

# **Inquiry into Australia's future oil supply and alternative transport fuels**

**Senate Rural and Regional Affairs and Transport Committee**

**Department of the Senate Parliament House**

**Canberra ACT 2600 Australia**



## **A Response by Motive Energy Pty Ltd**

**a subsidiary of National Power Services**

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**MOTIVE ENERGY**

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## TERMS OF REFERENCE

Referred 29 November 2005 for inquiry and report by 15 June 2006 Australia's future oil supply and alternative transport fuels, with particular reference to:

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



# EXECUTIVE SUMMARY



# EXECUTIVE SUMMARY

Motive Energy, being a company active in the development of fuel strategies for corporate transport operators, is vitally aware of the issues facing the country in terms of transport fuel supply uncertainty and the potential for fuel costs to continue their recent upward trend. Motive Energy recognises the key strategic advantages that a vibrant, sustainable, and cost effective transport sector brings to our country, given Australia's unique social and geographical characteristics.

Our view is that the costs to the nation of a dependency on crude based fuels are not sustainable in the medium to long term. These costs derive from a myriad of sources, including security concerns, social impacts, political outcomes, economic instabilities, environmental degradations, and health perspectives. We also believe that the rest of the world's economies are in a similar situation. Subsequently the transport sector, technologies underlying its development, and the fuels used to power the vehicles, are in a chaotic process of change.

Some nations have taken decisive and effective action to take advantage of this change or to counter its effects. Nations which choose to ignore or merely follow others in this action will be at a significant strategic disadvantage in the medium term.

The focus of this inquiry, being the future of oil supply and alternatives for transport fuel, is a welcome one and timely given the current world picture. Over the last four years of its gestation Motive Energy has confronted many of the issues underlying the inquiry.

We have come to a view that one of the key elements in setting national transport fuel priorities is security of supply and the most secure supply is from indigenous sources.

Natural gas is foremost amongst the nation's indigenous and versatile fuel sources.

Similarly we have reviewed the technical maturity and potential for long term advantage for a variety of fuel/engine combinations. We have arrived at one of several significant fuel futures. This fuel future will, at first minimise, and then in the medium term eliminate, many of the costly side effects of the current crude oil transport economy.

Our vision is that of a natural gas led transport fuel (both source and fuel). This will evolve over time to hydrogen fuel sourced from natural gas. Ultimately our vision encompasses a sustainable target of hydrogen fuel sourced from renewables and/or nuclear power.

Motive Energy's contribution to this inquiry is to provide an overview of the key issues as we see them, pertinent to the terms of reference raised by this committee. We also note that these issues are complex and interwoven into many sensitive aspects of our society and subsequently this paper should not be considered an exhaustive response.



# **MOTIVE ENERGY**

## **An Introduction**



# MOTIVE ENERGY

Motive Energy is an subsidiary of one of Australia's leading corporations which had the vision and capacity to undertake the development of natural gas as a vehicle fuel. This recent initiative is despite the manifold difficulties and corporate and policy failures relating to this industry over the last quarter century. Conceptually the business was born in 2001, with its physical manifestation occurring in 2004. It entered the transport fuels market in Western Australia just prior to Christmas 2005 and is expected to enter its first national market in the first half of 2006.

Motive Energy believes that another gaseous fuel, hydrogen, will in time replace natural gas as the fuel of choice in the Australian context. Although hydrogen accounts for 80% of all matter in the universe, potentially providing an unlimited supply in comparison to oil (40-50 years of possible supply remaining) and natural gas (+100 years of possible supply remaining), its major drawback is the inability to produce sufficient quantities at an economic cost.

For a variety of reasons, natural gas has been described as the "Bridge to Hydrogen" and as a cleaner, cheaper fuel in plentiful supply.

Motive Energy's long term goal involves progressing from natural gas refuelling to being at the forefront of hydrogen fuelling services in Australia.

For further information, our corporate profile is included in the attachments to this document.



# **CRUDE OIL** **As A Source Of Transport**



# CRUDE OIL AS A SOURCE OF TRANSPORT FUEL

Crude oil derivatives, petrol and diesel, fuel the bulk of road transport worldwide, particularly in Australia, with its high vehicle dependency.

The current geopolitical and natural environments have significantly contributed to the price of crude oil experiencing nominally record highs. There is some evidence that the world will continue to see a shortage of this commodity. There are few commercially available options to replace the transport fuels derived from crude so the outlook for transport fuels is portrayed by some as being subject to a period of pricing increases and instability.

The following quotes typify some of the thoughts by a variety of people on this matter:

*“As a result of steeply declining domestic oil production and forecasts of dwindling world supplies, Australia is very vulnerable to temporary and permanent oil shocks in the short, medium and long term”*

**Bruce Robinson, Sam Powrie, “Oil depletion: the crucial factor in transport planning” Sustainable Transport Coalition (Aust), 2003**

*“It is hard to exaggerate how deeply dependent we have become on the “black gold”. It is not just the obvious direct economic issues - but the very shape of our cities and the structure of our daily lives that is fuelled by the availability of cheap oil.”*

**The Hon Alannah MacTiernan Minister for Planning and Infrastructure  
Government of Western Australia, “Western Australia: Beyond Oil?” Conference  
February 2003**

*“The most probable substitute for cheap plentiful oil is likely to be expensive and less-plentiful oil”*

**Anon.**



## OUR VIEW

## OUR VIEW

Currently the world and subsequently Australia faces significant stresses relating to the use of crude oil as a base for the fuelling of the transport task in our society. The current emphasis on supply and demand pricing issues is another indicator of the damage being done by crude and its derivatives to our politics, our economy, our sense of self within the world, our local and global environment and our health.

Balanced against this increasingly obvious damage are the advantages of utilising such fuels, primarily low cost and efficiency which, in the short term, provide potential for a good quality of life. Diesel remains to this day one of the most efficient fuels available.

Modal change is something that Motive encourages as this is a significant fuel use reduction strategy, however analysis and implementation of such strategies is not something we feel able to offer an opinion on.

When contemplating the future for fuelling transport the variety of choices of mode of transport and vehicle technology, coupled with its fuel type, is increasing at an every expanding pace.

### **Examples of emerging technologies include:**

- fuel cells;
- hybrid vehicles;
- high speed diesel engines;
- hydrogen powered internal combustion engines;
- natural gas powered internal combustion engines; and
- micro turbines;

### **Examples of fuel sources include:**

- coal
- crude oil;
- natural gas;
- nuclear;
- renewables eg solar, tidal, wind, wave, geothermal, hydro-electric
- biomass;

### **Examples of fuel carriers include:**

- diesel;
- petrol;
- LPG;
- natural gas (LNG and CNG);
- hydrogen;
- methanol and ethanol;
- dimethyl ether etc.



## OUR VIEW (cont)

What is clear to Motive Energy is that the current decade is one which is seeing the splintering of the “one size fits all” approach to the strategic choices available to individuals, corporations and countries regarding their transport mix. Countries which strategically choose transport modes and related technologies have a window of opportunity to align their own transport needs with national imperatives into the future, and develop potential trade opportunities. Examples of this include:

- Canada with its support of the Ballard Fuel Cell technology, now a world leading technology utilised in many multinational strategies for the transport future;
- Argentina and Brazil for its support of Natural Gas Vehicle (NGV) technology. In combination these countries in a little more than a decade have caused the penetration of natural gas as a vehicle fuel to reach approximately 30% of its national fleet, whilst underwriting a significant export market for the underlying technology;
- The Scandinavian countries for their wholesale use of wind power;
- Iceland for its efforts to become a wholly hydrogen based economy, due to their natural advantages with geo-thermal power and glacial ice melt hydroelectricity;
- Italy for its support of both LPG and NGV technologies over many years;

Currently Australia as a society is a follower in all strategic choices open to it and is thus losing current opportunities to manage its own destiny.

Examples of this relate to the supply of alternatively fuelled vehicles. In passenger car markets in Europe and the US, it is possible to find natural gas fuelled cars direct from distributors for just about any brand of vehicle on the market. In Australia, where the motor vehicle industry is sheltered through limited production facilities and global strategies for manufacture, no vehicle manufactured in Australia is available for use with natural gas from any OEM source. Vehicle manufacturers indicate this is due to the limited size of the market for these vehicles, but this is the same argument put forward by US vehicle manufacturers over a decade ago.

Within this chaotic mix, Motive has chosen its own vision for the future for transport fuels in Australia. This choice is based on our own analysis of Australia's strengths and weaknesses opportunities and threats.

Our current choice is natural gas as a fuel source and natural gas in the short term as a fuel carrier, based on the internal combustion engine.

## OUR VIEW (cont)

In the medium term our vision encompasses natural gas as a source and both natural gas and hydrogen as a fuel carrier, based on internal combustion engines, micro turbines, both on hybrid chassis and the fuel cell.

In the long term we see that renewables and/or nuclear power will become an integral part of the fuel source and hydrogen will become the fuel carrier.

Natural gas is one of only a handful of technically mature alternatives. It is proving to be increasing popular overseas. There are approximately 4,500,000 natural gas fuelled vehicles in the world, however it is interesting to note that, despite its vast natural gas reserves, there are only 2,100 in Australia. Significantly, natural gas offers a path to the hydrogen future.

Our contribution to this investigation follows. It seeks to identify the issues we believe are pertinent to the specific terms of reference and that helped Motive form its own view.




# THE ISSUES






# THE ISSUES


## a. projections of oil production and demand in Australia and globally and the implications for availability and pricing of transport fuels in Australia;

 An alternative focus is that the country should work back from projected transport task towards strategic transport mechanisms through to desirable fuel options and compare this with the base case of diesel and petrol rather than work from the crude oil derivative case outwards;


 What supply (and subsequent pricing model) opinion to listen to?  
There is significant debate over the underlying supply causal factors for supply and pricing of crude. At one end of the spectrum is the “Oil Peaking” camp; at the other is the “business as usual” camp. The latter is generally representative of pro-oil producer arguments.


As we have limited expertise in this specialty we form our views based on current evidence and have subsequently prepared ourselves for a world with oil prices unlikely to dip below USD50 per barrel, with more frequent and unpredictable spikes as more natural and man made factors impact on the supply chain.


Key factors regarding availability and pricing for crude, particularly for Australia include:


 Net imported proportion of our oil and derivatives supply will only increase, following the path of the US set a decade before us;

 The mix of heavy versus light crude affects our importation profile;

 Older smaller refinery capacity in Australia compared with our near neighbours will artificially inflate the cost of the derivative fuels through lack of economies of scale;

 The movement of supply options from developed nations toward developing nations poses a significant structural trend which skews supply issues to those nations who can influence or own that supply. Can Australia directly or indirectly influence these nations?;

 Price and availability of crude and associated derivative is link to world growth. We are not in a position to make a comment on the prospects relating to this;

 Sovereign pricing models have a big impact on the price of transport fuels. Historically several strategic decisions have been undertaken such as the deregulation of the pricing of Australian crude and the imposition of excise on the derivative fuels. There is much debate over whether these pricing decisions fully compensate the right communities for the overall impact of an economy based on crude oil.

## THE ISSUES (cont)



Crude oil is so entrenched in our fabric of life that there is significant resistance and lag in any strategy designed to reduce the harmful impact of our current transport fuel choice. Key decisions and transitional strategies should be implemented early;



Each of the technology and fuel source/carrier combinations previously discussed have their own underlying price and availability structures. These structures interact with cost and quality issues for crude derivatives. An example has occurred in Perth, where BP was invited to supply better quality diesel as a direct consequence of competition with natural gas, over the government operated urban transit bus fleet, and proceeded to do so, making Perth's diesel quality the highest in Australia at that time.

**b. potential of new sources of oil and alternative transport fuels to meet a significant share of Australia's fuel demands, taking into account technological developments and environmental and economic costs;**



As noted in the previous section entitled "Our View", Motive believes there are a multitude of options open to Australia in regards the transport fuels future. However there are only a few tried and proven technologies which are currently ready for deployment as a first step in the need to alleviate the longer run impacts of our crude oil dependence.

Motives view remains that the most feasible strategy is to use our abundant natural gas reserves to displace crude as a transport fuel source and to plan for a medium term future dependent only on renewable sources and which may be articulated from natural gas as starting point.

Further, we have seen evidence of the success of this strategy in other countries which have up to 30% of their national fleet operating on natural gas fuel.



The world is in flux over the interlink between vehicle technology and fuel. This change is driven by the very issues being teased out by this inquiry, and other related societal impacts. We believe that there is no one unified answer as was the case in the last century, which was characterised by petrol and diesel based transport options.

Australia may choose to take advantage of this uncertainty in transport technologies, and base its direction on its own strategic needs and strengths, including

## THE ISSUES (cont)

- Highly road transport dependent as a function of our lifestyle and long distances between destinations;
- Significant natural gas surpluses;
- geo stable continent;
- politically stable continent;
- agrarian expertise;
- coal surpluses;
- technological savvy workforce etc



As a society we need to understand the whole impact of the crude oil economy on which we thrive including:

- Australia's environmental and economic costs;
- those of the rest of the world;
- other costs including security of supply, social equity and health impacts;

### **c. flow-on economic and social impacts in Australia from continuing rises in the price of transport fuel and potential reductions in oil supply;**



Australia may suffer severe dysfunction given its dependence on road transport, which in turn is based on a crude oil fuel supply chain. This dysfunction will occur as a consequence of more frequent supply shortages globally and subsequent price escalation. Motive believes that the debate over the likelihood of this occurrence has been over for some time and the only debate left is when this dysfunction will start to impact on our life style.



The economic and social impacts depend on choice of strategic option(s). Australia may choose to be a;

- Leader and innovator
- follower; or
- drifter.


Benefits of an integrated strategic response to the costs associated with our current transport regime include:





## THE ISSUES (cont)


- increased security of life style through indigenous solutions to our needs;
- at best lower underlying price structures for our transport fuel needs and at worst an introduction of true price competition through significant choice of modes, technologies and related fuel;
- an increased ability to meet societal expectations of good health and minimal environmental impacts;
- Well funded and strategically managed industry development at this critical juncture offers Australia potential to develop trade throughout the region, as the supply of traditional fuels dwindles and prices spike.


### d. options for reducing Australia's transport fuel demands.


 In Australia, road transport in particular is an essential thread in the social and economic fabric of our society. Our view is that the more difficult task is to re-weave that fabric. The key element is whether as a society we can initially reduce and then eliminate in a timely manner the societal costs of the current transport fuels, whilst retaining the significant advantages that our transport systems offer to Australia. Reduction in use of fuel is only one potential strategy.


 A key element in reducing security, supply and pricing impacts of our current transport strategy is to undertake a quantum leap forward by targeting a zero import strategy for transport fuels.


 Pricing competition remains one of the biggest drivers in the transport industry. Positive pricing discrimination is a key element in driving change in fuel type towards more beneficial fuel types. Current excise arrangements provide some incentive at this stage;


 Infrastructure development for transport fuels is a key barrier to entry of alternatives. It has taken Australia 30 years to achieve  
5% national fleet penetration rate for  
LPG, whilst it has taken Argentina only 15 years to achieve nearly 30% for natural gas;

 Motivation of our suppliers to and the transport industry itself to undertake change remains a challenge. Initiatives which reduce the technology risk for alternatives remains a priority;

 Focus on development of a viable industry around alternatives to traditional fuel/engine technologies significantly enhances the opportunities for fresh new innovative products to supply both the Australian and other markets. This window of opportunity is quite narrow.

 Health and environmental impact of current transport fuels are a key element of this equation. An acceleration of the legislative program aimed at improving transport based emissions must continue to be implemented. Acceleration to at least world best practise at the same time as others will have a big impact on driving change.

 Another key element is to recognise the time and technology lags in making alternative options viable under our capitalist and democratic system. The development of a clear national and regional strategy and articulation of its key elements is essential.

 As Motive's expertise is clearly within the engine/fuel industry, we decline to comment on modal change opportunities for Australian transport options.

# ATTACHMENTS



# THE CASE FOR NATURAL GAS



# THE CASE FOR NATURAL GAS

Natural gas being utilised as a transport fuel is not a new concept. It has been used to power nearly 5 million NGV's vehicles globally since the mid 1940s. However, natural gas has achieved little market penetration in Australia due to the historically plentiful supply of cheap diesel, resistance to technological development in the internal combustion engine, and a lack of political understanding and awareness of the impact of burning fossil fuels on our self reliance economy health and environment.

In Australia there are just (approximately) 130 refuelling sites, of which less than 10 have some form of public access.

The Australian Natural Gas Vehicles Council estimated that there are some 2,000 NGV's operating in Australia, principally public transit buses and forklift trucks.

Australia has a developed natural gas industry, an extensive and growing level of gas distribution to urban regions and has proven gas reserves in excess of 100 years.

Similarly, most urban areas are well reticulated with distribution networks, such as that owned and operated by Alinta in Perth. The following maps show Australia's gas pipeline systems and Perth's northern region reticulated regions.

However, despite our dependence upon road transport and the ready availability of natural gas, currently less than 0.11% of natural gas consumed in Australia is used in road transport applications.







Figure 1. Australia's Gas Transmissions Pipelines





Figure 2: Perth Natural Gas Distribution System Coverage


# GOVERNMENT RESPONSES




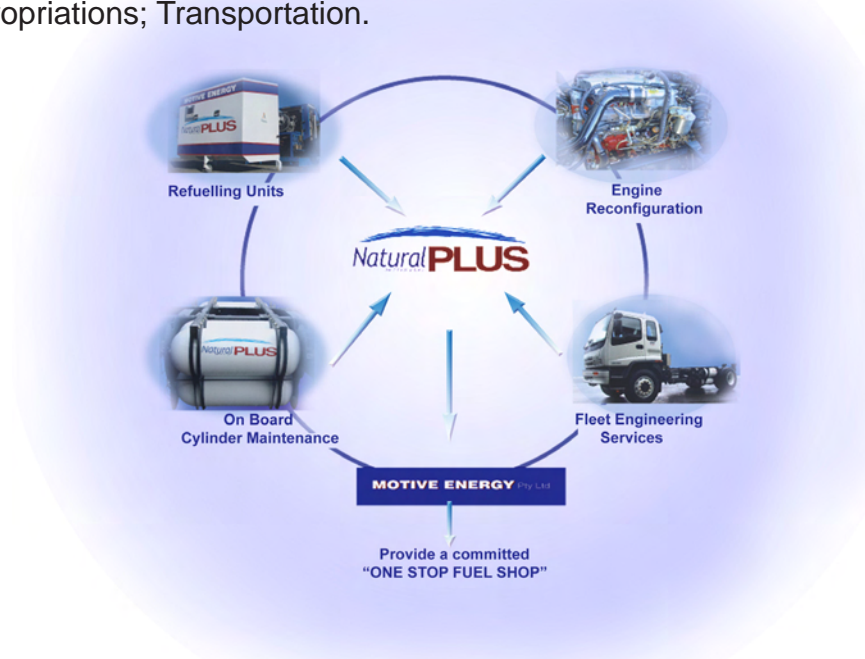


## GOVERNMENT RESPONSES

World-wide governments have reacted in a variety of ways to facilitate the introduction of natural gas as a vehicle fuel. Responses include:

 In 2003 the European Commission (EC) adopted an action plan and two proposals for Directives to foster the use of alternative fuels for transport. The action plan outlined a strategy to achieve a 20% substitution of diesel and gasoline fuels by alternative fuels in the road transport sector by 2020 in the current 15 member States in the European Union. It concluded that only three options would have the potential to achieve individually more than 5% of total transport fuel consumption over the next 20 years: biofuels, which are already available; natural gas in the medium term; and hydrogen and fuel cells in the long term. The EC has targeted natural gas to replace 10% of petroleum-based fuels in the transport sector by 2020.

 The US view natural gas vehicles as playing an important role, especially in targeted markets, where the benefits of natural gas may have the biggest impact. Every dedicated NGV in use displaces 100 percent of the petroleum that vehicle otherwise would use. Therefore, a growing NGV market is good for the US since it helps reduce the amount of oil needs to import. The US thinks the best place to focus its effort is on high-fuel-use fleet vehicles: transit buses, trash trucks, school buses, taxis, shuttle vans and the like. Since these vehicles use a lot of fuel, these fleets are in the best position to take advantage of the lower cost of natural gas to recover the incremental up-front cost. By promoting NGV's in fleets, the US hopes to increase demand to the point where the incremental cost of NGV's will begin to decline. Legislative influence on the market comes from a variety of acts including: Airports; Alternative Fuels Acceleration Act Program; Clean Cities Appropriations; Clear Act; Energy Bill; Energy Policy Act of 1992 Restructuring; Green School Program; NGV R and D Appropriations; Transportation.










## GOVERNMENT RESPONSES (cont)

In Australia, Commonwealth and State government support for alternative fuels has seen natural gas vehicle fuel at the forefront of alternative fuels.

Federal Government support is evident through a multitude of arrangements including:

-  Maintaining a significant competitive price differential through fuel excise arrangements. Natural gas, along with LPG, currently has an excise free status in comparison to that of diesel and petrol.
-  Indicating its timeframe for the introduction of a 50% (of diesel and petrol tariffs) for alternative fuels commencing in 2012 with full implementation by 2017;
-  Enhancing the significant competitive price differential through the subsidy of the price of urban natural gas in comparison to diesel for vehicles over 20 tonne, where diesel get some credits;
-  Through the Australian Greenhouse Office, offering subsidies for vehicles with a gross vehicle mass greater than 3.5 tonne, providing up to 50% of the additional capital costs of acquisition of vehicles to operate on natural gas fuel;
-  Through the management of both its fuel quality and vehicle requirements acts and legislations, continually increasing vehicle emissions standards;

The various Australian states assist in the introduction of natural gas vehicle fuel in a variety of ways. For example, in Western Australia, Motive in conjunction with Swan TAFE is developing skills based training courses for our industry funded with a State Government grant.



# **MOTIVE ENERGY CORPORATE BROCHURE**

# COMPANY

## PROFILE

Motive Energy is an **Australian company** focused solely on the delivery of **natural gas as a vehicle fuel** to the urban return to base fleets under its brand name "NaturalPLUS". Despite its burgeoning use internationally, this valuable and **proven product** remains under utilised in Australia.

**NaturalPLUS** competes directly with **diesel** and other fuels, and offers **fuel price stability**.

Motive and its alliance partners also offer **natural gas fleet packages** that directly compare with alternatively fuelled vehicle **purchase prices and other operating expenses**.

Motive has an **Australia wide focus** with expansion across three states anticipated in 2006 and other States on an "as demand" basis. Motive has assembled **personnel and technology** which leverages off WA's technical and commercial pedigree fine tuned over the last 25 years.

Motive offers a **complete service** for vehicle fleet operators from initial purchase, through operation and fuel supply, servicing, to maintenance, which ensures both equipment and financial security.

Motive has established key **strategic alliances** with some of WA's and Australia's pre-eminent business enterprises, relevant to our industry including:

### **N**ational Power Services

*(a subsidiary of Alinta) as an equity participant and key alliance partner with its presence in all states of Australia;*

### **M**ajor Motors

*(an authorised seller of Isuzu vehicles) as a key alliance partner in WA and avenue for working with Isuzu-GM Australia elsewhere in Australia;*

### **W**A Fork Trucks

*(an authorised seller of Nissan forklifts) as a key alliance partner in WA, VIC, NSW and NT;*

### **A**dvanced Engine Components Ltd,

*an innovative and long standing leader in natural gas engine technology, that is recognised and exported worldwide;*

# CUSTOMER BENEFITS

The **alliance** of Motive Energy with a variety of leading Australian companies brings some significant benefits to users of internal combustion powered vehicles for fleet service.

**NaturalPLUS** is the fuel produced by Motive utilising natural gas.

Benefits include:

**R**educes your **current** fuel bill

The Price of the fuel is highly competitive in today's volatile fuel market;

**R**educes your **future** fuel bill

The Price of the fuel may be locked in for the period of the contract subject only to CPI variations;

**P**rovides the convenience of on-site fast fill refuelling station

By utilising Motive's on-site refuelling facilities connected to the natural gas distribution network in your street, you get one of the most reliable and safe fuelling options available;

**M**inimisation of Administrative and Logistical Management

as natural gas is delivered through existing distribution pipe networks, there is no administration required for re-order, nor is there the need for fuel trucks to enter your facility;

**S**ignificant reduction of your environmental impact,

the use of NaturalPLUS reduces both your noxious and greenhouse gas emissions significantly;

**24** hour support

both alliance partners supply 24 hour service and fault support.



# PRODUCT BENEFITS

Motive's product, **NaturalPLUS**, is an integral part in a complex matrix of responses to some significant societal concerns. **NaturalPLUS** reduces the impact of:

**R**oad transport greenhouse emissions, one of the most difficult and fastest growing **climate change** challenges. NaturalPLUS, when combined with Motive's engine technologies, **reduces vehicle emissions of Greenhouse Gases by up to 50%;**

**U**rban air pollution problems by directly addressing one of its major sources, road vehicles. NaturalPLUS achieves this by **eliminating or greatly reducing generic noxious gas emissions**, such as CO, NOx, NMHC, particulates and SOx. This minimises the cost to the community of ever increasing fuel quality and emissions standards necessarily imposed to reduce the impact of **health and environmental** effects of transport fuels;

**E**scalating diesel petrol and LPG prices, through a competitive pricing structure that enables a **significant discount** to these alternative fuels. At a time when the community is experiencing yet another price shock due to the international trade in petroleum products NaturalPLUS pricing **remains stable**, being linked only to the CPI;

**S**ecurity of supply risks for **critical transport functions**, by utilising an **indigenous natural fuel**. This compares well with the supply and production of diesel, for which the majority of crude oil is imported. Note: Australia produces a lighter crude more suitable for petrol production;

**T**echnology risk through the use of products tried and proven over decades of **international development** for markets in **Japan, Europe, USA, Brazil and Argentina;** and

**E**scalating production infrastructure, vehicle, and fuel costs required to meet more **stringent emissions standards** for conventional fuels, through provision of a significant alternative.

# COMMUNITY COMMITMENT

Motive actively promotes the Australian business community through its:

**A**lliances  
expanding alliance program;

**M**anufacture:  
commitment to **manufacture natural gas engines** in Australia;

**R** & D:  
program of research and development of its own and other Australian engine products;

Similarly, Motive is working within the community to provide:

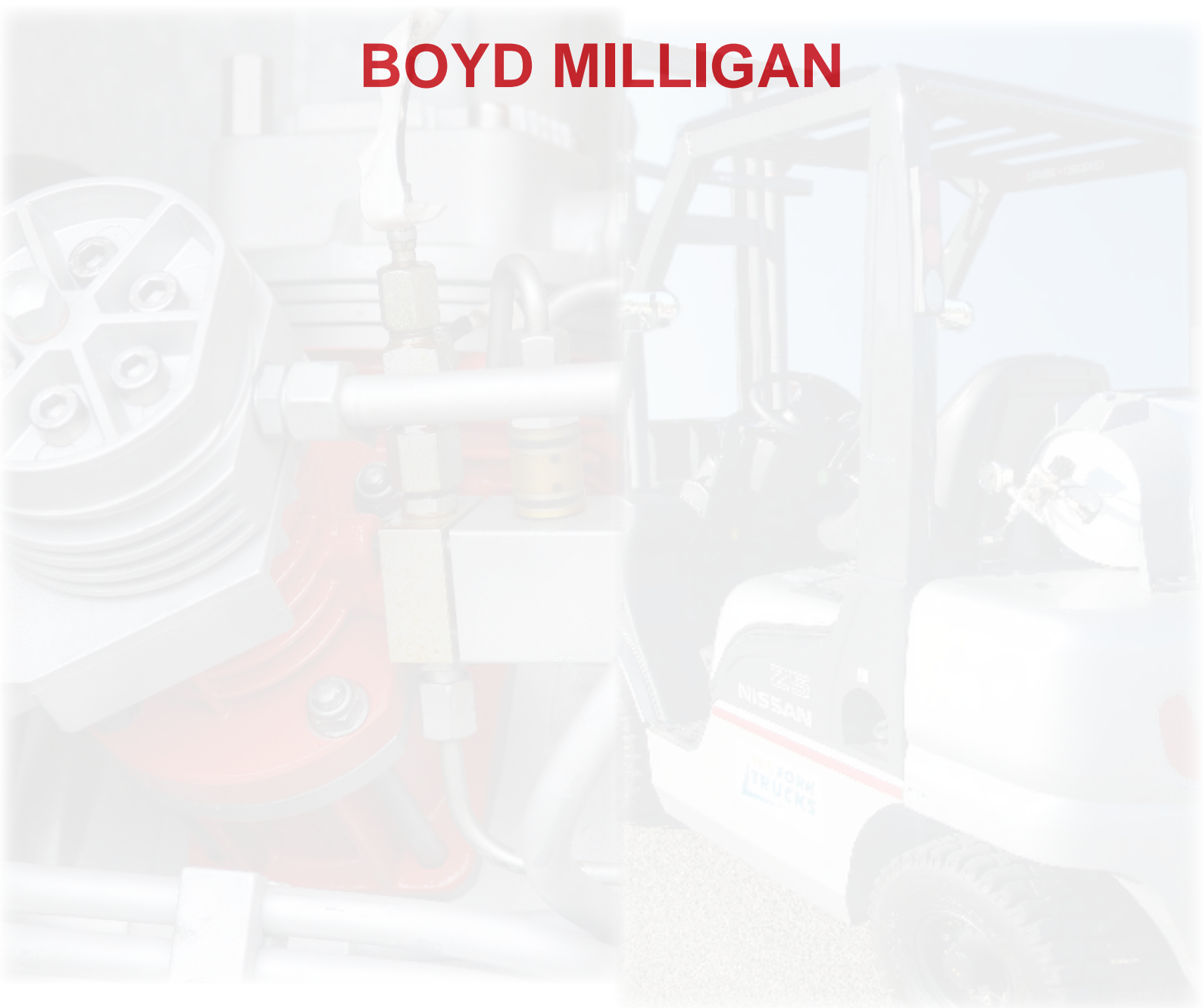
**A** path forward to a more **sustainable transport fuel future**, a stepping stone for the much anticipated introduction of commercial **hydrogen fuel cell vehicles** through infrastructure development for distributed hydrogen production estimated to be in **7-15 years time**;

**S**upport and development of **Australian industry** such as the facilitation of local technology company AEC's remarkable **engine technology**. We also utilise local manufacturing capacity in metal working, coatings technology, controls design, fabrication, electrical and mechanical services; and

**A** focus for an **automotive industry specialty** at a time of rationalisation of more traditional segments; and

**A**ustralian **workforce** development through its course development with the TAFE system.

# BOYD MILLIGAN



## BOYD MILLIGAN

Boyd Milligan is the Managing Director of Motive Pty Ltd and has been at the forefront of developing the natural gas vehicle industry in Western Australia since 1987.

Boyd's experience in natural gas vehicles began when as a Director he introduced the concept of dual natural gas/diesel engines to the publicly listed Transcom International Ltd. Along with a team of dedicated engineers he subsequently developed several dedicated natural gas engines based on high-powered diesel blocks within his own company, Gas Torque Engines Pty Ltd.

In 1993, Transcom acquired the technology rights developed by Gas Torque and evolved into the publicly listed company, Advanced Engine Components Ltd, an advanced natural gas engine technology company working with some of the world's largest engine manufacturers, including China's First Autoworks, Hong Kong's Weichai Engine Company, Renault and Mercedes.

Boyd was also the founding managing director of Urban Energy Pty Ltd, a supplier of natural gas as a vehicle fuel to complement the evolving engines marketplace, and was been a director from 1994 to 2001. Urban Energy managed the task of re-engineering, repairing and maintaining the gaseous fuelling systems in Perth for Transperth, and developed a string of natural gas refuelling facilities in WA and Victoria.

Boyd has worked closely with various government organisations to develop safe industry practices. These organisations include the Office of Energy and its predecessor the State Energy Commission, State Vehicle Licensing, Environmental Protection Authority, WorkSafe and Department of Minerals and Energy (responsible for Dangerous Goods issues).

Boyd has practised as a business manager and engineer in Western Australia for 27 years and is currently a member of the Institution of Engineers Australia, an associate member of the Society of Automotive Engineers and a founding member of the Maintenance Engineering Society,.

He holds a Masters Degree in Business Administration, Honours Degree in Mechanical Engineering, and is one of only two people in Western Australia authorised by the Office of Energy to be a Supervising Gasfitter, class P, for natural gas vehicles refuelling infrastructure.