Biofuel Mania[1]

Bill Malcolm

School of Agriculture and Food Systems, Faculty of Land and Food Resources, University of Melbourne

Paper presented to Sheepvention, Hamilton, August, 2007

Against a backdrop of concern about the natural environment and renewed worrying over world energy supply, governments around the world are diverting resources into investment into biofuels as a source of energy. This has potential implications for the Australian economy and the agricultural economy, and beyond.

Investment commits capital now to reap rewards in the future. The future awaiting the invested capital cannot be known. Some of the possible futures awaiting invested capital can be imagined. When imagining the future it is helpful to draw on what is known. Theory and principles explaining the behaviour of what is known are a help also.

The causes and effects that derive from established theory about how parts of the world work represent the best explanation we have at this time – with good research and tough testing, new knowledge is established and theory evolves. This approach is better than making up your own theories about science or economics, based on some particular set of personal experience, or simply seeing phenomena through the prism of private interest. Such approaches are no less fraught for being increasingly common approaches. In the following discussion, principles of economics are applied to questions about the implications of investing public and private resources in biofuel production in Australia.

To draw conclusions about 'what could be' for biofuels from an economic perspective, information about the future of biofuels in Australia is drawn from research from the ABARE, views presented to the ABARE by experts from science, the fuels industry and business; a series of research reports recently commissioned by and reported in the Australian Farm Journal; and research of the RIRDC and the CSIRO. As well, some views from management of businesses that are investing in biofuels around the world are canvassed.

These sources are considered, substantial analyses, central to the question. As always with issues involving the environment and the economy, at the periphery of this debate are purveyors of an impressive collection of fallacies and shibboleths: self-sufficiency and protectionism, environmental fundamentalism, regionalism, agrarian socialism, northern developmentism, business opportunism and self interest. There is no shortage of this type of commentary. The 'ism' most notably missing from much debate is economic rationalism.

Next some brief background to the current biofuel situation is given.

Biofuels

Under pressure about the state of the natural environment and with oil prices that are higher in real terms than has been experienced in recent times, and with the concept of sustainability as the rationale for a wide range of actions, governments around the world have readily recognized the popularity of supporting the development of biofuels industries. The economic merit of producing biofuels does not seem to have much to do with it at this stage. For what it is worth, the economics of biofuel production is determined by:

- World energy prices - particularly oil prices
- Costs of production, which depends on cost of biomass feedstock and extraction rates. Feedstock represents 60-70 per cent of total cost typically.
- And, at present and for the foreseeable future, the size of the support via protection and subsidy from the public, as taxpayers or as consumers.

In Brazil the ethanol industry dates from the 1970s. Fuel is mandated to include 25 per cent ethanol; most of the car fleet is adapted to ethanol-based fuel; the ethanol derives from sugar cane; and the ethanol can be produced for a cost that is competitive with oil at around $40 per barrel.

The US has set the legal target that ethanol use in the economy should increase from 5 bn to 7.5 bn gallons by 2012. Corn is the basis of US ethanol production. If all the current US corn harvest went into ethanol, this would produce 7 per cent of the US total fuel requirement. The EU has set a voluntary target of 5.75 per cent biofuel use in total fuel by 2010. The UK has mandated a 5 per cent component of biofuels in total fuel.

In Australia, biofuels account for a tiny proportion of total fuels used: 41 million litres of fuel ethanol and 16 million litres of biodiesel were produced and consumed in 2005/06 (ABARE). Total petrol consumption was 19,050 million litres and 15,880 million litres of diesel were used. In the 2001 federal election, the Federal government committed Australia to supplying around one per cent of total fuel as ethanol per year by 2010. The target is 380 million litres of ethanol per year by 2010. Following the 2001 Federal election commitment that 5 per cent of Australian fuel should be ethanol, a shipload of relatively inexpensive ethanol from Brazil appeared in Australian offshore waters. True to form, the Federal government turned it away. No foreign biofuels will be allowed to enter Australia.

Current capacity to process ethanol in Australia is 140 m litres and 323 m litres of biodeisel. The ABARE (2007) reports that there are existing and planned ethanol production plants around Australia with the total capacity of 1100 million litres. The ABARE (2007) says that the grain based processing facilities would require up to 2.5 million tonnes of sorghum or wheat a year by 2012. Four new biodiesel plants were commissioned in 2006, with others planned (ABARE 2007). ABARE reports that the Australian Biodiesel Groups Total capacity in Australia for biodiesel production is around 1100 million litres per year. These plants can use oilseed such as canola, palm oil, tallow or recycled cooking oil. These plants would require 800,000 tonnes of feedstock per year. On average Australia has around 500,000 tonnes of tallow (most currently exported) and 50,000 tonnes of used vegetable oil available. Though ethanol costs around $65/barrel equivalent to produce (ABARE), the ABARE conclude that given the current levels of subsidy, Australian production of ethanol and biodiesel will increase over the next few years.

In Australia production of fuel ethanol and biodiesel is encouraged by a subsidy of 38.143c/litre on biofuels. This is to reduce to 10c/litre real by 2016. These rates represent a 50 per cent discount on the excise duties on petrol and diesel (ATO 2006). Further public support comes from $37.6m Biofuels Capital Grants Program that was granted to seven companies, at a rate of 16c/litre for new or expanded projects producing a minimum of 5 million litres a year (ABARE 2007). In 2006 a $17.2m Ethanol Distribution Program was aimed at assisting service station operators to upgrade equipment and sell more petrol that contained ethanol. There is also a Renewable Energy Development Initiative that is a $100 m grants program that supports innovation and early stage commercialization of renewable energy sources. Added to this, each state is getting in on the act, providing a range of smaller subsidies to encourage biofuel production.

Economic criteria for judging investing in potential new production activities, from the perspective of the national good.

Having the technical capacity to transform biomass into fuels is a necessary condition for an economic biofuel industry, but alone this it is not sufficient. To serve the national good, biofuel production as a business activity has to be profitable, with neutral or net positive spillover effects.

A nation's people are made as well off as can be with the resources at their disposal when the extra private and public benefit to society from using those resources and producing an extra unit of output just exceeds the extra private and public cost of using those resources in that use; and earns a return as good as any other use in the economy. These are the concepts of opportunity cost and equi-marginal returns.

A closely related principle that plays a big role in determining whether or not some form of production should happen in an economy is called the principle of comparative advantage. This principle holds that the people of a region or nation are best off when each producer in each region or nation do what they are relatively best at doing; or, if not able to be relatively better at something, do what they are relatively 'least bad' at doing.

To clarify: Producer A might have the resources to produce products Y and Z. Producer A might be able to do both these things better than Producer B. He has an absolute advantage in both activities. Does this mean Producer A makes both products Y and Z, and Producer B does nothing at all? No.

Suppose Producer A is better than Producer B at making product Y by a lot, and is better than producer B at making product Z by only a little. The principle of comparative advantage dictates that both producers are best off if Producer` A does what they are *relatively better at* (Product Y) and producer B does what they are relatively '*least bad at*' (product z). Then they trade.

Producer A gets the product Z they require from Producer B cheaper than if they made it themselves. Producer B gets the product Y they require from producer A cheaper than if they made it themselves. More of both products is made from the total available resources. The result is that both producers obtain the mix of products Y and Z they require *at a cheaper cost than if they each made their own mix of products Y and Z*.

Specializing in what each business is relatively best at, and trading, is the basis of improving the lot of the growing population of the world. Interfere with the application of this principle, and the outlook for the lot of humanity becomes bleaker. This principle of comparative advantage is the central principle of economics that serves the interest of nations and regions by determining what should happen where in the world.

The tests of economic efficiency are (i) whether a good or service is provided to consumers at a price that would enable it to sell in competition with other sellers of the same product, and (ii) the producer earns a return on capital that is commensurate with other uses of capital in the economy, and (iii) if private benefits of production exceed private costs and is profitable, and whether the combination of private and public benefits exceed private and public costs. At present, biofuels fails the test of whether private benefits exceed private costs, while the public benefits are not defined, though substantial public costs are being incurred.

Discussion

All up, there is underway worldwide a massive diversion of resources into new capacity to produce biofuels in the future. Most of this investment is the result of governments around the world deciding they have to 'do something for sustainability and the environment'. So, the decision is made that their economies have to produce and use ethanol, even though it is not economic to do so. The decision to force biofuels into the economy via subsidizing its production is justified in terms of biofuels (i) helping to reduce the effects of a market failure that results in the wrong amount of vehicle pollution, (ii) replacing a non-renewable source of energy with a renewable source, which is considered meritorious regardless of cost; and (iii) notions of energy self-sufficiency.

From an economic perspective the concern is that it is not clear that this is an effective or best way to achieve goal (i), nor that goals (ii) and (iii) are sensible. Further, subsidizing biofuels to force this business activity into the economy, despite the economics, causes many other 'spillover' effects on innocent bystanders. It incurs an opportunity cost by reallocating resources away from uses that would make people better off to ways that make people worse off, and introduces a whole new set of distortions with the potential to affect adversely standards of living of people. Applying notions of 'sustainability' that are bereft of an economic dimension does not further the aims of sustaining society.

The appealing populist position seems to be that if enough public costs are incurred subsidizing ethanol, eventually private benefits plus public benefits may exceed private costs and public costs. Meanwhile, with a given world supply of feed grains, and substitutability between feed grains for livestock production, the significant investment in ethanol production capacity around the world, and particularly in the US, represents an increase in demand for the ethanol biomass grains wheat, corn and oilseeds. In the short term this will increase the price of these grains, and increase the profitability of producing these grains. This will increase the value of assets used in producing the now more profitable grains. At the same time, consumers of food from grain will have less access to this food source; there will be less available at higher price. Livestock will be disadvantaged by higher cost feed inputs, even allowing for the possibility of some increase in feed by-products from biofuel processing.

A View From Abroad

A couple of recent articles from the Financial Times in London give an interesting insight into views of the situation in the UK.

Investors gambling on the promise of biofuels (by Andrew Hill, Financial Times 27/6/07)

> If cars running on biofuels performed as erratically as investments in the sector, you could expect a very bumpy ride.. Yesterday Associated British Foods and BP announced that they and Du Pont of the US would build a new biofuel plant in the UK, earning a warmish welcome from investors. Meanwhile, heavily indebted Biofuels Corporation heralded its disappearance from the public markets, with the publication of plans to restructure and delist.
>
> Biofuels fate is in part a cautionary tale about the perils of early adoption in a technology – biodiesel in this case- with uncertain potential, in part an old-fashioned saga of commercial mistakes and mishaps. But, above all, it is a story about the triumph of investors hope over experience.

BP gets into position for the biofuels era (by Ed Crooks, Energy Editor, Financial Times 27/6/06.)

> The downfall of Biofuels Corporation will have come as no surprise to Phillip New, the president of BP's global biofuels business.
>
> Speaking at yesterday's launch of a new $200m ethanol plant in Hull, Mr New rejected the idea that BP would similarly expand into biodiesel.
>
> 'Esterification (the process of making biodiesel from vegetable oil) is relatively basic chemistry with low barriers to entry' he said.
>
> 'And our conclusion in investment decisions is that this is a market that either is, or shortly will be, oversupplied with production capacity.
>
> Yet the launch shows that BP is prepared to invest in the other 'first generation' biofuel – ethanol- which, like biodiesel, is produced by a reasonably simple process, and has also been criticized for having high costs and questionable environmental benefits.
>
> For a company of BP's size, its share of the plant at Saltend in Hull – about $90m – almost counts as petty cash. But it is an important move in the oil company's strategic repositioning to prepare for a world in which biofuels will provide a significant proportion of road fuels.
>
> As with biodiesel, the economics of ethanol production are fragile. Prices for wheat and other grains have been rising, under pressure from poor harvests and demand from the food industry, as well as expectations of rising demand from biofuel producers. Margins in the ethanol industry have been squeezed.
>
> BP admits the project as it stands is uneconomic without government help, even with oil at $70 a barrel.
>
> 'Without the regulatory environment, no company would be able to compete at current prices and the industry would not exist, says Mr. New…..
>
> But Mr. New insists government incentives were not the reason why BP and its partners were making the investment. The Saltend plant is to be a 'platform for new technology' and support an alliance that the groups hoped would lead to further biofuels developments….
>
> However, BP's approach contrasts sharply with that of Royal Dutch Shell, which has stayed out of the business of producing first-generation biofuels.
>
> Rob Routs, Shells executive director for downstream, said this week: 'We don't believe the current situation is sustainable, because if agricultural land is being picked up for fuel

> production, sooner or later there is going to be a clash. And as a fuel company, we don't want to get involved in that'.
>
> Shell's effort is going into 'second generation' biofuels: a diesel fuel made from wood chips and ethanol made from straw. BP is researching this second generation too: its work seems less advanced, by no one has yet made a commercial breakthrough.

An alternative future can be imagined. Imagining it starts by recognizing that biofuels are not economic with current technology and prices of oil less than $50-70 US (ABARE, BP) and the usual livestock feed prices. Then the possibility can imagined that the end of the role of oil as an energy resource will not happen because we have run out of oil. Instead, present and potential oil and other energy supplies including biofuels are such that they will eventually become a resource of little value as new energy technologies make them too expensive and redundant as an economic source of energy. It is a good bet that cheaper energy alternatives will develop long before we run out of supplies of oil and gas.

World population is expected to grow over the next 40 years by 3.5 bn to 9.5 bn from 6 bn currently. Hitherto, world grain supply has grown faster than demand, and the world food problem has been in reality a world income problem. Hence, 800 m people go hungry daily because they are too poor to buy food. In future, increases in productivity in feedgrains will be required to supply affordable grain to feed the markedly increased population. The prospects for feeding the larger population are best if market signals about world food supply and demand are **not** distorted by government interventions that attract resources out of food production and into biofuel production *when this would not otherwise happen.* In the meantime, the worlds poor and hungry will be poorer and hungrier.

Increasing world grain output sufficient to meet the looming extra food demand and at the same time increasing grain supply sufficient to bring prices down far enough to enable unsubsidized biofuels to be profitable, will be a tough task in the short term. As it happens, subsidized demand for feedgrains for biofuel will increase feedgrain prices and cropland values in the short term, making the prospects of profits in biofuels more not less remote in the short term.

The notion that biofuels will usher in a permanent boom in grain production is equally misplaced. If real prices of grains of all varieties rise, in the medium term world supply of grain will increase as resources move out of less profitable forms of production and into the relatively more profitable grain production. Research to further increase productivity too follows the money.

For wheat, the supply response is highly geared. Around 80 per cent of wheat is consumed in the country in which it is grown. The wheat trade is a residual trade. Of over 600m tonnes of wheat usually grown each year, around 20 per cent enters world trade. This means a 20 per cent increase in world supply effectively doubles the supply of grain in world trade and prices fall. This causes traded wheat prices to be highly volatile. Australian wheatgrowers typically export 80 per cent of their production. They are always on the receiving end of this volatility.

The biofuels question brings overlap of a rich collection of interests; namely, environment, self sufficiency in energy, regional development and, as ever, develop the inland and the northern country. Enthusiasts in the latter group see vast areas of relatively cheap land, some of which could grow crops suited to biomass for biofuel. This may be correct in a technical sense. Caution is warranted. Enthusiasts would do well to acquaint themselves with Bruce Davidson's work on northern development as a first step. Some of the many technical and economic factors that have constrained cropping in the inland and northern Australia in the past, such as transport costs of high volume, low value materials, will continue to apply in the future[2]. Advice here is to treat the inland/northern boom scenarios based on new biofuel feedstocks with great care, and keep your hand out of the taxpayers pockets.

It is worth making the point also that taxpayers and consumers will pay one way or another, if we insist on forcing home grown ethanol down our bowsers. The choice is paying via taxes to subsidize private ethanol production and/or paying more for products that use feedgrains to produce foods. These extra taxes or higher expenditures on consumption have an opportunity cost. The money would be better used in other ways, for example, on measures that might better contribute to goals of reducing pollution than going down the ethanol route.

The infant industry argument that is being deployed often to justify the public subsidizing the financial survival of private biofuel firms and protecting them from more efficient competition has never had a lot of support in economic circles, mainly because of the abundant evidence that firms that start off with protection

and taxpayer or consumer subsidies grow up very slowly, if ever. In the biofuels case, when the technical breakthroughs in ethanol production come, the technology is internationally transferable.

There are many people with a scientific orientation to their view of the world who subscribe to the (flawed) concept of 'energy theory of value' or 'energy budgeting'. Ethanol also might disappoint on this score, though this is a subject of debate. Anyway, it does not matter as this type of analysis is nonsense (like its relatives, carbon footprints, food miles, now fuel miles). In judging uses of resources, what matters to the welfare of people is the value people put on the cost of resources used, the value people place on the output that results and the difference between these two values –the difference in physical quantities of energy, or any physical other inputs involved in the process, is neither here nor there. It is dollars not joules that should be counted (Edwards 1977).

An important dimension to the current conventional wisdom, is that technical specialists and business analysts agree that the prospect of a profitable biofuel industry in Australia based on current or 'first generation' technology is remote, without public subsidy. Few pretend otherwise. The hope of the side instead is second generation technology. People who understand the technical aspects of biofuel production are confident that somewhere down the track the combination of better technology and new non-food sources of feedstocks for biomass will reduce the cost of producing ethanol and it will become an efficient use of resources.This is one possible future, and it may well eventuate in some countries. Even so, for biofuel to be an economic proposition it requires that the other half of the equation – oil prices- stay at historically high levels. Or, other, better technologies do not overtake biofuels. With biofuels being the marginal proposition they are at present, this seems problematic.

Biofuel Research

There is potential reward and private interest in developing new techniques for extracting more from biofuel feedstocks and for developing new forms of feedstocks. From the viewpoint of potential agricultural producers of biofuel feedstocks, the public good case for public support of research of agricultural production in general is strong. This case is also valid for research into beefing up existing biofuel feedstock sources as well as finding potential new sources. There would be social under-investment by agricultural producers in these areas without public investment in this type of research.

Conclusion

From an economic perspective, the current fashion for biofuels to help achieve something towards something called 'sustainability' seems ill-judged. At some point, economic sustainability becomes relevant. At present, unless heavily subsidized, biofuels only make economic sense if the feedstocks cost little and oil costs a lot. The prospects of achieving much towards the goals of reducing carbon-related pollution need to be established to justify a market failure/public benefit argument. Goals of replacing a cheaper energy source with a more expensive energy source in the name of self sufficiency makes no economic sense. The merit of 'renewability' of a resource to replace a resource in plentiful supply until technology makes it passé, is also dubious.

At current high levels of oil prices and typical feed grain prices, ethanol production in Australia and around the world does not make a profit unless taxpayers and consumers subsidize it. Economically struggling bio-diesel firms suggest profit-making in bio-diesel production too is a hard row to hoe. At present, putting resources to producing biofuels violates principles of economy-wide economic efficiency and the operation of the principal of comparative advantage. This may not always be so for all places for all time. What is economically efficient and what makes up 'comparative advantage' changes as economic conditions change and new technology arrives. Even then, if and when biofuels become a potentially competitive source of energy somewhere, Australian consumers of fuel energy should obtain it as cheaply as possible,

This could well involve managers of resources in Australia continuing to do what they are relatively better at, and buying ethanol from producers in other countries who can make it more cheaply than it can be done in Australia, i.e. who have a comparative advantage in biofuel production. That test would have to be passed when the time comes.

Banking on boom conditions in agricultural commodity production, or anything for that matter, to be sustained beyond the short term defies centuries of empirical evidence that as soon as they can, rational producers respond accordingly and supply increases rapidly. The short term good times soon end. The best operators have an eye to the main chance and exploit these opportunities as they arise whilst at the same

time recognizing the folly of thinking ‘good times are here to stay’ and ‘if things are good they can only get better’. Recognizing that if things are good they can only get worse, is prudent in farming.

This mania for biofuels might yet prove to be one more example, from many in Australia’s mixed economic history, of mercantilist interests masquerading as the national interest, and politics temporarily winning over economics. History is littered with plenty of examples of politics overwhelming economic sense, for a while at least. Fashions change, subsidies dry up, firms go bust. Economics wins, eventually.

References

ABARE, Australian Commodities, March, 2007.

ABARE, Australian Commodities,December, 2006.

ABARE (various)

Edwards, G. Energy Budgeting: Joules or Dollars, *Australian Journal of Agricultural Economics*, 20:3, 1976.

Financial Times, July 27, 2007

Farm Policy Journal, Australian Farm Institute, May 2007

CSIRO, BYTR and ABARE Appropriateness of a 350 ML Biofuels Target, Report to the Department of Industry, Tourism and Resources, Canberra, 2003.

RIRDC, Biofuels in Australia_ Issues and prospects, June 2007

Short, C. and Riwoe, D. Biofuels: An assessment of their viability, ABARE report, Canberra.

[1] Mania defined in Oxford English Dictionary as ‘Mental derangement characterized by excitement; a period of excitement affecting a body of persons’.

[2] Alistair Watson makes the salient point that in Australia, highly variable yields, and transport costs, could increase production costs markedly. And, if it were on average profitable, ethanol plants would best be placed in Australian cities -viz. near grain terminals to spread the risks of regional crop shortfalls.