

ETHANOL – A CREDIBLE DIVERSIFICATION OPPORTUNITY FOR NON-METROPOLITAN REGIONS OF AUSTRALIA OR NOT?

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ABSTRACT: Interest in ethanol production is rising rapidly throughout the world as countries strive to address the declining stock of fossil fuels, pollution problems and meet their obligations under the Kyoto protocol. While ethanol provides a clean and green option as a fuel extender, within Australia the debate over the investment in ethanol is still evolving. With declining gross margins in our grains and sugar industries and the case for a renewable transport fuel energy gaining greater acceptance internationally there exists a significant opportunity to consider ethanol as a import replacement option, a value added activity for Australian produce and a significant chance to diversify the economic base of the non-metropolitan regions of Australia. This paper explores the ethanol industry in terms of its ability to provide a real diversification opportunity for the non-metropolitan regions of Australia. It is argued that there is clear evidence to suggest that, with the right policy framework, potential exists to develop this new industry, build smart and sustainable jobs as well as provide a credible diversification opportunity for the non-metropolitan regions of Australia.

1. INTRODUCTION

As a fuel, ethanol has been around for many years. The interest in ethanol can be dated back to when Henry Ford first designed the Model T Ford. Henry Ford's expectation was that ethanol would be the major transport fuel. However with the discovery of major oil fields and the ability to use lower compression engines, petroleum dominated as the transport fuel for the remainder of the last century (Canadian Renewable Fuel Association).

Gasoline however has many disadvantages when compared with ethanol including toxic emissions (particularly when blended with tetra-ethyl lead), air pollutants (particulates, GHG etc) and residues, and is more likely to accidentally explode. With limited understanding of the scale or impact of these environmental flaws, fuels made from petroleum dominated for two reasons (a) cost of travel relative to fuel cost and (b) the subsequent large investments made by the auto industry in capital and technology (Australian Ethanol Limited).

Between the emerging environmental concerns and geologists forecasting that the world will run into problems of oil scarcity within the next 10 to 20 years, the interest in cleaner renewable fuels has been reignited. Unlike fossil fuels that have a finite supply and a wide range of environmental problems, ethanol is a valuable renewable resource-based fuel, capable of being produced sustainably in increased volumes world wide with limited environmental impacts (Australian Ethanol Limited).

Hence this growing interest in renewable sources of energy such as ethanol

may provide an opportunity for new industries in rural areas. This is a significant point as like many regions throughout the world, rural and regional Australia is losing vitality. For many decades Australia has ridden on the economy of the rural sector. However with diversification of the Australian economy in the global market and the declining terms of trade for most agricultural commodities, the importance and value of the rural sector has declined (Cocklin and Alston, 2003). With global competition, variable climatic conditions, land degradation and falling commodity values the rural economy now accounts for less than 10% of Australia's GDP (ABS 2004).

Rural sector decline and rural reconstruction in Australia is a significant issue and is at the forefront of minds of the three tiers of Government (Sorenson, 2000). For many non-metropolitan regions of Australia, one of the major problems facing a number of small communities is their reliance on a single traditional industry. This reliance on a single industry exposes them to the vagaries of global price fluctuations which are beyond their control (Gray and Lawrence, 2001).

The impact of this rural decline is not just economic. Considerable social issues are emerging. Loss of employment leads to a loss in the ability to attract and retain professionals and the skilled trade's areas. In turn this leads to a lack of support services such as health, education and communications and eventually to loss of social cohesion and community livability. The end product is that as the population declines, communities die. This is a serious issue that confronts Australia and has severe implications for sustaining our non-metropolitan regions (Miles et al 2004).

With the growing world wide concern over energy and the emergence of interest in renewable energy the question is raised: Does the ethanol industry provide a credible diversification opportunity for the non-metropolitan regions of Australia? It is the purpose of this paper to consider the ethanol industry in terms of an emerging or developing industry for non-metropolitan regions of Australia, the jobs this may bring and the economic spin off for these communities. The paper accordingly draws on the experiences of other nations and explores the way in which this industry will emerge.

2. THE CASE FOR ETHANOL

Almost all transport fuel consumed in Australia (and world wide) comes from oil or gas. Oil and gas are fossil fuels. These fuels are derived from the decay of forests from millions of years ago. These fossil fuels bind the carbon into a stable form and when extracted and burned create energy releasing greenhouse gases such as carbon monoxide carbon dioxide, sulphur and nitrous oxides (Australian Ethanol Limited). These products are not renewable and are now seen as major causes of greenhouse problems.

Some 70 percent of Australia's petrol is derived from imported oil (Australian Friends of Ethanol) and the demand for oil and gas throughout the world continues to rise exponentially. The world reserves are now being exhausted with a production decline due to depleted reserves being expected in the next decade (Australian Ethanol Limited). Australia is also facing a decline

in crude oil production. Without new discoveries Australia's liquid fuel self sufficiency is predicted to decline from 85 percent in 2000 to 40 percent in 2010 (Australian Ethanol Limited). Hence an alternative energy source is an imperative nationally and globally.

On the other hand, ethanol is a renewable energy source and can be made from the sugars and starch of any plant material. Currently, ethanol is produced from grain or sugar which can be grown and harvested each year in Australia. In the future, ethanol production potentially could come from large-scale tree plantations or other cost effective crops. One of the benefits of ethanol over traditional petroleum products is that the combustion process of ethanol is non-toxic, free of pollutants such as sulphur and nitrogen, clean and efficient. In addition the carbon dioxide emissions that are produced by the use of ethanol are recycled through the next crop production phase (Queensland Ethanol Industry Blueprint 2004).

3. POTENTIAL ECONOMIC, SOCIAL AND ENVIRONMENTAL BENEFITS OF A DOMESTIC ETHANOL INDUSTRY

In order to determine if it is smart to invest in a new or emerging industry some consideration needs to be given to the economic, social and environmental benefits of the industry. In an increasingly environmentally sensitive global market place with strong emerging trade sanctions it does not make long term sense to invest in any industry that will create waste or lead to irreversible environmental damage. One of the major reasons for the interest in ethanol has been that it is a renewable fuel and is environmentally compatible.

In addition the high octane-blending value of ethanol makes it an excellent alternative to other octane enhancers which have known or suspected health dangers and are now used widely in petroleum. Ethanol can substitute for aromatic hydrocarbons, which include the carcinogen benzene (the U.S. Clean Air Act limits benzene to 1 percent, and total aromatic hydrocarbons to percent, as of January 1995).

Australia has a growing dependence on imported light crude oil. This light crude is needed for petroleum and diesel fuel manufacture. As reported earlier approximately 70 percent of Australia's petrol needs are met by using imported oils. This importation results in several billion dollars flowing out of the country each year, and fewer jobs for Australians.

The net economic benefit of a domestic ethanol industry in Australia is substantial. In Canada it is projected that 3,000 to 6,000 jobs will be created in the next 15-year period if ethanol is used as a 10 percent blend in 50 percent of Canadian gasoline (Urbanchuk and Kapell 2002). A similar quantum would be expected in Australia and the investments in, and spin-offs from, ethanol would directly benefit Australia's economy.

There is an abundant and renewable supply in Australia of grain and sugar cane for fuel ethanol production. If Australian use of fuel ethanol realised a 10 percent concentration, Australia would still remain one of the world's major grain-exporting and sugar-exporting countries. In addition the potential exists to make fuel ethanol from a wide range of other biological materials such as

forestry and domestic waste (Australian Ethanol Limited). It is of note that the by-product of ethanol production from grain is a high-protein livestock feed that could be used to support an increasing feedlot industry worth over \$200 million annually.

A major case used to promote the development of the ethanol industry is that as an alternative source of fuel it will reduce air toxins, carbon monoxide, ozone formation, and net carbon dioxide emissions into the atmosphere (Canadian Renewable Fuels Association).

Of significance is that while the current cost of ethanol is higher than the cost of petroleum the societal costs associated with petroleum energy, such as respiratory and other health problems, crop yield losses and damage to vegetation, environmental disasters (e.g., tanker mishaps), etc, are not fully accounted for in the price of gasoline. By comparison, renewable ethanol produced by sustainable agricultural practices is reported as being able to assist stabilising farm income, and contributes to reducing overall government support payments to agriculture (Short and Dickson 2004).

There is a building case that increased use of renewable fuels such as ethanol will reduce smog and greenhouse gas emissions. According to the Canadian Renewable Fuels Association, renewable fuels such as ethanol are the best tools we have to fight air pollution from vehicles. Ethanol contains 35 percent oxygen. Adding oxygen to fuel results in more complete fuel combustion, thus reducing harmful tailpipe emissions.

Gasoline containing a 10 percent ethanol blend will reduce smog-generating emissions like carbon monoxide (by 25-30 percent), particulate matter (by 50 percent) and volatile organic compounds (by 7 percent). Ethanol can be used in place of harmful aromatics like benzene – the most toxic compound in gasoline. In addition, ethanol does not contain sulphur (Indcor Limited, 2004).

The environmental benefits increase as bio-diesel and cellulose ethanol grow as a percentage of renewable fuel (Canadian Renewable Fuels Association). The Canadian government estimates that:

If 35 percent of gasoline in Canada contained ten percent ethanol, GHG emissions would be reduced by 1.8 mega-tonnes per year (1.8 million tonnes), which is the equivalent of removing more than 400,000 vehicles from the road.

The American Lung Association of Metropolitan Chicago credits ethanol-blended reformulated gasoline with reducing smog-forming emissions by 25 percent since 1990.

4. GLOBAL SUPPLY AND DEMAND OF ETHANOL AND BIODEISEL

If the ethanol industry is to represent a viable option for diversification in non-metropolitan regions then the questions must be asked as to what real growth potential the ethanol industry represents to Australia and how sustainable will the industry be in terms of long term investment for sustainable regional development. In order to gain an understanding of the long-term industry prospects some consideration of the growth phase and interest in ethanol on a global scale must be considered.

Ethanol consumption and production worldwide is now viewed as a substantial growth industry (Australian Ethanol Limited). The industry has developed under two distinct production models. The first is the Brazilian model where production is from large scale sugar plantations. The second model is referred to as the American model where the production of ethanol is based on grain.

Based on information tabled in the Indcor Annual report (2004) on International Ethanol fuel markets, Brazil is the largest producer of ethanol and in 2004 produced 12.6 giga litres (GL). The Brazilian Government has mandated for 23 percent ethanol content in petroleum. Forty percent of vehicles in Brazil use E85 or similar. The United States is the second biggest producer with 72 ethanol plants generating 10.8GL of high grade ethanol. It is of note that America's oil refineries are operating at near full capacity to maintain supplies of gasoline and other petroleum products. The oil refinery industry in the United States is aged and increasingly susceptible to failure. Unlike the ethanol industry, no new oil refineries have been built in the United States in the past twenty-five years and none are planned. The US has mandated for a 10 percent blend by 2004.

Japan is currently trialling a 10 percent blend and is expected to mandate 10 percent by 2008 realising a demand usage of 7GL. Canada has a stated plan for 35 percent of petrol to contain 10 percent ethanol by 2010 – this level would reflect a usage of 1GL/year. China produces around 3GL/year with a growth rate of about 10 percent per year. Europe has many signatories to the Kyoto protocol and is expected to mandate similar levels to the rest of the world by the end of 2005, to be placed on their markets by 2010. Plans are in place for India to expand from 5 to 10 percent mix, while Indonesia is reported at 4GL with a projected 500 percent increase to 20GL over the next five years. In Thailand 8 plants are under construction with plans to build a further 12 facilities (Indcor Annual report 2004).

It is clear from this level of international interest and capital investment that the industry is well established and likely to continue to grow substantially in the short and medium term. Non-metropolitan regional Australia could be a substantive player in this emerging global business.

5. COMPETITIVENESS OF ETHANOL AS AN EMERGING AUSTRALIAN INDUSTRY

Ethanol is currently regarded as a fuel additive (volume extender) as opposed to a petroleum replacement due to the cost (Queensland Ethanol Industry Blueprint 2004). The cost of petroleum in Australia is set by the spot price of Singapore Mogas 95 unleaded (Short and Dickson 2004). Between 2008 and 2015 the world average trade weighted price of oil is expected to average around US \$21 (2004 dollars). At an assumed exchange rate of US 60c the benchmark price of petrol and diesel, ex-refinery in Australia is estimated by ABARE to be AUD 31c and 34c respectively. Using an equivalent energy unit (ethanol of 68 percent of petroleum and bio-diesel at 90 percent of diesel) it is estimated that without assistance and excise ethanol would be 20c/L and bio-diesel 31c/L.

After 2015 the excise rate of 12.5c/L for ethanol and 19.1c/L for bio-diesel will apply (Short and Dickson, 2004).

Using ABARE predictions of grain and molasses prices to 2015 the real rate of return (using 2004 dollars) is expected to vary from 28 percent in 2004/5 to 8 percent (with full excise) in 2015 for grain based ethanol and 36 to 12 percent for C Molasses based ethanol and for waste oil based bio-diesel 42 to 21 percent for the same time periods (Short and Dickson, 2004). It is note that the International Monetary Fund predicted in 2005 that crude oil prices would exceed US \$80.00/per barrel. If these prices are sustained then the real rate of return will be substantially higher than the conservative estimates provided here.

The Short and Dickson (2004) study on the viability of bio-fuels in Australia concluded that the new excise arrangements announced in 2003 are likely to provide sufficient assistance to the ethanol and bio-diesel industries to underpin their viability over the longer term. Further, they concluded that the returns available to new entrants to the industry over the next ten years are potentially very large.

While grain supplies can be stored, the highly variable supply of C molasses, both seasonally and year to year, presents a logistical problem to any large-scale production plant.

6. ETHANOL PRODUCTION AND NON-METROPOLITAN REGIONS IN AUSTRALIA

The world ethanol industry is poised for its most significant growth phase for several decades (Indcor Annual Report, 2004). The interest is driven by the need to secure renewable energy sources with declining world oil reserves, as well as addressing the problems of greenhouse gas emissions. Non-metropolitan regions in Australia are well placed to be an active player in this growth phase as large-scale producers of grain and sugar. The grain and sugar industries are at present facing problems with declining terms of trade and international competitiveness.

Our grains lend themselves toward these styles of initiatives as ethanol is best produced from the lower value grains (barley, and feed wheat) and weather damaged grains (Australian Ethanol Limited). Apart from a value added use for these lower value products an added benefit is that the high quality grains (bread and noodle wheats) potential remain in supply for the domestic and international markets. In addition the by-product from grain ethanol production is a high protein livestock feed suitable for use in Australia's extensive feedlot industries. In practice while about two thirds of each tonne of grain is converted to ethanol the remaining third is available as the high protein feed material (Australian Ethanol Limited). It is of note that this material generally provides a higher level of nutrition than other traditionally utilised protein feed products. This provides an additional opportunity of increasing the competitiveness of the producers of these types of animal feed products and represents a significant added profit to the venture.

In general, the Canadian and Australian studies have found that the economic return from ethanol plants is optimised where they are located in reasonable proximity to the source products (inputs such grains, sugar cane etc). This is due

to the high relative transport and storage cost associated with these products as opposed to the fuel product (Australian Ethanol Limited). As will be discussed later, the costs of transport of the ethanol based fuel product also are considerable and transport costs are a major determinant of the competitiveness of the fuel price.

The plant which most countries are building, or planning to build, in the immediate future for ethanol production is the 40 million gallon per year dry mill unit (40MGY). (Urbanchuk and Kapell, 2002; Australian Ethanol Limited, 2004). As a grains-based unit there is no continuity of supply problems, as in sugar based production, since grain can be stored. Two existing plants under construction in Australia are the Swan Hill and Coleambally plants. Both have been strategically located adjacent to the major Australian fuel markets of Melbourne, Sydney and Adelaide (Australian Ethanol Limited). In addition they are ideally placed near the irrigated and dry land grain production areas of Victoria and the Riverina.

The Australian market for ethanol is likely to rapidly rise to 1.8 billion litres (10 percent of the total Australian fuel consumption of 18 billion under the E10 model) (Indcor 2004). Australia currently produces 150 million litres of ethanol for all uses. That translates to a potential development of approximately 10 additional production plants (40MGY). Each plant is expected cost about \$60 million US to build. Any investment in new ethanol plants is an investment that will largely be made in the nation's rural communities due to the supply of feedstock.

The benefit that may accrue from the expanding ethanol industry to non-metropolitan regional communities is best demonstrated by a detailed Canadian socio-economic study. This study considered the benefits to a non-metropolitan regional economy based on the construction of 40 MGY new grain based plants (Urbanchuk and Kappell 2002). The results from their study are summarised here to demonstrate the potential value of this industry to regional communities.

As indicated the construction cost of these plants is of the order of \$60mil US, the cost of which largely represents the cost of goods and services provided within the region. The construction period is approximately 12 months and this provides a single economic injection to the regional economy of \$142 mil US. The annual operating costs are calculated at \$56 mil US in terms of grain inputs, labour utilities and maintenance etc. All of these are most likely to be sourced within the region.

Using the US Bureau of Economic Analysis for output earnings and employment estimates and multipliers for the grain processing industry the following regional benefits were calculated (expressed in US dollars).

- Add \$142.2 mil to final demand in the local community
- Generate \$46 mil in new household income
- Annual operating expenditure of \$56mil averaged over a 10 yr period
- 41 new permanent jobs and a further 694 jobs through multiplier effects
- \$19.6 mil in additional local household income
- An additional \$1.2 mil in taxes.
- The annual usage of approximately 15 million bushels of grain.

Their study concluded that if farmer based cooperatives were established, farmers would receive a 13.3 percent return on investment over a ten-year period. The US Department of Agriculture determine that for every 100 million bushels of corn used, a price increase of 3-5 cents per bushel would be realised, thereby increasing the viability of the grain sector. In addition the feedlot industry benefited from a new source of feed protein.

Within Australia ninety percent of fuel consumed is in the coastal strip from Mackay in the north coast of Queensland to Adelaide in South Australia (Australian Ethanol Limited). Of note is that the majority of the Australian sugar industry does not fall within this area meaning that any ethanol produced would need to be transported, adding to the cost of the base production. Further, sugar is an annual crop with a short harvest season, meaning that invested capital in ethanol from sugar under current production practices would be idle for much of the year. Hence, without government intervention, commercial investment in ethanol in Australia can be expected to be associated with the grains sector. However there is a substantive case for sugar-based production to be considered.

In Queensland approximately 4 billion litres of fuel are used annually. Ethanol in Queensland is currently produced from sugar from mills located at Sarina, Rocky Point and Bundaberg. However, only a very small proportion of this ethanol is used in transport fuel.

Sugar is a tropical crop (C4 plant) and production in Australia exceeds 5200 kt annually. Of this production a total of 4100 kt is exported. (Perry, et al., 2004). With the projected global decline in sugar prices, the long-term global commercial competitiveness and viability of the industry is under question (Perry, et al., 2004). This decline has triggered considerable interest in the long-term viability of the affected sugar based communities particularly along the eastern seaboard of Queensland. One way to diversify the industry and provide an alternative commercial footing may be in the diversification by the industry into ethanol production. In order to realise this potential and stimulate further real commercial interest a number of issues need to be addressed and these require further economic analysis. These issues include production efficiency of the industry, year round and continuity of supply of cane as a feed-stock for ethanol production, the effect of subsidies on the long term viability of the industry as well as the trade-off and opportunity costs in lost export earning from sugar (Perry, et al., 2004).

The future analysis and resolution of the issues needs to take into consideration the value of a replacement for imports of fuel from other countries and the development of jobs from value adding to products within Australia. As indicated, the job multiplier in Canada found that for every new 40MGY plant constructed 694 new job positions can be expected to be created. In addition it appears that there is some degree of international agreement that alternative fuel sources are needed and that in the short to medium term one real option is to use ethanol as a fuel extender. The demand under the current policy environment will require a substantial number of new plants to meet world demand. With Australia facing a significant imbalance in terms of trade and from an import replacement strategy it makes sense to move toward a policy of self-reliance.

While some opportunity potentially exists within the sugar industry, the cost of transport may limit the growth of this sector

7. CONCLUSION

Clearly there are substantive environmental, economic and social reasons why ethanol should be rigorously evaluated as a credible diversification opportunity for non-metropolitan regional Australia. There is clear evidence to suggest that with the right policy framework in Australia potential exists to develop this new industry, build smart and sustainable jobs as well as providing a credible diversification opportunity for non-metropolitan regional Australia.

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