Ms Maureen Weeks
Committee Secretary
Senate Rural and Regional Affairs and Transport References Committee
Parliament House
Canberra ACT 2600

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Dalkeith, 28February 2006

Dear Maureen,

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

This letter is intended as a submission to the above Inquiry. It is written on a personal basis, and does not purport to represent any views other than my own. In regard to the Terms of Reference for the Inquiry, this letter will address item (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.

The potential sources of alternative transport fuels that I wish to discuss in this letter are Gas-to-Liquids, shale oil and ethanol. I have personally worked on development of all three as replacements for conventional transport fuels. I would like state that I am no longer involved in the development of these fuels, and that I do not stand to gain from the recommendations contained in this letter.

Gas-to-Liquids

Australia's gas reserves are tremendous by any standard. The technology to convert natural gas to transport fuels has been available and commercially proven for a considerable time. Those fuels include petrol (e.g. the Mobil plant in New Zealand, although that was closed in the 1990's due to persistent low crude oil prices and a lack of gas); diesel and jet fuel (e.g. Shell's plant in Malaysia); and methanol (e.g. various Methanex plants around the world, including one mothballed in New Zealand last year due to lack of gas). Various Gas-to-Liquids ("GTL") plants will be going up around the world in the next 5 years.

GTL is a great way to create transport fuels. The produced fuels are of a high or very high quality with usually zero sulphur compounds. The process generates power during the production of the liquid fuels. Carbon dioxide emissions in production are very low: the main emission is steam.

Australia should be very well positioned for GTL plants to provide a contribution to our transport fuel pool. Not only are there abundant reserves of relatively cheap natural gas, but Australia is politically stable and investor-friendly. However, there are some serious obstacles:

- GTL plants need to be located close to the source of the natural gas they use as feedstock. Construction rates in locations such as Karratha are amongst the very highest in the world, and this is only partly offset by the productivity per head of labour. This makes the construction of a plant more expensive than in the majority of other locations worldwide that have similar gas reserves.

- The transport of fuel from a GTL plant along our North-Western coast to the market within Australia (mainly located in the South-East) is reportedly more expensive than shipping it to an overseas market such as Singapore, due to the high coastal shipping charges. This would make it more attractive to establish an export-GTL than one that aims to replace transport fuels in the domestic market.
- The product from a GTL is a "ready for market" product, not a crude oil replacement that still requires refining. Companies that operate refineries in Australia would have to consider that any supply from a GTL to the transport fuel market would reduce the output of their refinery for that same product. Given that refineries need to operate at high levels of capacity to remain profitable (and usually at relatively low margins), a GTL would render a refinery operation unprofitable. Closing a refinery would be an option, but the book value of most Australian refineries following the recent investment in sulphur-removing plants is still several hundred million dollars. Also, unless the owner continues to operate part of the refinery such as the tank farm, refinery closure may well incur hundreds of millions of dollars in clean-up costs. Refinery owners therefore might prefer to locate their GTL plants in countries where those plants do not compete with their existing assets.
- Methanol is an excellent fuel for fuel cells, which are considered likely to start playing a serious role in car transport within the foreseeable future. It is also a great octane booster and the easiest GTL product to create. However, it can only be used in relatively small quantities in petrol, unless the car's engine is modified. That makes methanol a longer-term proposition as a major contributor to the replacement of conventional transport fuels.

To counter some of the above objections, following options would be suggested:

- A GTL plant producing for the Australian market could be considered a strategic asset for this country. As such, the Committee might want to consider the possibility of Federal Government support over and above the regular Major Project status to offset the construction costs to some extent.
- If the statement on shipping charges is correct (of which I am not entirely certain as it is not in my field of experience), the Committee might consider a recommendation to review the applicable legislation covering coastal shipping.
- The Federal Government could concentrate its "marketing" of a GTL opportunity on companies that do not operate refineries in Australia, but that is not easy: the world's 4 largest privately-owned oil companies all have refineries here. On the other hand, GTL technology is not limited to major oil companies. Several technology providers offer processes and the required catalysts. As such, any operator of suitable gas assets in Australia and in particular local firms such as BHP-Billiton, Woodside and Santos should be encouraged to consider investing in GTL plants for the domestic market rather than in LNG export facilities.
- Alternatively, the Federal Government could consider reducing or offsetting the costs of closing-in refinery capacity.

Notwithstanding the objections mentioned above, GTL is an outstanding way to create alternative transport fuels for Australia. I would wholeheartedly recommend that the Committee consider this as the prime option available.

Shale oil

I did considerable work on shale oil for Shell, in particular on Queensland shale fields including Stuart near Gladstone, and Yaamba near Rockhampton. The Committee will be aware of the failure to develop a commercially viable shale oil plant at Stuart South. Stuart South is the richest shale field in the world, and as such the lack of success is disappointing.

It is difficult to see a new wave of development of shale oil, similar to the efforts by major oil companies in the 1980's. The investments are huge; the technology is in a very early stage of development and consequently risks are very high compared to conventional investments in oil exploration; the resulting oil flows are relatively small; and the operation is mainly mining-oriented, something that most oil companies would feel uncomfortable about. I am not at liberty to divulge detailed cost estimates, but in 1988 the development of Yaamba was believed to require well in excess of US$10 billion, yielding no more than about 80,000bbl/day of refined product and requiring a mining operation of some 500,000tpd of overburden and ore removal. This level of investment put shale oil at a considerable premium over conventional oil.

For the global players, there was the additional problem that worldwide only some 5-10 shale oil reserves could be considered economically viable at an oil price of US$40/bbl (1986 prices). The development of shale oil recovery technology would cost each company hundreds of millions of dollars – for a potential worldwide output of no more than 400,000-800,000bbl/day. The good news for Australia was that 4 of those reserves are located in Queensland, so if there were to be any serious development of shale oil, chances are it would take place here.

The environmental impact of SPP/CPM's shale oil plant has been well-reported and will be a cause of concern to the public in case of future development. However, it was primarily caused by the choice of technology for the winning of oil from the shale. The technologies that were proposed by other oil companies would in all likelihood not have had the same potential for release of sulphurous compounds. In that sense, the Committee need not regard environmental considerations as the prime disincentive to shale oil developments, although no doubt it will be a factor.

Overall, shale oil should in my opinion not be regarded as a potential key source of alternative oil supplies. However, if the Committee were to intend giving support to the eventual development of shale oil fields, a prime requirement would be to free up the exploration title on the fields. A single firm has held the exploration rights to all of the good fields for many years, and one could argue that this has been to the detriment of their development.

Ethanol

The Committee will undoubtedly review the potential for renewable sources of transport fuels. Ethanol is of course one of the main potential alternative transport fuels currently available, and its use is technically well proven.

My involvement with ethanol took place in 2002-2003 when, on behalf of John Holland Development & Investment Pty Ltd, I was project director for the development of ethanol-producing facilities near Nambour and at Mossman, both in Queensland. In both cases the plants would use sugar cane as its feedstock. Both developments foundered, but not because of a lack of technical or commercial viability of the chosen technology.

Nevertheless, I did learn some key points about the production and marketing of ethanol as an alternative transport fuel:

Feedstock:

- The feedstock for conversion to ethanol must be cheap per unit sugar available for conversion, and abundantly available within a limited transport radius to ensure economies of scale without excessive transport penalties.

- The feedstock must be priced such that it allows the grower a reasonable level of net income, but also structured such that it provides an incentive for continuous improvement in growing and harvesting practices.
- Upon conversion, the feedstock must leave no residue that cannot be recycled either for use in the plant or in the growing of the feedstock.

Sugar cane is ideal in all of the above. Its cost-yield ratio is low, it is abundantly available, and its growers are in need of an alternative outlet. The by-products that are created are bagasse, which can be used for cogeneration purposes; and a wastewater that makes a good fertiliser.

Molasses can also be used, but are lower in yield because the sugar from which ethanol is to be formed has already largely been taken out. Also, the liquid fertiliser produced by a plant operating on molasses is stronger-smelling and may cause some environmental concerns in this respect. Molasses production per mill is limited, so in most cases either economies of scale would have to be foregone or transport charges would have to be expected. (The exception is where several large sugar mills are in close vicinity of the ethanol plant, e.g. CSR's Sarina facility.) The fact that production of ethanol from molasses may benefit the mill, but not necessarily the grower whose price is tied to the initial sugar production from the cane, is a serious issue in terms of long-term security of supply.

Grain requires water and heat to form sugars of a type that can be converted into ethanol. Grain processing also leaves a residue that does not meet the above specifications. Although it can be used as cattle feed, it places the investment proposal at the mercy of a dual commodity risk on both input (grain, gas) and output (ethanol, cattle fodder). This has proven to be an insuperable problem for the plants operating in the USA, and early indications in Australia were that grain-based ethanol plants would not be easily bankable.

Technology:

- The technology to convert the biomass into ethanol must be both well-proven and cheap. The use of sugar cane allows the application of Brazilian technology and equipment that meets both criteria. The price of biomass fuel depends mainly on the feedstock costs, but it is worth noting that in 2002-2003 it was expected that ethanol could be produced from sugar cane for $0.65-0.75 per litre.
- Ethanol is a good octane booster and as such can replace high-price alternatives whilst boosting an oil company's green credentials. The former could be an important element in price negotiations – except that the major oil companies rejected it as a pricing basis.
- Independent petrol distributors were considerably more open to the use of ethanol than the integrated oil firms (i.e. those refining as well as distributing and marketing oil products).

Environmental considerations:

- Objections that ethanol derived from sugar cane requires more fuel for its growing, harvesting and transport than it produces have been investigated and (as I understand) rebutted; and that was without counting the effect of using cane trash for cogeneration purposes.
- The wastewater from a sugar cane-based ethanol plant can be concentrated into a solid that, mixed with "mill mud", makes an excellent pot soil.
- Ethanol plants can be designed to be net water exporters.

Finance:

- There is substantial "in principle" support in financial markets for the development of biomass-derived fuels. Funding is therefore not a problem, as long as the underlying economics meet regular investment criteria.

There are of course also problems with the introduction of biomass-derived ethanol as a transport fuel:

- As mentioned under the heading "Gas-to-Liquids", oil refineries require operation at high levels of capacity to be profitable. Adding a percentage of ethanol to petrol reduces the throughput of the refinery by about the same percentage. Some of the integrated oil companies would only consider ethanol if the price differential between petrol an ethanol made up for the loss of capacity in their refineries. Others just refused to consider the use of ethanol. Even when dealing with oil companies that took a benign view of biomass fuels, the demands on price and volume were such that it would have been impossible to obtain finance for a new plant. This effectively closed the market. This is by far the biggest problem facing the biomass fuel industry.
- The cheapest ethanol comes from sugar cane, and the sugar cane must be processed immediately after harvesting to provide the best yield. This places the source of ethanol (Queensland Coast) at a considerable distance from the main user locations (the Sydney-Melbourne-Brisbane triangle). The cost of transporting the ethanol to the oil companies' main blending facilities is a serious price factor only partly included in the aforementioned ethanol price.
- Oil companies would require a steady supply of ethanol to blend in their fuels, rather than a massive supply over 4-5 months that has to be stored for several months. So either the ethanol plant has to store its product in a tank (a large non-producing investment); or the process has to be adapted to store part of the sugar juice as a syrup for later processing. The latter process is new and would require testing. Whichever way, someone has to pay for the discrepancy between seasonal sugar cane production and continuous ethanol use. The ethanol price cited above did not include a provision for storage or syrup-processing.
- From a farmer's point of view, any biomass product will have to compete with all other crops that he or she could conceivably grow on the land, or even with the option of selling land for real estate development. In wet areas, where most sugar cane is located, competition is limited; but that does not apply to moderately dry soils.

The major obstacle to the use of ethanol is the lack of support from the major oil companies. Their lack of enthusiasm is understandable: they stand to lose in terms of crude oil sales and of refinery margin. On the other hand, I received essentially no response on invitations to oil majors to participate as co-owners in ethanol ventures.

There is now a much better case for the use of ethanol, not just from "security of supply" point of view, but also considering its cost advantage over petrol. However, the refinery issue is still there and would (I expect) still be a deal breaker. Reluctant as I am to say it, my personal experience is that the ethanol industry requires a measure of Government support to start up. Having said that, I am convinced that a combination of domestic and overseas demand will ensure the medium- and long-term viability of the biomass fuel industry, and that Government support need not be a long-term proposition.

There are two main options for the form that the Government support could take. The bluntest instrument is to mandate the blending of locally produced biomass fuels into the transport fuel pool at a prescribed minimum percentage. This could start at, say, 2% as of January 2008 growing by 1% per year. As for the final level, I would be tempted to say that 10% should be achievable. At present price levels I believe this would be cost-neutral, even if the Government were to excise the biomass fuels similar to crude oil products.

A second instrument, which would be less dramatic but better suited to an environment where oil prices might drop back to previous levels (unlikely as that appears), would be to put a Renewable Energy Credit scheme in place similar to what was done in the power industry. In other words, unless fuel distributors obtain a prescribed percentage of their output from renewable sources, they would be financially penalised. In terms of the prescribed blending of biomass fuels this is the same as mandating. The difference is that there would be a positive incentive for fuel distributors to encourage a healthy and

competitive biomass fuels industry. As with the power industry, the financial penalties for under-utilisation of green fuel will set the average price for biomass fuels, and thereby the price of the biomass-component of transport fuels. Every fuel distributor will seek the cheapest biomass fuel supply so as to make a profit on that component of their product pool. This would encourage them to support competition in the biomass fuel industry, or even lead to them participating in that industry financially or through technical advice. However, in contrast to what is happening presently, they could not stop biomass fuel production on cost grounds. In other words, this measure would promote the early starters in the industry, as well as ensuring continued competition for better and cheaper products that would ensure the continued viability of the biomass fuel industry beyond the duration of the support scheme. This scheme, too, would not require an abolition of fuel excise on biomass, as this would be priced in to the penalties for failing to meet the prescribed level of renewable content.

The duration of a Renewable Energy Credit scheme must be sufficient to allow financing of the first tranche of biomass fuel plants. That would mean a minimum of some 10 years. By that time, the biomass fuel industry should be sufficiently entrenched to ensure its continued survival and should also be sufficiently competitive to no longer be solely reliant on the domestic market.

If one of the above two measures were to be adopted (and the Committee will understand I favour the Renewable Energy Credit scheme), I believe the other issues are can be managed and will fall into place.

Overall, I believe that biomass fuel in general and ethanol in particular can and must make a contribution to the Australian transport fuel pool.

I hope that the foregoing may contribute to the Committee's deliberations and look forward to the issue of the Committee's report in mid June. Should my letter require clarification, I would be pleased to assist further where I could.

Yours faithfully,

Lex Creemers