicated high petrol volatility is the only immediate issue, due to consequent high evaporative emissions from motor vehicles. The motor industry considers petrol volatility should be regarded as a priority fuel issue, independently of any future emission standards. Modest reduction in summer (and winter)-time volatility would produce significant reduction in hydrocarbon emissions, toxics and in ozone formation potential (*EA/FORS Fuel Volatility Project*). This must be a balanced approach as too great a reduction may give drivability or starting problems. Government stakeholders consider RVP reductions should be negotiated with the petroleum industry on a state by state basis, as has already occurred in NSW.

- Oil industry data indicate that current petrol quality in Australia meets Euro 2 quality standards.

- The vehicle suppliers indicated that with introduction of Euro 2 standards in Australia, they would prefer to optimise many or even most new vehicles (both imported and locally manufactured) for 95 RON PULP, thus enabling achievement of optimum fuel efficiency. However, they indicated that the future market price for PULP vs ULP would need to be reduced for this choice to be made. The AIP has agreed to factor into the scenarios a differential market price equal to the import parity price differential.

- Vehicle suppliers also indicated they would like the freedom to introduce some future models with 98 RON optimisation. Government stakeholders were not enthusiastic about such a move, considering it would not assist in achievement of overall government objectives. The petroleum refiners considered 98 RON would be well beyond the optimum for overall refinery/vehicle efficiency, but indicated their preparedness to consider a 98 RON niche grade in the scenarios.

- The motor industry indicates that while Euro 3 technologies are being proven effective in achieving very low emissions with substantially reduced fuel consumption, they are very sensitive to fuel sulfur. In particular, the activity of advanced lean-NO_x catalyst formulations, lean oxygen sensors, and OBD sensors can become progressively and quickly inhibited, even with quite low levels of sulfur. Euro 4 technologies under development, are even more sensitive to sulfur. The motor industry considers petrol sulfur levels need to be reduced through Euro 3 (150 ppm) and Euro 4 (50 ppm) levels to support these technologies. As with diesel, the industry consider a maximum sulfur level of 30 ppm is desirable to fully support Euro 4 technologies and beyond.

- The motor industry provided several technical papers relevant to sulfur sensitivity. In particular, it provided copy of a US EPA technical Paper *'EPA Staff Paper on Gasoline Sulfur Issues'* May 1 1998, which appeared to be the most relevant and authoritative. This paper indicates the complexity of the technical issues and reaches no firm conclusions. It does though appear to support views that –

    - sulfur sensitivity (at least in the range considered, 40 to 150 ppm) may be greatest for advanced engine/emission control technologies (LEVs and ULEVs), and in particular those having ultra-lean combustion and lean-NO_x control technologies.

    - the most reactive catalyst systems, capable of the greatest emission reductions, are the most susceptible to sulfur inhibition.

    - developing fuel cell technologies may also be very sensitive to sulfur. (In technologies using hydrogen generation from petrol, hydrogen may be contaminated by sulfurous gases formed from the fuel sulfur.)

    - OBD sensors are also highly sensitive to sulfur.

    - reversal of sulfur inhibition (by running on ultra-low sulfur after contamination on higher sulfur fuel) may not be achieved in normal driving conditions. Most government agencies expressed concerns that some petrol components (benzene, aromatics and olefins) may increase regulated exhaust emissions and may lead to higher levels of some unregulated toxic and reactive compounds. While limits on these components are desirable, matching the Euro 3 limits and especially the Euro 4 limits might be too costly to justify. It was suggested the scenarios should enable estimation of costs of meeting Euro 4 limits for these components, compared to other,

softer targets. The petroleum refiners indicated these components are important in cost-effective achievement of higher-octane levels.

4.2.3 Baseline And Scenarios For Evaluation

Stakeholders generally were of the view that all policy and technical issues should be taken into account in developing scenarios. The scenarios should not be limited by previously identified difficulties or costs. They should embrace all seriously canvassed options.

Base Case

Stakeholders considered the base case should represent business as usual, and should include continuation of current programs, and all established or announced policy settings–

- ADR 37.01 and ADR 70 continuing.
- 10% NAFC reduction for cars from 1990 level by 2000.
- Commonwealth agencies considered continuation of the current NAFC agreement, at a rate of 1% per year to 2010, is a baseline condition. The motor industry does not necessarily accept this view.
- Current fuel qualities continuing but with sulfur and volatility reductions in train or planned for market reasons, or as may have been agreed between the petroleum industry and the states.
- MVEC considers progression on a voluntary basis to provision of 500 ppm sulfur diesel fuel by 2002, initially in city regions, is a reasonable base case assumption. The Petroleum industry does not accept this view.
- early phase-out of leaded petrol.
- business as usual growth in VKT.

NSW EPA considered the current policy settings should include all items in the Commonwealth's *'Environmental Policy for the Motor Vehicle Industry'* announced by the Prime Minister in November 1997 –

- Euro 3 emission standards to be implemented in 2002/2003 and Euro 4 to be implemented by 2006, to achieve full harmonisation with International standards, (and from then on, the implementation of further relevant standards on schedule with Europe).
- 15% reduction in NAFC for passenger cars, 4WDs and light commercial vehicles by 2010.

- (by implication) fuel quality requirements as necessary to allow the introduction of Euro 3 and 4 vehicles, with regard to octane, RVP and sulfur (for petrol), and sulfur for diesel.

- accelerated adoption of CNG (especially to replace diesel in heavy vehicles) and other alternative fuels, with continuing support and encouragement by State and Commonwealth Governments.

MVEC 'Preferred Option'
MVEC requested its *'Preferred Option'* be included as a scenario. Most stakeholders considered this to be essential.

There were no suggestions from stakeholders that any less stringent scenario (other than the base case) should be considered.

'Most Stringent Case'
The AIP considered a 'most stringent case' scenario should be adopted, which should include progression to Euro 4 fuel specifications by 2006, with further progression to a lower sulfur level for petrol and diesel. The AIP considered this a 'worst case' scenario.

Most stakeholders supported this view.

The motor industry considers 30 ppm maximum sulfur (as specified in the industry's *'World-Wide Fuel Charter'* is the desirable longer term target for both petrol and diesel.

NSW Agencies expressed a strong view that the impacts of some more radical possibilities need to be considered. The impact of greenhouse gas emissions and rising green consumerism represented one potential scenario that may have a major impact on the oil refining industry. The scenarios must include a 'lower growth' option. At the least, this must include a scenario where GHG emissions are contained to no more than 108% of 1990 emissions by 2010 (i.e. the overall GHG targets agreed by Australia in the Kyoto Protocol).

Other Scenarios
Stakeholders considered that other scenarios should consider fuel options with intermediate timing (in respect of sulfur levels) and stringency (for other fuel parameters) between MVEC's 'Preferred Option' and the 'Most Stringent Case'. The particular parameters mentioned, mainly by government agencies and the petroleum refiners, were –

- benzene, aromatics and olefins in petrol.

- density and PAH in diesel.

4.3 Summary of Key Issues

4.3.1 Key Issues Common to Most Parties

- Harmonisation with UNECE standards on schedule with the European Union is unrealistic;
- Future fuel quality standards should be mandated and enforced;
- Commitment to the phasing out of leaded petrol;
- Increasing demand for 95 RON PULP for new vehicles following the introduction of Euro standards;
- Increased energy and greenhouse emissions through production of higher octane petrol;
- Future market price for PULP versus ULP;
- Possibility of the supply of very low sulfur diesel in major city regions, with higher sulfur in country areas for an interim period;
- Consideration of government excise differentials and other financial incentives for green fuels and vehicles;
- There is an urgent need to upgrade Australia's fuel quality standards;
- For diesel fuel, sulfur is the main quality issue having immediate and growing impacts on vehicle performance and durability ;
- Concerns that imported vehicles designed for Euro 2 fuel will not achieve their designated low particulates levels on current Australian fuel;
- Interaction required between fuel quality standards, vehicle emission control standards and vehicle technology, particularly the sensitivity of emissions control systems to the sulfur content of fuel; and
- Reduction of RVP as a cost effective means of controlling vehicle evaporative emissions.

4.3.2 Petroleum Industry

- Studying the air quality benefits of the introduction of Euro 2 fuel quality standards before Euro 3 fuel quality standards are introduced;
- Acceptance of the need to supply fuel of a quality that will support future vehicle technologies;
- Concerns that limits on the benzene, aromatics and olefins content of fuel will increase the investment required to make higher octane petrol; and
- Production of high volumes of 98 RON petrol is not feasible using conventional refinery configurations.

4.3.3 Vehicle Industry

- Inspection / maintenance programs should be given priority over the introduction of more stringent vehicle emission standards;
- The availability of high octane fuel (98 RON) is important for optimisation of fuel consumption;
- Difficulties associated with the impact of the introduction of Euro 3 fuel quality standards on locally manufactured engines prior to the model change cycle;

- Australian fuel quality standards should be harmonised with Euro fuel quality as soon as possible;
- Sulfur in both petrol and diesel, and RON/MON in petrol, are the important parameters;
- Concerns that stringent fuel consumption targets would disadvantage locally manufactured vehicles;
- Concerns regarding dual grade diesel relating to city vehicles obtaining high sulfur fuel in the country and risking catalyst and OBD failures
- Concerns regarding the use of octane enhancers;
- Preference for the optimisation of new vehicles for 95 RON PULP; and
- Would like the freedom to introduce some future models with 98 RON optimisation.

4.3.4 Motoring Associations (Representing Consumers)

- Early adoption of Euro 2, 3 and 4 emission standards to force adoption of latest technologies.

4.3.5 Regulators

- Commitment to achieving and maintaining compliance with the ambient air quality standards specified in the NEPM;
- Strong commitment to meet the greenhouse gas emissions targets set in the Kyoto Protocol;
- Strong commitment to achieving a 15% reduction in NAFC for new cars over business as usual by 2010;
- Full harmonisation of vehicle emission standards with International Standards supported;
- Concerns relating to the pressure on refiners to increase benzene, aromatics and olefins in order to achieve higher pool octane; and
- Concerns that there may be demand for the use of MTBE and/or other octane enhancement additives.

APPENDIX 4-A

LIST OF STAKEHOLDERS

- ACT Department of Urban Services
- AGL
- AIR
- Australian Automobile Association
- Australian Competition & Consumer Commission
- Australian Institute of Petroleum
- Australian LPG Association
- Australian Natural Gas Vehicles Council
- Australian Petroleum Agents & Distributors Assoc.
- Australian Service Station Association
- BP Australia
- Burmah Fuels
- Burn Bank Consulting
- Caltex Australia
- Commercial Vehicle Industry Association
- Commonwealth Department of Industry Science & Resources, Petroleum Division
- Commonwealth Department of Industry, Science and Resources, Automotive Industry Section
- Conservation Council of WA
- CSIRO
- Department of Environment & Heritage, Qld
- Department of Environment & Land Management, TAS
- Department of Environmental Protection, WA
- Department of Infrastructure, Energy and Resources, Tasmania
- Department of Lands, Planning & Environment, NT
- Department of Natural Resources, Victoria
- Department of Transport, Queensland
- Dept. of Transport, Tasmania
- Department of Transport, WA
- Department of Transport & Works, NT
- Department of Transport, the Arts & Urban Planning, SA
- Environment Protection Authority, NSW
- Environment Protection, Dept of Urban Services, ACT

- Environment Protection Authority, Victoria
- Federal Chamber of Automotive Industries
- Federal Office of Road Safety
- Federation of Automotive Products Manufacturers
- Gull Petroleum WA
- Iain Cameron Consultancy
- Liberty Oil Pty Ltd
- Minerals & Petroleum Dept of Natural Resources & Environment, Victoria
- Minerals Council of Australia
- Mobil Oil Australia
- Motor Traders Association of Australia
- National Environmental Consultative Forum
  C/- Tas. Conservation Trust, Inc.
- National Farmers Federation
- National Road Transport Commission
- NRMA
- NSW Cabinet Office
- Premiers Department
- Road Transport Forum
- Roads & Traffic Authority – NSW
- Shell Australia
- Society of Automotive Engineers
- Sustainable Energy Group
- The Treasury
- Victorian Farmers Federation
- VicRoads