To: Senate Select Committee.
Fuel and energy inquiry

Submitted by: Bob Fozzard.

Executive Member, The Australian Institute of Agriculture Science & Technology, NSW Division.

Affiliate Member, The Chartered Institute of Purchasing and Supply [CIPS Australia]

Affiliate Member, Royal Aeronautical Society.

Address:

Phone:

E-mail: _____

In a world that continues to change dramatically, governments increasingly seek to accomplish their most vital goals by working with advanced technology companies from around the globe. Building and sustaining partnerships that achieve their objectives is a question of how. And it is the how that makes all the difference.

With the urgent and growing demand on the worlds limited food supplies the need for farmers to introduce more efficient production and processing methods has never been greater.

With the food / distance ratio becoming a major constraint on trade freight / fuel costs, on both inputs and outputs, which in most cases, indirectly or directly, the farmer bears, must be contained.

"ISSUES". [Phone 03 9500 0255.] in a recent Editorial said:

"When people in Australia and other developed countries talk about security they usually mean safety from terrorism, or financial security:

However, for millions of people around the world food security is a much bigger threat than war, and a healthy bank account is an impossible dream.

Food security is when people are not sure how they will meet their food needs because they cannot produce enough food themselves, or they do not have enough money to buy food, or the food they get does not nourish them enough.

C Ford Runge, and Benjamin Senauer in an article in Foreign Affairs, stated: “Filling the 25 –gallon tank of an SUV with pure ethanol requires 250 lb of [dried] corn- which contains enough calories to feed one person for a year”.

As they impact input costs at all levels the application of higher cost energy sources, and their flow on impact on food production costs, inflation rates, and future employment prospects must be seen as a critical part of any fuel and energy inquiry.

In their September 2007 report: -

“ **Bio-fuels: Is the cure worse then the disease**?”

Richard Doornbosch and Ronald Steenblik of the OECD’s Economic Co-operation and Development Secretariat informed the General Secretariat that:

“ It might be time for legislators to take a second look at bio-fuels, saying: “Their capacity to address fuel shortages is questionable”.

In summary the report suggests:

“Current policies are costly, and needlessly disrupting to agricultural markets without any promise that they will accomplish the goal of reducing energy dependence or cutting the environmental impact of today’s oil and gas”.

A major contributing to the increase in grain prices has been the increase in the cost of the producer’s inputs in particular freight and fertiliser costs. The latter being high-energy users.

Driven mainly by the US demand for ethanol feedstock, mainly corn, the price for phosphate rock has risen from $US50.00 per tonne at the start of last year [2007] to between $US 350 and $US 400.00 per tonne.

Fertiliser Industry Federation of Australia Executive Manager stated in the Andrew Norris item **“ Fertiliser price squeeze”** page 9 of the 10 th May 2007 issue of THE LAND that:

“ Increased demand for crops for bio-fuel production was forcing up world fertiliser prices, and in turn in the Australian market”.

The big drivers were bio-fuel giants, South and North America, and their impact would continue to pressure supplies while oil prices remained high. Continued high oil prices – which in turn pushed up fertiliser prices – was adding to the pressure to increase bio-fuel production. [Oil is required to produce hydrocarbon dependent fertilisers eg: mono-ammonium phosphates [MAP] and di-ammonium phosphates [DAP] – and urea.

In 26th October 2006 issue of “The Land” page

24 Allan Dick in his article **“Fuelling bio-diesel”** stated.

“CROP residues and timber waste rather than grain will have to provide the basis for a major fuel ethanol industry in NSW”

In response NSW Department of Primary INDUSTRIES director of Health Sciences, Strategic Alliances and Evaluation, Helen Scott-Orr made this very important statement:

“Harvesting crop residues for fuel may reduce stubble retention on paddocks and lead to environmental degradation, so the industry would have to think carefully about what system to adopt”

In the 28 / 29 April 2007 Sydney Morning Herald Bruno Waterfield item: “ Bio-fuel push will ravage habits, say “Eurocrats”. Bruno reported”.

“The European Commission [EC] has admitted that the objective, which aims to cut CO2 emissions, may have the unintended result of speeding up the depletion of tropical rainforests and peat-lands in South East Asia – increasing, not reducing, global warming”. The EC report continued: -

“Countries such as Indonesia [and Malaysia] have already began planning an increase in the production of palm oil, a development campaigners fear will see more rainforest fall to the axe and rare peat soil burnt”.

John Vidal in London wrote in the 10th May 2007 issue of The Australian Financial Review World page 21: “A UN report highlights the mixed benefits of the push towards bio-fuels.” In summing up the UN report Mr Visal said.

“ The global rush to switch from oil to energy that is derived from plants will drive deforestation, push small farmers off the land and lead to serious food shortages and increased poverty <u>unless carefully managed</u>.”

The United Nations report, compiled by “UN-Energy”, includes all 30 of the world organization’s agencies, and points to crops such as palm, maize, sugar cane, soy and jatropha.

Max Walsh in the keynote Business section of the April 2007 issue of The Bulletin stated:

“The US sees corn-based ethanol as the answer to its oil and greenhouse problems. The resulting agriculture revision could well fuel global recession”

From the above reports it is clear that with mandated bio-fuels content prices the raw materials eg corn, sugar or grain paid by ethanol producers for would need to exceed prices paid for the same products used in the food chain. The resulting higher liquid fuel and food prices must impact the Australian inflation rate and may well result in higher Reserve Bank interest charges. It is also clear that ethanol production from grain, using current technology, may in fact result in a net increase in greenhouse gas inputs.

The NSW Government by mandating ethanol use in petrol [10% in 2009] is placing a number of new and existing grain ethanol producers in a position where they may not be able to meet their legal responsibilities to their stakeholders, or indeed meet their social and environmental responsibilities.

In meeting Government mandated ethanol targets such at risk companies might well operate outside local and international treaties, standards and norms.

The recent move to create a multi- billion-dollar industry producing liquid transport fuels [GTL] from coal and gas offers hope of alternative local portable fuel sources.

The development of plants suitable for enriching the poor Australian soils may offer a long term solution to suppling feed stocks to a viable bio–fuel industry: - In Australia's north crops like "cassava", "mustard seed", and other plants have the great potential for development. Such crops can grow in poor soils, on marginal lands where other crops cannot. They require minimal fertilizers, pesticides and water. [In 2007 AIAST member and Sydney University lecturer Dr Daniel Tan Co

published a paper on oil-bearing plants suitable for growing in low rainfall marginal regions.]

A huge plus for Cassava grown in the high rainfall areas of Northern Australia, is that crops slated for ethanol production, may be diverted to meet unexpected world food shortages. [Cassava can be harvested anytime from 8 to 24 months after planting.]

If world food shortages are anticipated mature cassava may be left in the ground for up to 18 months before being processed into food products.

Sadly, despite its importance as a staple crop in many developing countries, cassava has been neglected in Australian agricultural development policies.

Other potential second generation bio fuel crops include the high yield [45.2 t/ha/year] salt tolerant Arundo donax. See “Pathways to Prosperity” pages 28 to 33 Australian Institute of Agricultural Science and Technology Technical Publication Vol 21 Number 1 Feb 2008 1/08.

Across Australia developments, including pelletising of surplus rangeland grasses and weeds in accessible areas, thus turning waste plant growth

into an energy source, would provide alternatives to regular greenhouse gas producing undergrowth burn-offs, and to costly weed control efforts.
Eg: Patterson's curse presently infests more than 33 million hectares of land in southern Australia".

Pelletising, or conversion of surplus grasses / weeds to a liquid fuel, would largely avoid the greenhouse gas producing "great northern burn-off". A proportion of the product may be processed into rich organic fertilisers, the product being available for enriching thin unproductive inland northern soils. Another example of a potential oil production source, again a source regarded by some as being of little value, is algae. A production method was recently described in a National Geographic article entitled:

GROWING FUEL The Wrong Way, The Right Way.

The article expressed high hopes for algae heated and fed by power plant exhaust. It stated: The process could soak up the power plants carbon dioxide emissions, while producing upwards of 5000 gallons of bio-diesel an acre each year. International trials are currently underway.

The Smorgon Group is currently planning trials of algae bioreactors at the Hazelwood power plant in Victoria.

When reviewing renewable fuel targets it should be noted that algae grows much faster than other plants. An alga thrives in a carbon dioxide rich stream of emissions. Algae have great benefits compared with other biofuel crops such at corn, sugar cane canola or palm oil. Algae produce far greater quantities of oil. It is claimed that algae to oil has the potential to produce around 100,000 litres of oil per hectare per year compared with canola or palm oil at between 1000 to 5000 litres per hectare per year. Reference: Rebecca Weisser, The Australian, 28 July 2008.

Working along similar lines, it is feasible to locate large areas of sealed hothouse's [Hydroponic and otherwise] adjacent to power stations:

The exhaust gasses from the power plants heating the houses, the growing of vegetables / fruit / sprouts / bamboo / algae absorbing greenhouse gases produced. Compressed Surplus greenhouse gas being transported for injection into old oil or gas fields, thus bringing some partly depleted fields back into production, albeit on a smaller scale. Such facilities would fit well with electronic power

plants located in colder climates. The generators waste heat providing certainty of food /oil production even during the coldest periods.

Linked fish / pig / rabbit etc production / growing and processing could be a bi-product of the plant production. Waste / surplus product could be converted into oil by such processes as, “The Thermal Conversion Process” [See pages 48 to 54 of COSMOS June / July 2006 issue]

If applied carbon capture and storage costs would come down, as a result of plant /algae absorption.

Without such absorption some 20 to 30 percent of a generators gross power output would be needed just to compress the surplus CO2.

Alternately biomass [surplus grasses /waste forest products] could be used as a primary energy source for electricity production, the output being utilised for hydrogen [A portable fuel] production via electrolysis.

Alternatively hydrogen could be extracted from the biomass by a gasification process. The latter technology needs further development. Reference: The Aeronautical Journal Volume 110 Number 1110 of August 2006.

Along similar lines: In the February 2008 issue of "Government News" page 39 the writer stated;

The CSIRO and Monash University have discovered a chemical process to produce a bio-fuel using green waste including waste paper and household garden clippings.

The team is quoted as saying:

"Bio-Crude Oil" has the potential to replace conventional crude oil as well as bio-fuels that are currently produced using plant crops like sugar and corn."

Reference Dr Stephen Loffler of CSIRO Forest Biosciences.

Should the CSIRO process be cost competitive it would open the way for the use of surplus grasses and forest undergrowth to be used in the process.

Last month [February 2008] British Energy Secretary John Hutton announced the construction of the world's biggest power station to be fuelled by wood chips. The 1 billion 350 MW power station in South Wales will source low grade timber

in the form of wood chips from forestry plantations in the US, Russia and the Ukraine.

When considering the use of fuels derived from plants it is essential that soil organic matter [humus] be preserved.

Humus is one of the most important ingredients for maintaining and improving soil fertility and productivity.

Humus is derived from the natural decomposition of plant and microbial matter over a prolonged period of time. Most Australian soils contain relatively low levels of humus.

Oil Extraction from Power Station Feed Coal is another area that is again being investigated.

Australia's reserves of coal are expected to last at least 100 years. See The Institution of Engineers Australia "Transactions" Vol . MC11, nos.1and 2

A huge plus for Australia is the huge local and nearby reserves of clean, green, natural gas. **Natural gas and coal seam gas are clearly the green friendly energy sources for the immediate future.**

Liquefied Natural Gas [LNG] is some 40 % cleaner burning than petrol. Incentives must be provided by Government to encourage the transport industry to make the change to LNG.

Both State and Federal Governments need to encourage the introduction of “Dual – Fuel” truck/ locomotive / industrial engines into transport and rural industries. World proven engines that may on starting operate on both natural gas [LNG] and diesel simultaneously switching to 100% LNG when operating temps are reached.

Researchers are currently testing ways to speed up methane production in naturally occurring “Geobioreactors” deep underground. They are also developing strains of microbes to inject into shale or spent coal and oil deposits to quickly produce clean burning natural gas.

Further research needs to be undertaken to study the use of water produced from coal-seam methane gas extraction. The process of extracting coal- seam methane gas from coal reserves produces as a by-product massive amounts of water. While it’s not potable water it may be treated so that it can be a substitute for water currently coming out of river systems. Renewable energy targets should unlock

technology that could provide real solutions to water shortages.

For their long-term survival, there are convincing ethical and environmental reasons why growers need to look for alternatives to growing grain for ethanol production. From research data provided by the UN, and others, the growing and processing of grain for ethanol production results in ethanol from grain being a net contributor to greenhouse gasses:

For this reason alone a very big question mark must hang over the need for Australia to join the bio-fuels rush.

On a positive note: Within the next 25 to 50 years low cost safe clean “Fusion” power will by available in time to replace the worlds dwindling coal and gas supplies.

Because of the unlimited supply of the raw material “Fusion Energy” must be regarded as a future renewable energy source.

The future availability of low cost electric power opens up the possibility that liquid hydrogen will be the portable fuel of future generations. See Dr Tim Jones [UK Atomic Energy Authority] talk reported page 10 of the Aerospace Professional.

From a technical point of view, it seems to be feasible to use hydrogen for aero gas turbines. The main changes comprise redesign of the combustion chamber and fuel control system, as well as the introduction of facilities to evaporate the hydrogen prior to its entry into the combustion chamber.

UAV ‘s powered by hydrogen fuel cells are already reported to have flown considerable distances. The aviation field contributes no more than three percent of greenhouse gas emissions:

Hydrogen use offers the possibility of a significantly reduced number of emission types, resulting in only H20 and NO emissions. All emissions containing carbon and sulphur are eliminated.

In the meantime: There is scope to improve the thermal efficiency of coal and gas fired power plants. Boiler efficiency can be improved by: -

The introduction of new ultra-super critical coal fired power plants. Such plants although expensive can provide 43-44 per cent levels of efficiency. The efficiency increase comes with the higher steam pressure generated. The temperature of the plasma, the source of the most intense heat reaches 1000C. Any move towards setting renewable fuel targets

must take into account the potential for such efficiency improvements.

Further improved boiler efficiency by using low melting point heat conductive metals, or even colloidal mixtures, [fine metal or other heat conductive powders mixed with high temp liquids] as a first stage in a two stage the water evaporation process.

In respect to the two stage process: It should be noted that in the late 1930's a US coal fired pilot plant using mercury as the initial heat absorbing medium proved that the two stage heating system for steam production was more thermally efficient. Safety issues, the war, and the resultant high demand for mercury put a hold such developments.

With much higher combustion chamber air intake pressures becoming available: With newly developed high temperature alloys / ceramics, also comes the possibility of further developing non-moving part plasma electronic power generators: Locally available LNG /natural gas or hydrogen would be the fuels of choice.

USSR research work indicates that electric power can be produced in the hypersonic engine [Scramjet type] exhaust. A magnetohydrodynamics [MHD]

electricity generator could be as much as 50% more efficient than a steam turbine Reference Dr Sarah White article page 22 New Scientist 3 July 1975.

[Queensland University Centre for Hypersonics, has routinely performed scramjet engine testing in shock tunnels since the early 1980's. See October 2007 of the Aeronautical Journal vol 111 No 1124]

Long-term projects such as those noted above would require much funding, funding difficult to obtain in the current short term planning regimes of both Government and business.

Government decision makers must take into account the potential for large efficiency improvements in the electricity production cycle.

The grave danger is that setting unrealistic renewable energy targets will act as a constraint on the development of less costly ways of achieving the same result.

In the short term greenhouse gas emissions may be greatly reduced by shifting road freight back onto rail, [One inter-modal container train can carry nearly 300 truck trailers] Queensland Rail has now launched a web site to promote the energy efficiency and carbon savings of rail. The GORAIL web site says that rail freight is 3 to 11 times more

energy efficient than road freight, depending in the task, and passenger rail is 2.4 to 9.7 times more energy efficient than other modes. GORAIL suggests that by changing their freight from road to rail freight customers could reduce their carbon footprint by up to 75%. See:

http://www.gorail.com.au/

With the rundown of the rural rail network,
[Four of 15 branch lines closed] and with Asciano [Pacific National] pulling the plug on carting grain [They state. “Due to rundown inefficient lines”.]
In NSW the transport of bulk grain by rail has become problematic. See front page plus Page 5. “The Land” 21st Feb 2008 issue.

Major carmakers appear to view electricity as the power source of the future. This view may well produce a fundamental shift in the energy debate. Eg The Toyota Prius, and The Volt.

The Volt, due in showrooms in 2010, can run on battery power alone for up to 64 kilometres. Using the on board small petrol / LNG powered generator the Volt has a driving range of 1000 kilometres.

Recharge may be from the power network, thus electricity charges, as they relate to such usage, must become part of any renewable fuel target scheme. Power companies and local councils need to be encouraged to provide public power outlets for recharge purposes: Every parking meter should include a power outlet.

The French [MDI] have recently developed a hi-tech vehicle the runs on compressed air: Air is stored at high pressure in built-in spiral wound carbon fibre air tanks. In the event of an accident the tanks are said to harmlessly split along their entire length. The five passenger OneCAT has a range of 800 km on one fill and can travel at 110kmh. The vehicle has a built in electric driven compressor. It takes just four hours for a recharge the OneCAT ‘s air tanks. Again electric power from the grid may be used to recharge the tanks.

On top of 70% reduction to fuel burn per passenger kilometre since the beginning of the jet age further efficiencies, up to 20%, may be achieved by better routing of aircraft, and by increasing co-operation [Capacity sharing] between airline companies.

In the December 2007 issue of AEROSPACE international Page 4 it was reported that Pratt and

Whitney have a geared turbo fan engine ready for testing. The new engine promises a 12% reduction in fuel burn, a 50% reduction in noise and emissions and a 40% reduction in maintenance cost.

For regional airlines already there is a strong move back to “fuel efficient” turboprop commuter aircraft. Eg the Dash 8 Q Series. See Aerospace International February 2008 issue Page 28 in which Richard Gardner looks at the remarkable resurgence in demand for turbo-prop powered aircraft.

In the long haul airfreight area an up to 30% reduction in the ratio of fuel burn to cargo weight carried may be achieved by introducing soon after take- off in-flight refuelling. [For perceived safety reasons in-flight refuelling may initially be limited to aircraft involved in long haul commercial freight operations.]

Lower fuel loads at takeoff would allow increased freight capacity: On some routes refuelling stops would be avoided.

Nigel Wilson Energy writer of the Australian reported in the 26 February 2008 issue page 24 BUSINESS that Australia last year spent 7.5

Billion on energy imports, more than it gained from selling oil, gas and coal exports. He said.

“The country has only about eight years of oil at current rates of extraction, but more than 100 years of gas and about 600 years of coal”.

We often forget that Australia also has geothermal power from hot rocks and largely untapped oil shale deposits.

Government and industry must acknowledge that, although a key part of the equation, fuel and energy is not the most pressing issue the world faces. **Food Security is the most pressing issue.**

Brian Hino reporting from New York in the Weekend Australian Financial Review 8/9 December 2007 stated in his articles “ Modified Seeds of Content”.

“In a speech at the annual in Decatur, Illinois Monsanto chief technologist Rob Fraley described the coming “step change in yield”. He said:

“In 1970 the average corn harvest yielded 70 bushels an acre. In 2006 the average yield was 150 bushels an acre. By 2030 Fraley predicts, yields will push 300 bushels an acre”.

Increasing rural grain, fruit and vegetable production rates, reducing inputs, including those of oil hungry fertilisers, chemical insecticides and herbicides, has the direct result of reducing greenhouse gas emissions.

Thus Australia must be part of the “Genomic Revolution” Refer article in October 2007 Australian Institute of Agricultural Science & Technology [AIAST] Weekly Alert Edition No 35. Entitled.

“OFFICAL LAUNGH OF GENOMIC SERIES –ADELAIDE”.

AIAST reported that at the Adelaide Conference Professor Maddocks said an ABARE analysis found no evidence from market risk from engaging in GM crop [Canola] production. As well it was reported that a recent grains industry review reinforced the industries position as being ready and able to deal effectively with product segregation in the market.

For further information re GM risks and rewards it is strongly recommended that readers study the Deborah Keith comment and analysis pages 17 and 18 of the 5 April 2008 issue of New Scientist. On the IAASTD draft report Deborah states: -

“Too often fears and prejudices over technology and business were treated as if they were fact”.