Submission No: 84

Foodcrops as Sources of Bio-Energy

Submission to the House of Representatives

Industry and Resources Committee

Committee Chairman: The Hon Geoff Prosser MP

Submitted by Ian J Fraser, MEng, BA, ARMIT (Met)

Executive Summary

This submission supports further development of Australia's bio-fuels industry, for three reasons:

1. primarily because of the positive outcomes for Australian rural communities
2. substitution of fossil fuel for use in transport
3. diversion of organic wastes from landfill.

The submission emphasises the following potentially major negative effects of diversion of food crops from cereal, edible oils and sugar markets to the bio-fuel market:

1. replacement of subsistence food production in developing nations by cash-cropping for fuel crops in large estate plantations
2. reduction of food-stocks, especially in self-sufficient countries, including Australia, from whose self-sufficiency, international food aid has traditionally been donated.

Because these negative effects are more likely to impact in developing nations than in Australia, the submission calls on the Federal Parliament to ensure that Australia uses her international influence to minimise the negative social effects of growing food crops for conversion to fuel.

The submission includes an argument against the use of rice as a fuel crop because of the large volume of water consumed in rice cropping. Given the scarcity of water in Australia, growing of rice for conversion to bio-fuel is not sustainable, and should not be further developed.

Contents

Introduction

On 7 June 2007, the House of Representatives Industry and Resources Committee (the Committee) announced that it would expand the terms of reference of its inquiry into development of Australia's non-fossil fuel energy industry to include examination of converting organic matter into energy.

The Committee is investigating the current position of the renewable energy industry and determining the prospects for economically viable electricity generation, storage and transmission, within each sector of the industry.

Limits on the use of fossil fuels

The present world dependence on oil, coal and natural gas is limited in scope on two counts.

Firstly, the estimated life of known reserves of these fossil fuels in 2005 varied from 43 years for oil to 212 years for coal, based on current and expected consumption patterns, as shown in Table 1.[1] The final column in Table 1 shows the reduced life of the reserves if production rates for 2005 are multiplied by 1.5, to allow for an increase in consumption, as nations like India and China expand their industrial production, an increase which is partially offset by reduced consumption in Europe, North America and Australasia, through application of conservation methods and reduction of domestic manufacturing.

FUEL	KNOWN RESERVES [MILLIONS OF METRIC TONNE]	ANNUAL PRODUCTION [MILLIONS OF METRIC TONNE]	LIFE OF KNOWN RESERVES [AT 2005 PROD'N RATE]	LIFE OF KNOWN RESERVES [AT 1.5 TIMES 2005 PRODUCT'N RATE]
Coal	501,172	2,369 3553.5	212	141
Oil	156,700	3,615 5422.5	43	29
Natural gas	158,198	2,292 3438	69	46

Table 1: Estimated Life of Known Fossil Fuel Reserves

Secondly, the continued use of fossil fuels is a major source of enhanced global warming which is now almost unanimously accepted among the scientific community as proven science. While there are natural sources of the so-called greenhouse gases, chief among them volcanic emissions and natural rotting of vegetation, anthropogenic greenhouse emissions, have significantly increased, especially since the industrial revolution. Deforestation and animal husbandry emit greenhouse gases, but the main contribution is through the use of fossil fuels, either directly, for example using coal as a chemical reductant in smelting iron, or indirectly by energy transformation – especially for transport and for the generation of electricity – for manufacturing, mining and commercial and domestic applications.

[1] http://www.earthtrends.wri.org/pdf library/data tables/en e4 2005.pdf

Carbon dioxide at 76%, and methane at 13%, together account for 89% of greenhouse gases and increase in the atmospheric concentration of these gases has been estimated at 30% for carbon dioxide and 50% for methane since 1750.[2]

For these reasons, it is timely that the Commonwealth conducts an enquiry to ascertain the options available for Australia to source the energy required for economic sustainability of the nation and, to the extent possible, the ongoing development of the nation in a sustainable manner.

Alternatives to fossil fuels

The alternatives to fossil fuels which can be used as sources of energy include hydroelectricity and nuclear power generation, both of which are proven, economically viable technologies for provision of base-load electrical power.

However, the current climatic conditions, together with the current social climate of environmental concern, preclude the expansion of hydroelectricity as an option for expansion in the near future. Indeed the continuing viability of both mainland and Tasmanian hydroelectric installations is under significant risk from the present drought conditions.[3]

Meanwhile the installation of nuclear power stations in Australia is not an option for the near future, again because of the social climate. The negative social perspective of nuclear power is supported by a large body of political opinion, and more significantly by the unresolved questions of security against misuse of nuclear material, waste management including the decommissioning of old reactors, and the total cost of nuclear power when all life cycle factors are included in the cost estimate.

Wind energy is increasingly accepted in Australia as a viable contributor to electricity grids, but not as a base-load source in the foreseeable future. Wind energy has been challenged on a life-cycle basis because of the energy consumed in constructing the turbines and towers which constitute a wind farm. However, despite the large energy cost in such construction, a large net energy gain is reliably expected during the service life of a wind-farm, its constituent turbines and other components.[4]

Wave energy is also a feasible technology for generating sufficient electricity for coastal use, but there seems to be little likelihood of being able to develop the technology to the extent that it becomes a base-load supplier for major coastal cities or to support electrical transmission away from the coast.

Geothermal energy has recently received positive press.[5,6] However, the likelihood of geothermal energy ever being any more than an additional supply for inland towns, mines and settlements is obviously limited by the need for copious quantities of water for steam generation from the hot rock deposits.

---

[2] Nick Hopwood and Jordan Cohen, Greenhouse Gases and Society, http://www.umich.edu/~gs265/society/greenhouse.hym

[3] Matthew Warren, Drought to force up bills for power, *The Australian*, May 05 2007

[4] Rodoula Tryfonidou, Hermann-Josef Wagner, Multi-megawatt wind turbines for off-shore use: aspects of Life Cycle Assessment, International Journal of Global Energy Issues 2004 – Vol. 21, No. 3 pp. 255 - 262

[5] Keith Orchison, Hot rocks promise 800 years' power, *The Weekend Australian*, March 25-25 2007

[6] Robin Bromby, Good things going for hot fractured rock, *The Weekend Australian*, June 9-10 2007

Apart from some use of geothermal water in Portland, Victoria, and hot rock exploration sites in Tasmania, significant formations of hot rocks have, so far, only been found in inland areas and they are not associated with reservoirs of hot water. The lack of large amounts of water remains perhaps the most recognised physical characteristic of inland Australia. Clearly, the energy consumed in transporting large quantities of water to the hot rock formations and recycling that water will have a significant negative impact on the net quantity of energy to be generated from such geothermal sources.

Solar power is widely used as a subsidiary form of electricity generation, especially through the use of photo-voltaic cells. As well as providing a partial substitution for diesel generation of power in some inland settlements,[7] it is now commonly used throughout Australia in road-works signage and, in a few locations, street lighting. Additionally, the direct use of solar power in roof-top hot water systems, now ubiquitous in the warmer Australian towns and cities, is an excellent example of replacement of fossil fuel by solar power in industry, commerce and the family home.

The use of organic materials as a source of energy, bio-energy, is discussed in the following section.

[7] Australian Greenhouse Office, www.greenhouse.gov.au/renewable/recp/pv/eight.html

Bio-Energy as an Alternative to Fossil Fuels

Various organic materials, or biomass, may be used to generate energy, including agricultural crops, forestry and food industry residues, municipal solid wastes, and residues from the agricultural industry. Generally, these organic materials are used to produce either ethanol or bio-diesel, either of which can be used as a fuel to provide motive power for transport or, in the case of bio-diesel, for (diesel) electricity generators.

In Australia, ethanol is produced by the fermentation of molasses from sugar cane, or from grains – mainly wheat, with smaller quantities of sorghum and rice. While the "virtual export of Australian water" as rice for food can perhaps be justified as a necessary complement to domestically produced rice in several Asian countries, the consumption of large quantities of water in this dry continent to produce bio-fuel is not sustainable, and should not be further developed.

Biodiesel is produced by transesterification of the natural fats in vegetable oils, mainly canola or palm oil, with methanol. Animal fats as tallow may be used as an alternative to vegetable oils.

Potential social effects of the bio-fuel industry

Rural employment

The positive economic effect of production of bio-fuels is the development of employment opportunities in the processing plants, which are established mainly in rural areas. The industry is distributed in several states, notably Queensland, New South Wales and Western Australia.

Internationally, a similar claim has been made for the bio-fuels industry in both developed and developing nations. Biofuels are said to have increased incomes for rural communities in both USA and Brazil.

> In labour intensive Brazil, the ethanol industry alone supports close to 1 million jobs, and in the US, close to 200,000 jobs in rural American communities.
>
> and
>
> ...farmers and agricultural cooperatives in the US own or operate close to 40% of operating ethanol plants in America.[8]

[8] http://www.grdc.com.au/growers/res upd/south/s06/gordon.pdf

Replacement of food crops by cash-crops for bio-fuel

Against these positive effects of the bio-fuel industry, there is the long-standing history of disadvantage caused by replacement of subsistence-level food-cropping with cash-crops for export, and the resultant deterioration in nutrition for rural societies, especially in developing nations.[9,10]

However, in a reference from the United Nations University, a study from Papua-New Guinea presents statistics which show positive nutritional outcomes following the introduction of cash-cropping in various areas of both the mainland and surrounding islands.[11]

This variation from the previously observed negative outcome is probably a result of the employment of approximately eight times more people in cash-cropping on small holdings than on estate plantations of the same cash crop, and continuation of food cropping by the small landholders. The statistics collected in the study show that less than half the food consumed in the communities studied is purchased, with most food still produced in the traditional community gardens. Meanwhile income generated by sale of cash crops enables the purchase of foodstuffs not otherwise available, mainly rice, tinned fish and tinned meat.

It can be concluded that the growth of a bio-fuels industry based on cash-cropping of food-grains and sugar-cane will not necessarily lead to nutritional disadvantage in the rural areas of developing nations. However, because of the economies of scale, large scale estate plantations will remain the favoured approach for cash-cropping in countries with suitable terrain.

If the difference between nutritional advantage and nutritional disadvantage is, at base, the difference between cash-cropping on small holdings and cash-cropping on estate plantations, then there remains a real risk of net disadvantage in the introduction of yet another cash crop – food grains for conversion to bio-fuel.

Australian contribution of food in disaster relief

A potential loss in development of the bio-fuel industry in Australia is some reduction of Australia's ability to respond to international disaster relief by contribution of grain foods. If 20 – 25% of food crops are diverted to energy production, then the level of food stock is effectively reduced by the same quantity.

Economically, Australia may not lose, depending on the value of grain crops for energy compared with the value of the same crops for human consumption. However, international communities who suffer food shortages caused by either natural disasters or long-term man-made interruptions to local food production will be the losers. A secondary effect would be the diminishing of Australia's international standing as a donor of emergency food aid.

---

[9] Connel J. Migration, employment and development in the South Pacific. Country Report no. 14 Noumea, New Caledonia: South Pacidic Commission, 1985.

[10] Kahn, M., Sexton, L. The fresh and the canned: food choices in the Pacific. Food and Foodways 1983, 3: 118.

[11] Peter F. Heywood and Robin L. Hide, Nutritional effects of export-crop production in Papua New Guinea: A review of the evidence, www.unu.edu/unupress/food/8fl53e/8F153EOk.htm

Australia's Role in the Bio-fuels Industry

International

As a significant primary producer, both in fossil fuels – coal, and bio-fuel crops – wheat, sugar and canola, Australia is in a position to influence the bio-fuel industry at the international level.

While it is legitimate, indeed necessary, that Australia uses that influence for her economic benefit, it is also necessary that Australia uses her influence to minimise the negative social effects of growing food crops for conversion to fuel. The following two potentially major negative effects are discussed above:

1. replacement of subsistence food production by cash-cropping for fuel crops in large estate plantations
2. reduction of food-stocks, especially in self-sufficient countries like Australia from whose self-sufficiency, international food aid has traditionally been donated.

Domestic

The bio-fuels industry plays an increasingly significant role in the substitution of fossil fuels in the Australian economy. Both in the form of ethanol for blending with petrol and as bio-diesel for automotive use, bio-fuels are particularly significant as fuel substitutes in the transport industry.

While much of the social and political commentary, the scientific research and commercial development is pitched towards fossil fuel substitution in stationary energy-intensive industries including electricity generation, mining and manufacturing, none of those industries could survive without large-scale use of automotive fuel. Substitution of fossil fuels in transport applications is critical for the reduced carbon economy of Australia's future.

The advantages of bio-fuels for rural communities in Australia have been discussed above. As well as providing a second market outlet for crop producers, bio-fuel processing plants provide employment in rural areas, which, generally speaking, have notably higher unemployment statistics than urban areas.

While the generation of bio-fuels from waste products has not been discussed above, the diversion of organic wastes from landfill remains a significant objective for the waste management industry throughout Australia. The production of compost contributes to sustainability of the Australian horticultural industry, and wastes from food processing can be diverted to use as animal feed, particularly in the intensive farming of poultry and pigs.

However, large volumes of organic wastes are still disposed of to landfill. The combined effect of strong social opposition to establishment of landfill sites in both urban and rural municipalities and the potential market value of re-processing as bio-fuels provide a beneficial alternative method of disposal. Generation of bio-fuel from organic wastes has the added advantage of producing bio-fuel without diverting food crops from provision of food for people in this chronically under-nourished world.

Bibliography

Australian Greenhouse Office, www.greenhouse.gov.au/renewable/recp/pv/eight.html

Connel J. Migration, employment and development in the South Pacific. Country Report no. 14 Noumea, New Caledonia: South Pacidic Commission, 1985.

Kahn, M., Sexton, L. The fresh and the canned: food choices in the Pacific. Food and Foodways 1983, 3: 118.

Keith Orchison, Hot rocks promise 800 years' power, *The Weekend Australian*, March 25-25 2007

Matthew Warren, Drought to force up bills for power, *The Australian*, May 05 2007

Nick Hopwood and Jordan Cohen, Greenhouse Gases and Society, http://www.umich.edu/~gs265/society/greenhouse.hym

Peter F. Heywood and Robin L. Hide, Nutritional effects of export-crop production in Papua New Guinea: A review of the evidence, www.unu.edu/unupress/food/8fl53e/8F153EOk.htm

Robin Bromby, Good things going for hot fractured rock, *The Weekend Australian*, June 9-10 2007

Rodoula Tryfonidou, Hermann-Josef Wagner, Multi-megawatt wind turbines for off-shore use: aspects of Life Cycle Assessment, International Journal of Global Energy Issues 2004 – Vol. 21, No. 3 pp. 255 – 262

http://www.earthtrends.wri.org/pdf library/data tables/en e4 2005.pdf

http://www.grdc.com.au/growers/res upd/south/s06/gordon.pdf