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Professor Ross Garnaut
Garnaut Climate Change Review
Level 2, 1 Treasury Place
Melbourne, 3002

Dear Professor Garnaut

Re: Climate Change Review, Research and Development: Low Emissions Energy Technologies.

MBD Biodiesel Limited is developing biodiesel for use as an alternative to petroleum fuels for the Australian transport, mining and agricultural industries. We are utilising proven second generation technology developed in France to produce biodiesel. In a three stage process we propose to create a demonstration algae farm to provide feedstock to the biodiesel plant. We are in the development stages to optimise an appropriate algae strain with the Queensland Government and James Cook University. This process has started with the first test plant programmed to commence operation in May / June this year.

This approach avoids the problems of habitat destruction attributed to other feedstocks such as palm oil or reducing agricultural food production such as soy and canola.

At full scale the algae farm will consume in excess of two million tonnes of CO₂ per annum. The algae farm will be located adjacent to major heavy carbon dioxide emitters such as coal or gas fired power stations.

The full scale demonstration algae farm will provide 100% of the feedstock required to produce 250,000 tonnes per annum of biodiesel at our Townsville plant. This process can then be replicated as biodiesel gains market acceptance. The process also creates 450,000 tonnes of protein enriched algae meal feedstock for use in agriculture and aquaculture.

Clearly this approach offers a far better alternative to current proposals for CO₂ storage through thermal sequestration etc.

We attach our submission which details MBD's approach and responses to the questions for consideration raised in your review paper. For this approach to succeed Government would need to change the current regulatory arrangements and support initiatives which provide long term solutions to CO₂ emissions through use rather than storage.

We would appreciate an early opportunity to further explain our scheme.

Yours Sincerely



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Climate Change Review Research and Development: Low Emissions Energy Technologies

March 2008



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Executive Summary

MBD Biodiesel Limited (“MBD”) was established in 2006 with private funds. MBD was created to develop sustainable green alternatives to fossil fuels by producing biodiesel for transport and industry use as a partial or full replacement of fossil diesel.

MBD is in the process of building a vertically integrated biodiesel company based on algal oil as feedstock. The by-product algal cake will provide a protein rich meal similar to soy meal to livestock and aquaculture.

MBD plans to develop an algae feedstock based on the key ingredients of waste CO₂, derived from gas or coal fired power stations and, where available, nutrient enriched surplus waste water. As a consequence MBD would not be reliant on traditional feedstocks derived from vegetable oils and grains that require large areas of farmland and significant volumes of water in order to sustain them.

This approach has the potential to provide a viable approach to coal flue gas sequestration (the removal of carbon from the energy system) by actively providing a cycle for carbon to be reintroduced or re-absorbed) into the energy cycle.

The project has the potential to significantly mitigate the climate change potential presented today by Australia’s power stations. In addition the biodiesel produced will substantially augment Australia’s current diesel consumption of circa 15 billion litres per annum.

This paper has been compiled to provide background information and comments with regard to MBD’s experience in seeking to develop a low emission biodiesel company in Australia. The submission seeks to use the companies’ experiences and proposed development plan as an example of the wider issues facing the biofuel industry.

This paper also provides comment specifically on the impacts of government policy as raised in Issues Paper 4 Research and Development: Low Emissions Energy Technologies including responses to the relevant “questions for consideration”.

We would appreciate an opportunity to meet with Professor Garnaut and provide further detailed information in relation to these matters.

Any further inquiries in relation to this document should be directed to:

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Background - MBD Biodiesel Limited (“MBD”) Company Profile

MBD’s vision is:

“To create Australasia’s preeminent vertically integrated biodiesel company - Sustainability, versatility, and high quality products leading to profitability”.

MBD has developed a feedstock strategy, with the following main elements:

- Initially develop a pilot algae farm of 35,000 TPA Algae Farm to proof concept on industrial scale that consumes CO₂ from a major emitter such as a gas or coal fired power plant, or other large industrial plant based on a development program executed together with James Cook University.
- The pilot plant will demonstrate how CO₂ sourced from a major emitter can be utilised to grow algae thus providing an effective solution to the problem of alleviating CO₂ emissions and consequent global warming of the atmosphere.
- If feasible build an industrial sized demonstration algae farm (700,000 TPA Algae Farm to supply the biodiesel plant) [~ 300 hectare footprint needed].
- Then construct a 250,000 TPA biodiesel production plant based on the Esterip-H Axens second generation technology in Townsville QLD.

No biodiesel company can proceed to construct a biodiesel business without first ensuring a sustainable and cost-competitive algae feedstock supply chain. It is proposed that MBD will develop an algae demonstration farm to deliver 100% of feedstock required for our proposed Townsville biodiesel plant.

The Biodiesel Industry

Renewable alternative to fossil diesel

The ever increasing price and demand for crude oil together with the environmental effects of using of fossil derived fuels has driven the search for renewable and sustainable alternatives. Global warming and agreements such as Kyoto are driving governments and business to assess their carbon footprint and seek alternate low / neutral carbon solutions.

Biofuels have the potential to provide a significant component of any future solution whereby the fuels produced can meet increasingly higher standards for energy, power and emissions.

Biodiesel meets the applicable standards and provides significant environment advantages through significantly reduced emissions. Biodiesel can be manufactured from feedstock that is sustainable such as algae. Algae consume significant quantities of carbon dioxide as raw material. The algae will abate large amounts of carbon dioxide from existing and future coal and gas fired power stations as well as other large industrial carbon dioxide emitters.

Algae will deliver the following:

- significant positive consumption of CO₂
- sustainable and affordable algal oil to the biodiesel industry
- Provision of feedstock for livestock and aquaculture industry with the production of a drought resistant protein rich feed through the use the algae cake (the remnants following the extraction of the oil).
- Substantially reduced footprint.

Key benefits of biodiesel include:

- i. A renewable alternative to petroleum diesel
- ii. Similar in performance to petroleum diesel
- iii. Non toxic and bio-degradable
- iv. Very low in sulphur content
- v. Significantly lower exhaust particulates (including CO₂)
- vi. Lifecycle greenhouse gas emissions reduced by >80%
- vii. Able to be used in conventional diesel engines as a blend
- viii. Able to be blended with petroleum diesel at any ratio
- ix. Improves engine ignition and lubrication
- x. Higher flashpoint (150°C) compared to petroleum diesel (70°C) makes for easier & safer handling and storage
- xi. Provides highest energy content of any alternative fuel

Biodiesel – Drivers

Markets

Biodiesel has many applications and can be applied across the spectrum of the mineral diesel market. Key target markets exist from truck transport to light vehicles, mining industry, heavy industrial applications as well as traditional energy and heating uses.

The value of high quality Glycerine that is produced as a by-product has also increased through 2007 due to high demand from new industrial applications. 2008 is expected to see world capacity increase in line with demand and a stabilising of the current high prices.

Regulatory

Several issues are key to a viable biodiesel industry. Governments, Federal and State must provide policies and regulation to provide certainty to the biofuel industry. These include:

- Blend Mandates
- Fuel Rebates that are at a minimum equivalent to those available for mineral diesel and preferably greater to encourage the rapid uptake and ongoing use of biofuels.
- R&D Tax support
- Direct capital and / or taxation support to ensure innovation across the industry.
- Carbon Credit trading and offset framework.

Feedstock

Feedstock has become one of the critical elements of a successful biodiesel company. A high demand for vegetable oil and animal fat (tallow) demand from China and India has seen the price and availability of feedstock become the number one issue to ongoing profitability in the biodiesel sector.

- Negative carbon footprint
- High unsustainable production acreage required from traditional sources like canola, soy, palm oil.
- Rainforest degradation as a result of new palm plantations.

Concerns have been raised that the use of edible oils and fats for biodiesel will lead to higher food prices and reduced availability of food products for developing countries and will cause the acceleration of rainforest destruction.

Fuel Tax Legislation (Federal)

The current legislation has actively discouraged the biodiesel industry through rebates to mineral diesel at 38c a litre vs. 0c for biodiesel. The lack of cohesive blend mandates also serves to create a background for the industry that discourages research and investment by new companies and has led to the industry floundering in the marketplace.

Consumer Confidence

The quality standard for B100 should be endorsed by an independent producer organisation (similar to BQ9000 as in North America, www.bq9000.org) to strengthen consumer confidence in biodiesel quality.

Proposed B5 (5% blend standard; Federal proposed)

The proposed limit of 5% blend of biodiesel in diesel will increase the working capital costs for producers and distributors to market the biodiesel.

Such a low maximum blend means that large scale users (especially the mining industry) face further hurdles to reduce their greenhouse gas footprints and discourages them to increase their biodiesel consumption.

The proposed measures will lead to a reduced total consumption of biodiesel in Australia and increased marketing and working capital expenses for producers and distributors of biodiesel. The consequence is that consumption will be impacted.

Biodiesel – Market Status and Key Learning’s for a Sustainable Industry

Market Status

A number of local and European biodiesel producers have significantly reduced or ceased production of biodiesel as a result of exposure to significant recent feedstock price rises and limited/no availability of alternate suitable feedstock.

Companies with assured access to feedstock, e.g. vertically integrated, still continue to operate with strong fundamentals (none in Australia)

Major community considerations have been raised that the use of edible oils and fats for biodiesel will lead to higher food prices and the reduced availability of food products for developing countries plus accelerate rainforest destruction.

Although prima-facie, Australia provides incentives for the use of biofuels, recent Federal government decisions are now detrimental to the uptake of the industry.

MBD acknowledges these issues and has made a definitive decision at board level to pursue algae based feedstock as a key element of our company to ensure no impact on the food chain.

Key Learning’s Elements for a Sustainable Industry

Vertical integration is now the key issue facing the biodiesel industry to enable its economic viability.

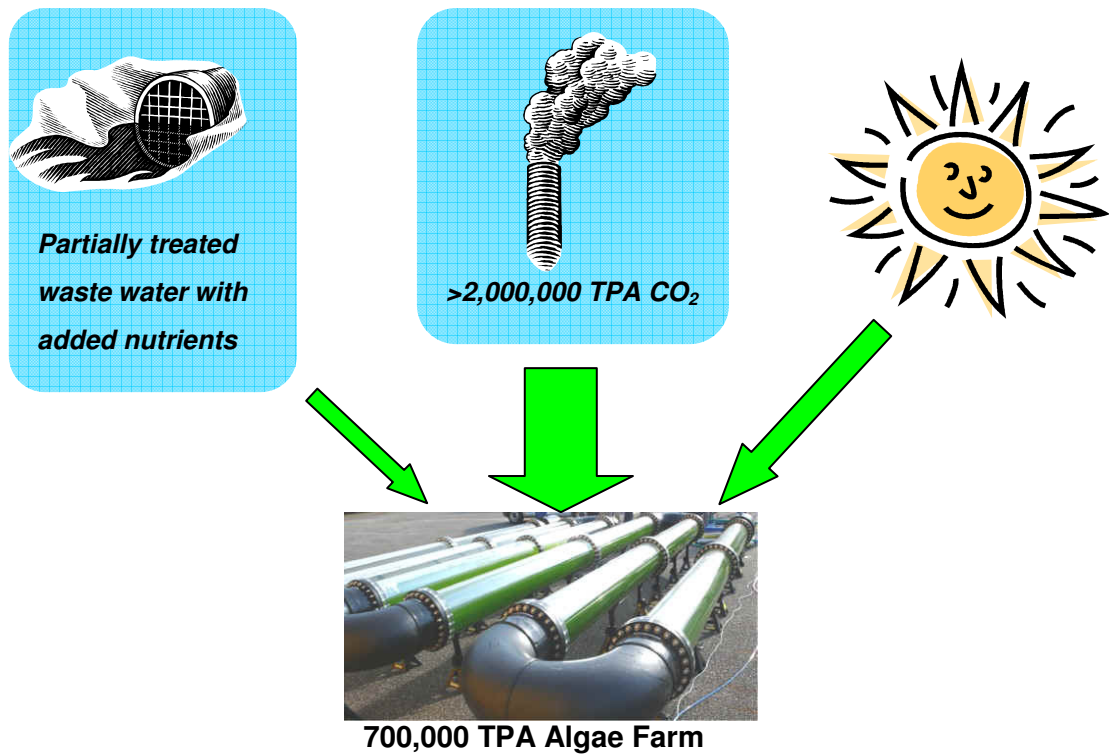
Biodiesel Companies must adopt medium to long term *strategies* based on seeking a “non-edible” “non-farm based” and “sustainable” oil feedstock produced from non-rainforest land.

Algae provide an ideal second generation feedstock for biofuels that is ideally suited to Australian conditions. Once proven at large scale, it is anticipated to be immediately replicable.

Algae – the ideal feedstock

Algae is an ideal feedstock alternative with significant environment benefits:

Key Inputs for 700,000 TPA Algae Farm:



300 Ha of marginal land

Pros:

- High consumption of CO₂.
- Ideally suited to complement coal and gas power stations.
- Large scale recycling of carbon into the energy cycle as against coal sequestration which seeks to remove carbon from the energy cycle.
- Independent of rainfall and soil quality
- Small footprint.

Cons: 2 to 3 year development timetable.

- Capital intensive option to establish the infrastructure.
- Long term contracts needed with power stations driven by a stable emission market.

Required Area:

- Approximately 300 hectares of marginal land.

Key Power Station options and Algae plant outputs, usage and expenditure.

	Coal power plant 400 MWeI	Gas power plant 400 MWeI	Algae plant 700,000 tpa
Investment	USD 520m	USD 280m	USD 350m
Yearly production:			
• Algal oil	na	na	252,000 t
• Algal cake (soy meal)	na	na	448,000 t
• Electricity	3.2 M MWh	4.8 M MWh	-0.064 M MWh
• Carbon dioxide	2.9 M T CO2	1.4 M T CO2	-2.1 M T CO2
Specific carbon intensity	0.9 t CO2 produced per MWh produced	0.44 t CO2 produced per MWh produced	-33 t CO2 removed per MWh used
Land area	20 ha	20 ha	320 ha

The commercial scale Algae farm will provide a highly compatible partner to large scale carbon emitters including Gas and Coal fired power plants.

Additional environmental benefits of the large scale Algae farm:

The Algae based proposed production plant will allow the abatement of in excess of 2 Million Tonnes per annum (“TPA”) carbon dioxide. The environmental outcomes of MBD’s proposed project will provide a world leading example of CO2 reduction and promote MBD and Australia as world leaders in this field.

The produced Algae cake will provide the local cattle and feedlot industry with a sustainable and consistent supply of protein rich feedstock. A supply that is cost effective and independent of drought.

It will enable a significant reduction in the consumption of fossil diesel and the associated production of CO2 and other pollutants through combustion.

Algae Farm – Stepped Up-Scale Process

Algae Farm - Stepped Up-Scale Process	
Stage 1 - Test Plant	
Scale	3 kg per day equivalent to 1 TPA
Estimated Total Value Project	\$600,000
Key Milestone Dates Test Plant facility <ul style="list-style-type: none"> - Order Test Plant - QLD Government submission - Commission Plant - Develop optimum Algae strain - Engineering output for pilot plant - Finalise optimum Algae Strain 	
Key Outcomes <ul style="list-style-type: none"> - Develop local Algae Strain - Develop local expertise in Algae production and process parameters - Optimise Algae variety for oil output 	
Stage 2 - Pilot Plant	
Scale	100 TPD equivalent to 35,000 TPA
Estimated Total Value Project	\$25,000,000
Pilot Plant facility requirements <ul style="list-style-type: none"> - Identify site - State Government submission - Develop Detailed Engineering - Order Pilot Plant - Construction - Commission Plant - 6 month Trial Optimisation Program 	
Full Operation	
Key Outcomes <ul style="list-style-type: none"> - Prove Algae plant on commercial scale - Refine plant operation and design for demonstration project - 105,000 TPA CO₂ consumption - 10,000 TPA Algae Oil - 25,000 TPA Algae Cake 	
Stage 3 - Demonstration Plant	
Scale	2,000 TPD equivalent to 700,000 TPA
Estimated Total Value Project	\$400,000,000
Demonstration Plant facility steps <ul style="list-style-type: none"> - Identify Site - Federal Government submission - Develop Detailed Engineering - Order Demonstration Plant - Construction - Commission Plant - Full operation 	
Key Outcomes <ul style="list-style-type: none"> - Prove Algae plant and optimised harvesting and processing on commercial scale - Refine plant operation and design for demonstration project - 2,100,000 TPA CO₂ consumption - 250,000 TPA Algae Oil - 450,000 TPA Algae Cake 	

Algae Farm / Biodiesel vs Sequestration / Mineral Diesel

The following information seeks to give example of the two options and the respective use of Carbon in each cycle:

Algae Farm / Biodiesel Process

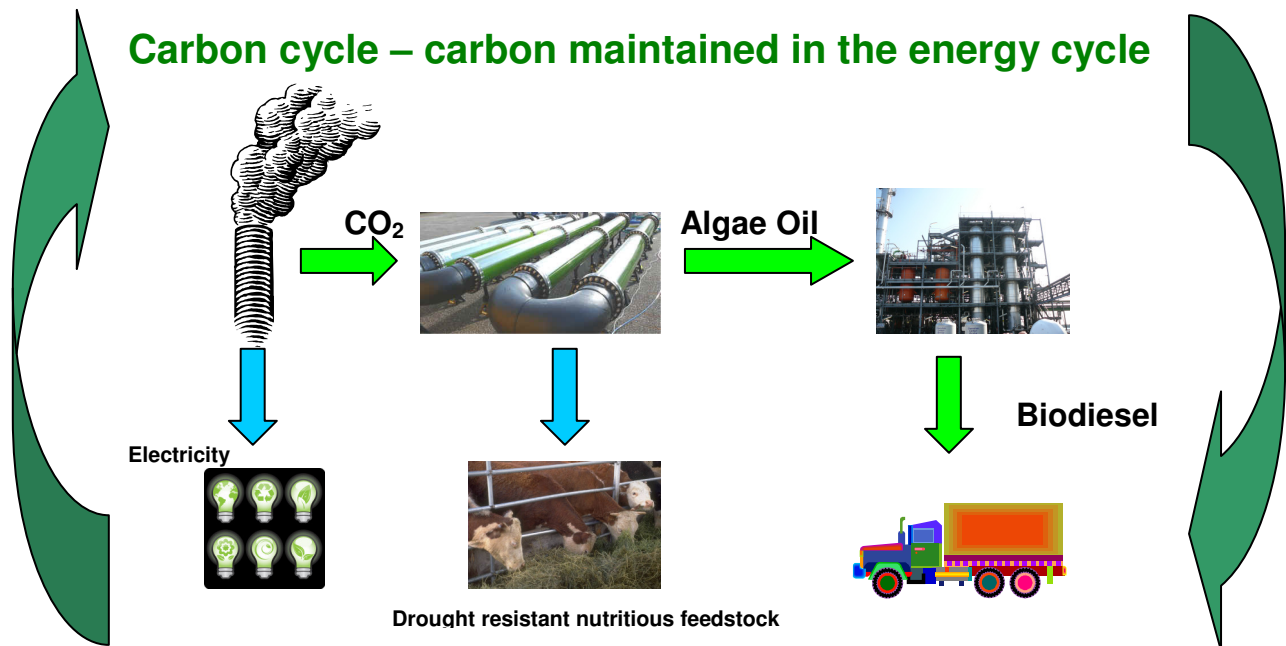
Power Plant: CO₂ is collected directly from heavy carbon emitter and piped directly into algae farm.

Algae Farm: Algae Farm introduces carbon dioxide to nutrient enriched water for consumption by algae. Outputs 100% used

- 40% oil processed in biodiesel plant
- 60% algae cake used as nutritious feedstock for agriculture.

Biodiesel Plant: Biodiesel plant processes algae oil into biodiesel and glycerine

Diesel Consumer: End product is biodiesel that is suitable for alternative to mineral diesel. [Car, truck, train, plant etc]



1/4 CO₂ emission compared to mineral diesel

Key Issues:

Carbon is a finite element.

Carbon is a base element for all oil, gas and coal based energy generation producing CO₂.

CO₂ is maintained in the energy cycle – consumed by algae.

The CO₂ can be harvested from a heavy emitter or air.

Algae is then crushed and oil extracted for biodiesel with the remaining cake providing large quantities of drought proof nutritious feedstock for agriculture and aquaculture.

Less than a quarter of CO₂ is released by biodiesel compared with mineral diesel.

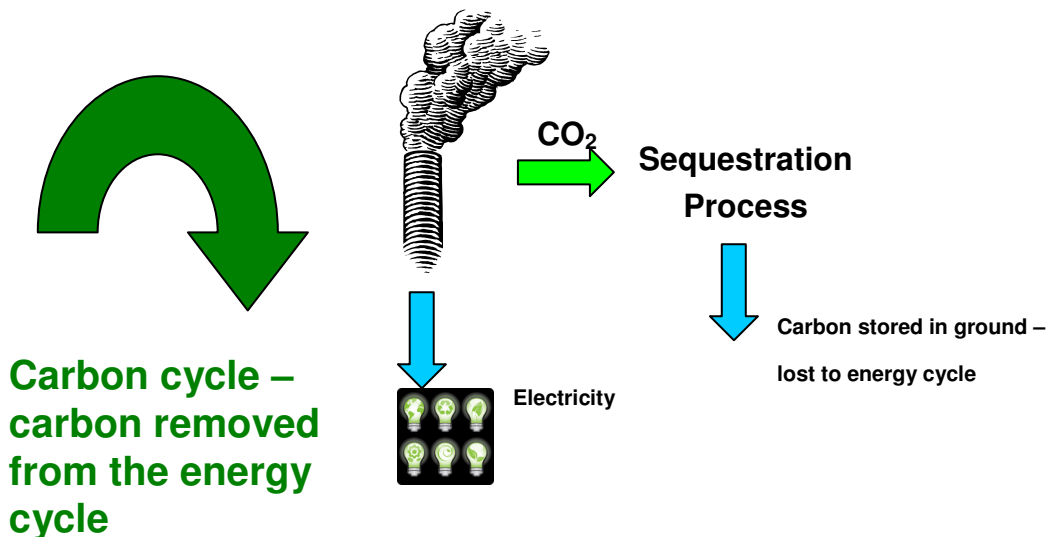
Power Plant – Sequestration

Mineral Diesel - Diesel user (car/ truck/ train/ plant etc)

Power Plant: CO₂ is collected directly from heavy carbon emitter and piped directly into sequestration process. CO₂ pumped into ground with carbon removed from energy cycle.

Oil Drilling: Oil is removed from ground and refined into a variety of petrochemical products including mineral diesel

Diesel Consumer: Used by a large range of engines [Car, truck, train, plant etc]



Mineral Oil
and diesel
refinery plant



Mineral diesel



4x CO₂ emission compared to BIODIESEL

Key Issues:

Carbon is a finite element.

Carbon is a base element for all oil, gas and coal based energy generation producing CO₂. The CO₂ is then stored back in the ground - removing carbon from the energy cycle.

Oil is a finite resource.

Four times the CO₂ is released by mineral diesel compared with biodiesel. Mineral diesel leads to a significantly higher range of sulphides and other toxic gases being produced in the process.

What can be achieved by biodiesel based on sustainable feedstock (algae)

- ii. Australia becomes a biodiesel regional leader supplying a sustainable alternative to fossil diesel fuel.
- iii. Decreased trade balance deficit caused by imported fossil diesel as the Australian crude oil production has passed "Peak Oil".
- iv. Develop significant "non-food chain" feedstock options -- Algae delivering a sustainable method to clean CO₂ from heavy carbon emitters including the coal industry.
- v. Provide alternatives to mineral oil which continues to rise in value and projected to reach "Peak Oil" in the very near future.
- vi. Create significant export opportunity together with significant local employment and major economic opportunities for industry.
- vii. Create a certain and economically viable company with significant opportunities for additional income from CO₂ credits and sale of Algae cake.
- viii. Establish Australia as the world leader in sustainable biodiesel production and the development of algae as a significant contributor to the reduction of CO₂ in the environment.

Key Government Support required

The key government policy change that has affected the biofuel industry over the past 2 years was the Howard Liberal Government's decision to remove the 38c per litre rebate for biofuel to primary producers. This change resulted in primary producers receiving the rebate on mineral diesel and no rebate for the use of biofuel. This has, in many cases, been the difference between biofuel companies being able to operate profitably and ceasing production. The removal of the rebate has led to the industry restricting the use of biofuel to low blends (max. 20%) in order to minimise the effects of rebate reduction.

The other key government policy that is causing uncertainty in the biofuels industry is the lack of legislated blend targets. Many of the developed world economies, particularly those that are net importers of oil, have sought to provide legislated blend levels to ensure that they reduce their reliance on imported oil and realise the environmental benefits of biofuel.

The USA, Brazil, and many European countries have successfully adopted rebates and legislated target blends of biofuels to reduce dependence on mineral oil and provide certainty to the biofuel industry.

The Federal Government must make the necessary legislative changes to support the biofuel industry or risk the loss of the industry all together.

Issues Paper 4 Research and Development: Low Emissions Energy Technologies -“Questions for consideration”

How innovation happens

What is the role of an emissions trading scheme in driving innovation?

The search for alternative fuels and energy sources is a very capital intensive process and in the case of biofuels has experienced active destabilisation by government through the removal of the rebate scheme and lack of established targets. R&D investment requires a degree of legislated certainty. A targeted emission scheme will ensure that fuels will be considered not only for the energy that they produce but the CO₂ they emit. In the case of algae based biodiesel a significant and quantifiable amount of CO₂ will be consumed in the process. This in turn will provide the company with a significant income source and foster research to maximise the consumption of CO₂ as against a total focus on oil production.

How large are the market failures in innovation?

We refer to the development of a large scale demonstration algae farm. The cost of the demonstration farm is in the vicinity of \$400M. It has the potential to mitigate >2M TPA of CO₂ and produce 100% of the feedstock oil requirements for a 250,000 TPA biodiesel plant. Whilst seeking to minimise the risks of the project of not achieving the target outcomes through adopting a staged approach the reality is that the process involves large sums of investment and carries significant risks.

Similar quantum's of cost are associated with the current solar project being developed in Mildura. The pursuit of large scale innovative alternatives requires these investments to provide a scale of project that will impact both CO₂ mitigation and commercial solutions for feedstock provision.

Are there alternative frameworks that may be useful in the processes of policy analysis and development?

Clear and certain legislated policy across the whole area including:

- Emission Trading Scheme
- Rebate for Biofuels that as a minimum matches the mineral diesel rebate but more desirably encourages the use of biofuels over mineral diesel. i.e. the US scheme
- Clear minimum mandates for biofuels set at a minimum of 5% and rising to 10% over the next 5 years.

- R&D tax support at 2 multiple

How can Australian governments improve policy clarity, continuity and coherence for businesses for looking to invest in new energy technologies, or in other sectors with the potential to contribute to mitigation or adaptation?

Clear and certain legislated policy across the whole area including:

Emission Trading Scheme

Rebate for Biofuels that as a minimum matches the mineral diesel rebate but more desirably encourages the use of biofuels over mineral diesel. I.e. the US scheme

Clear minimum figures for biofuels set at a minimum of 5% and rising to 10% over the next 5 years.

R&D tax support at 2 multiple

How will this be improved with the implementation of an Australian emissions trading scheme? What areas of uncertainty might remain?

A targeted emission scheme will ensure that fuels will be considered not only for the energy that they produce but the CO₂ they emit. In the case of algae based biodiesel a significant and quantifiable amount of CO₂ will be consumed in the process. The scheme must be clear in its definition of CO₂ emissions and must be able to be transparently applied.

How can the Australian Governments avoid 'picking winners' while encouraging increased innovation? What is current best practice for technology neutral innovation policy?

To a certain degree the government needs to create policy that encourages innovation in saying this it must be recognised that any policy will create winners and losers. The government must keep as its central mandate the bigger picture of the world reductions in CO₂. Policy must be directed at meeting the needs of the Australian energy and fuel sector whilst overseeing whole scale reduction in the effects of realising the energy and the CO₂ created in the process.

The current policy and thrust of research has followed the desire to find a solution to clean coal. This has significant investment by government in seeking to remove carbon from the current environment and storing it. This policy has created certainty in the industry and generated significant levels of research. However the policy fails to recognise that the current users of energy will continue to use coal and gas while they remain abundant and cheap alternatives.

A far better solution is to develop a mechanism to convert carbon back to a usable form and manage the process of transfer from fuel (coal/ gas) to energy and CO₂ and then back to fuel and so on. There are technologies such as algae based biodiesel that

provide such a solution. These are the current losers under the existing Australian Government policy and legislation regime.

How can the Australian Governments balance the need for diversity and option value with the increasing returns from uniformity and specialisation?

The large quantum of cost associated with research and commercialisation of low emission fuel technologies requires a high level of specialisation within each company to pursue optimum outcomes in their particular field. Whilst each development company requires a high degree of flexibility to pursue research within their given field it intrinsically must pursue targeted research that adds value to its central proposition. Very few companies can afford the research budgets to pursue a significant spectrum of high risk / high return research across the spectrum. It is perhaps time to put in place sufficient funding from the government's CSIRO body and similar state agencies to pursue alliance projects with the private sector and in turn realise the benefits of such research to fund a continuing program of exploration and research within Australia. The current reliance on the market to push research has failed in Australia.

The time has come for government policy, legislation and funding to ensure that Australia provides world leadership in CO2 mitigation and sustainable alternate energy solutions.

How can policy promote diversity without falling into the trap of needing to specify at a technical level what such diversity should include?

Government Policy must create an environment of certainty for companies seeking to research in as wide a spectrum of low emission fuels and energy sources as possible. Government must not singularly pursue individual areas at the expense of the wider options or withdraw support for maturing technologies as new innovative options are developed. A key determinate in pursuing innovation is the commensurate high rewards associated with the high risks taken in pursuing innovation. Companies pursuing innovation particularly benefit from government support in early development stages. Once the technology is established and providing sustainable returns the company can then seek to refine its technology and seek the next generation of innovation. Policy must be provided by government that is constantly in advance or at least in parallel with technology and innovation. This has been a major failing of the past decade.

What are the barriers to entry that create uncompetitive incumbency advantages in the Australia?

The wide variety of information and varying views distributed in the wider community make new technologies an easy target for incumbent fuel sources to target with misinformation. The current major fuel companies have dominated the market for the last 50 years.

Clearly the major oil companies seek to protect their large scale distribution networks. They seek to maintain the status quo and have established a highly developed level of political support.

Government policy should ensure that all fuel sources are considered equal and that the incumbent fuels and fuel companies do not receive free emissions or quotas in any new carbon emission trading schemes. Emission trading levels must be priced such that the low emission technologies are encouraged over conventional fuel sources. Australia will need to pursue these objectives if it is to meet its global warming targets.

What are the appropriate policies for minimising barriers to market entry without undermining the competitive advantage of established firms?

In order to encourage private sector investment in low emission technologies government needs to positively support their entry into existing markets. The alternative is to ignore increasing consumption of mineral oil based fuels and reduce carbon elsewhere. It would seem there are clear decisions when assessing options to reduce CO₂ in the environment. The choices are to reduce car dependency, adopt low emission fuels or develop alternate cars and trucks that do not generate CO₂.

In the short to medium term low emission fuels provide the only real solution to significantly (70 – 80%) reduce CO₂ from transportation.

No industry should be exempt from the obligation to participate in the fulfilment of a National Trading Emission Scheme.

What criteria, processes and institutional structures are most desirable for allocating funding to public good research?

Certainty is the key to achieving good research. The government must adopt clear and legislated levels of CO₂ reduction and develop an emissions trading scheme that ensures there are clear benefits for fuels that deliver low emissions.

Tax support through research will further ensure increased and sustainable levels of research investigation.

What types of reforms are needed to ensure that public funding is allocated to the most appropriate and highest-value uses?

The carbon emission trading scheme together with mandated blend levels and positive, or at the least equal, rebate schemes must be adopted in policy and legislation to ensure Australia reaps the benefits of both high levels of research and the resultant development and adoption of real low emission fuel technologies.

The Governments' timely establishment of the Bracks' enquiry into the future of the Australian car industry needs to be fully informed on substantial alternative fuel options. A copy of this submission will be forwarded to the Hon Steve Bracks and Minister Carr.

Are patents adequate for internalising knowledge spill overs from new abatement or adaptation technologies?

Not really. The reality of patents is that they are increasingly irrelevant as the modern world develops at a quicker pace than the patent system can protect. Example includes

the patent process associated with DNA mapping and genetic plant varieties. These clearly have adverse social effects.

What policy alternatives are available to increase the incentives for firms to undertake more demonstration or commercialisation activities?

Governments must create certainty for the market so that innovative technologies are at the least considered on equal footing with the current incumbent technologies and where demonstrative improvements may be realised. Follow up support is then required to ensure that the benefits of new technology are realised.

What are the appropriate instruments available to government to reward early-movers for spill overs resulting from marketisation activities?

In addition to policy and legislation Governments will need to support innovative low emission technologies through a comprehensive education and marketing of the benefits and safety for consumers to adopt the new technologies. Governments need to lead by example and use new low technologies as early consumers – they can then publicize their experiences and encourage & incentivise the wider public and industry to use new low emission fuels.

Current lack of a consistent response from Government has resulted in low levels of consumption and demand for new technologies with all benefits failing to be understood or appreciated in the market place.

Does coordination improve research outcomes and thereby outcomes for society?

How large are the coordination failures in Australia?

Australia has a poor record over the last decade in seeking to provide and support world leading technologies that benefit the planet. As a consequence sustainable energy such as innovative solar power experts are forced to go overseas with these inventions. The biofuel industry is a classic example of an industry that has suffered the significant decline with the withdrawal of the fuel rebate system, lack of mandated blend and minimal support for sustainable feedstock alternatives result in the large scale failure of the industry. This in turn makes private capital raisings for technologies such as biodiesel extremely difficult. Millions of dollars have been spent pursuing the development of a viable biofuel industry. The lack of government support has directly contributed to a substantial write off of this investment. Thus the government needs to pursue a suite of linked initiatives including: consistent policy, encouragement, direct funding, support for research and legislation that provides certainty for each industry. Another model worth pursuing is an alliance or public private partnership model.

How can government create more cohesive research environments and promote genuine cooperation between rival firms or organisations? Is this a role for government?

Many responses in this document are repetitive because the same key elements will drive a successful future of innovation and the achievement of low emission fuels. The renewable fuel industry is a small industry that needs the industry as a whole to prosper in order to maintain sustainable levels of investment. Again governments must do everything they can to achieve certainty and reduce risk to new and emerging technologies.

In what areas would coordinated international public good research be warranted?

Governments need to either directly pursue innovation through government bodies and under private public partnerships or alternatively create an environment of certainty for private companies to pursue innovation that benefits the public good. Private companies are now leading the government in Australia – it is critical for governments to support and take a leadership role again for the pursuit of solutions that will provide the world with new innovation solutions. The world does not have the luxury of waiting for individual private companies to commercialise these innovations gradually. Innovations must be implemented on a world scale.