BIOFUELS – AT WHAT COST?

Government support for ethanol and biodiesel in Australia

One of a series of reports addressing subsidies for biofuels in selected OECD countries

April 2008

Prepared by:

Derek Quirke, Ronald Steenblik and Bob Warner

Prepared for:

The Global Subsidies Initiative

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Biofuels – At What Cost? Government support for ethanol and biodiesel in Australia

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Abbreviations and acronyms

Australian Provinces and Territories

ACT	Australian Capital Territory
NSW	New South Wales
NT	Northern Territory
QLD	Queensland
SA	South Australia
TAS	Tasmania
VIC	Victoria
WA	Western Australia

Common fuel blends

E10	10 per cent ethanol and 90 per cent petrol
E85	85 per cent ethanol and 15 per cent petrol
B5	five per cent biodiesel and 95 per cent diesel
B20	20 per cent biodiesel and 80 per cent diesel
B100	100 per cent biodiesel
gasohol	An ethanol-petrol blend typically containing 10 per cent ethanol
diesohol	An ethanol-diesel blend typically containing 10 to 20 per cent ethanol
E-diesel	Alternative name for diesohol

Units

A$	Australian dollars (AUD)
ML	Megalitre (10^6 litres)
MJ	Megajoules (10^6 joules)
mega	One million
kg	Kilogram

Acronyms

ABARE	Australian Bureau of Agriculture and Resource Economics
AGO	Australian Greenhouse Office
ASW	Australian Standard White (wheat)
AWB	Australian Wheat Board
BCG	Biofuels Capital Grants programme
CPA	Cane payment areas
CFGS	Cleaner Fuels Grant Scheme
CIF	Cost, insurance, and freight
DRET	Department of Resources, Energy and Tourism

DAFGS	*Diesel and Alternative Fuels Grants Scheme Act*
EGS	Energy Grants (Credit) Scheme
EDP	Ethanol Distribution Program
EIAP	Ethanol Industry Action Plan
EPG	Ethanol Production Grants programme
FOB	Free on board (value)
GMV	Gross vehicle mass
GST	Goods and Services Tax
NRMA	National Roads and Motorists' Association
QSEIF	Queensland Sustainable Energy Innovation Fund
RVP	Reid vapor pressure
RECP	Renewable Energy Commercialisation Programme
REDI	Renewable Energy Development Initiative
REEF	Renewable Energy Equity Fund
REIP	Renewable Energy Industry Program
SIAP	Sugar Industry Assistance Package
SIIF	Sugar Industry Innovation Fund
SIRP	Sugar Industry Reform Program
IR&D	Industry Research and Development (Board)
IIF	Innovation Investment Fund

Executive summary

In recent years, governments of numerous countries have promoted industrial-scale production and use of liquid biofuels—fuel-grade ethanol and biodiesel[1]—and backed that commitment with financial support. This report, one of a series of country studies undertaken by or for the Global Subsidies Initiative (GSI) of the International Institute for Sustainable Development (IISD), examines the types and magnitude of support to biofuels in Australia.

Biofuels have attracted particularly high levels of assistance in some countries given their promise of benefits in several areas, including agricultural production, greenhouse gas emissions, urban air quality, energy security, rural development and economic opportunities for developing countries. Such alleged benefits have enabled those promoting biofuels to assemble unusually broadly-based support for fiscal and regulatory relief.

But the ability of biofuels to deliver against these objectives may be questioned. Biofuels can have unintended effects that undermine the fiscal and environmental goals they are purported to support. By scrutinising the extent of government support for biofuels, this study highlights the opportunity cost of financial assistance to biofuel industries over other options available to policy makers. It also questions whether such levels of support are justified in the context of long-term viability of the industry in the absence of subsidies.

In the most recent financial year (2006–07), Australian federal and state governments spent around A$ 95 million supporting the production and consumption of biofuels. This number could grow to several hundred million dollars a year, despite a recent downturn of the Australian biofuel industry. The expected completion of new ethanol and biodiesel manufacturing plants over the next two years will lead to higher production- and consumption-related support.

Biofuels make up only a fraction of the nation's fuel supply: less than 0.5 per cent of the 19 billion litres of automotive petrol (gasoline) consumed each year, and perhaps one per cent of the 17 billion litres of automotive diesel consumed. Although both total transfers and effective support[2] per litre are roughly similar for the biofuels, support per gigajoule (GJ), a standard unit of energy, is higher for ethanol than biodiesel.

Support for ethanol and biodiesel in Australia: total transfers and assistance

Metric	Units	Ethanol			Biodiesel		
		2004–05	2005–06	2006–07	2004–05	2005–06	2006–07
Production	Million litres	22.7	40.3	83.5	4.4	21.2	77.0
Total transfers	A$ million	10	20	55	3	14	40
Total transfers per litre	A$/litre	0.46	0.49	0.66	0.64	0.66	0.51
Total assistance[1]	A$ million	9.3	16.6	36.2	1.8	8.8	31.4
Assistance[1] per litre	A$/litre	0.41	0.41	0.43	0.42	0.42	0.41
Assistance[1] per gigajoule	A$/GJ	19	19	20	13	13	13
Assistance[1] per litre of petrol or diesel equivalent[2]	$/litre equivalent	0.61	0.61	0.65	0.46	0.46	0.45

1. Calculated by converting capital grants and grants for land into annuities at the prevailing rate of interest.

2. Adjusted for the lower heat contents of these fuels compared with their corresponding petroleum fuels.

Source: main report.

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1 Biofuels refers to liquid renewable fuels such as ethanol (an alcohol fermented from plant materials) and biodiesel (fuels made from vegetable oils and animal fats) that can substitute for petroleum-based fuels.

2 The terms "transfers" and "assistance" both encompass market price support and subsidies. In this report, total transfers refer to all government support provided in a given year, whereas annualized assistance distributes grants for capital, land, research and development over several years, to reflect the benefits they confer over time.

Australia's biofuel industry is heavily supported compared with its other industries. The effective rates of assistance (ERAs) for most biofuels were found to be 100 per cent or more—i.e., government assistance is at least as large as the value-added through producing the fuel. For some feedstock-fuel combinations, without that assistance, most biofuel producers would only be able to cover the variable costs of production, and some not even that.[3] This is significantly higher than the ERAs for agriculture and for manufacturing as a whole, which now averages around five per cent, while the most-assisted industries (dairy cattle farming, and textiles, clothing, footwear and leather) had ERAs, respectively, of 15 per cent and 13 per cent in 2006–07.

The largest element of assistance for biofuels in Australia is an excise tax rebate, provided as a per-litre grant to producers that exactly offsets the $A 0.38143 fuel excise duty. The grant is not available for imported ethanol but it covers both imported and domestically produced biodiesel. Domestic production of biofuels (as well as imported biodiesel) will continue to be effectively excise-free until 30 June 2011. After that, excise duties for both biofuels will rise until, by 2015–16, they will be equivalent to 50 per cent of the excise payable on petrol and diesel on an energy-equivalent basis.

Complementing favourable tax treatment and production assistance, producers of fuel ethanol and biodiesel have also benefited from numerous grants tied to investment in fixed capital provided mainly by the federal government. The biggest was the Biofuels Capital Grants Program, which awarded A$ 37.6 million to three ethanol and four biodiesel producers in 2004. But other grants, worth tens of millions of Australian dollars in total, were also awarded between 2001 and 2006 in order to support investment in biofuel plants under programmes designed to promote innovation, restructure the sugar industry, or reduce greenhouse gas emissions.

In 2001, the federal government set a non-binding target for biofuel production of 350 million litres per year by 2010 (equivalent to approximately one per cent of the nation's transport fuel consumption). In contrast with many other national governments, the Australian federal government has so far resisted calls from the industry to mandate particular volumes or blending ratios in the nation's transport fuels. A state-level parliamentary inquiry in Victoria recently recommended against a biofuel mandate in that state. In August 2006, however, two states (New South Wales and Queensland) established requirements that petrol in their respective jurisdictions contain at least, respectively, 10 per cent and 5 per cent ethanol on average by 2011. Other states are also considering the establishment of their own volumetric or blending mandates.

This report calls into question whether such government intervention in the fuels market, and assistance to biofuel production and use, is warranted.

While biofuels can provide some benefits both through the displacement of petroleum and fossil fuels, and (under certain restrictive conditions) through reducing greenhouse gas emissions, this report demonstrates that these gains are relatively small in comparison with their subsidy cost. To measure assistance per unit of fossil fuels avoided through the use of biofuels, one has to take into account the (non-renewable) energy used to plant, fertilize and harvest (in the case of plant-derived biofuels), transport and process their feedstocks into fuel. Such a calculation yields subsidies per avoided fossil fuels (normalized to a petrol- or diesel-equivalent basis) that are in the same range as the wholesale prices of the petroleum-derived fuels that they displace. In other words, the government could have obtained the same fossil-fuel displacement by buying equivalent quantities of petroleum fuels on the open market. The substantial petroleum-based fuel input to biofuel production leads to marginal benefits in terms of energy security.

Subsidizing ethanol at current rates is generally less cost-effective than subsidizing biodiesel as a means to reduce greenhouse gas emissions. In addition, subsidizing biofuels from whole crops is less cost-effective than subsidizing biofuels from low-grade or "waste" materials, such as C-molasses, waste starch or used cooking oil. Even so, the subsidy cost of obtaining a one-tonne reduction of CO_2 through biodiesel production from used cooking oil could purchase more than five tonnes of CO_2-equivalent offsets on the European Climate Exchange, or more than 30 tonnes on the Chicago Climate Exchange.

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[3] The ERA measures net government assistance to an industry by comparing the difference between the value-added by the assisted sector to the value-added generated by the same, but unassisted sector (at the world or reference price).

Although there is currently little biofuel production in Australia from higher value products, such as grains and oil seeds, many new plants are designed to use these feedstocks, which would increase the subsidy price of any CO_2 reductions. For example, the subsidy cost of obtaining a one-tonne reduction of CO_2 through ethanol production from wheat could purchase more than 20 tonnes of CO_2-equivalent offsets on the European Climate Exchange, or around 140 tonnes on the Chicago Climate Exchange.

Assistance per tonne of CO_2-equivalent avoided through the use of for ethanol and biodiesel, 2006–07

	Units	Ethanol		Biodiesel	
		From low-grade materials	From wheat	From low-grade materials	From oilseed crops
Avoided non-renewable energy: assistance per litre of petrol- or diesel-equivalent	A$ per litre equivalent	~0.80	0.90–2.05	0.50–0.60	0.80–1.00
Assistance per tonne of CO_2-equivalent emission reduced	A$ per tonne	~400	680–790	160–190	~300
NB: Market price of a CO_2-equivalent offset[1]	A$ per tonne	5–30			

1. Lower number corresponds to average price on Chicago Climate Exchange (FY 2006–07); higher number corresponds to the price on the European Climate Exchange at the beginning of 2007.

Source: main report.

Industry assistance is sometimes justified as necessary to support infant industries that will later be economically viable and generate employment. But experience has shown that assistance to the biofuel industry is unlikely to be temporary. More established biofuel industries including in Brazil, the United States and the European Union, remain dependent on mandates or subsidies, or both, after decades of public support.

Australia's agricultural system and climate may also be unsuitable to sustain a large biofuel industry based on annual crops, due to the cyclical patterns of drought that dramatically reduce crop yields in some years. This was demonstrated in 2007 when several biodiesel plants suspended production due to high feedstock prices, and plans for proceeding with the construction of several new ethanol and biodiesel facilities were cancelled. Uncertainties about biofuel markets, government legislation and consumer acceptance in the Australian market were also contributing factors for some companies cancelling investments (Agri Energy, 2007).

The industry and its proponents had hoped for new pledges of support from the major political parties during the 2007 federal election, but no such commitments were made (Australian Biofuel Users, 2007). On the contrary, the federal government has signalled that the rate of assistance for biofuels provided by the federal government in the future will be less than it is today. First, as a result of low production and take up of biofuels, the federal government forecast savings in biofuel-related expenditure totalling A$ 15.8 million for the 2008–09 Budget. Second, no new grants for capital construction are planned. Third, the production bounties that fully offset the excise duties on both ethanol and biodiesel will be phased out over a four-year period, starting in July 2011.

The new excise duties on biofuels will, nonetheless, still contain a significant element of subsidy, as they will be set at half (or less) of the rate they would be charged were they set proportional to the energy value of these fuels relative to their petroleum-derived counterparts. The cost to the federal government of reduced revenues from excise duty, should the volume of biofuels consumed rise substantially over the next decade, could therefore be significant in future years. The threat remains that, even with these announced curbs on subsidy growth, the ethanol tariff or production bounties could very well be extended in response to industry or other interest-group pressure. Some excise-duty differential might be appropriate for biofuels, related to their tailpipe emissions and life-cycle greenhouse-gas emissions, but the current regime does not discriminate on this basis.

The study concludes with several recommendations for the federal government. In our opinion, it should:

- Continue to resist calls for instituting national blending mandates for biofuels, at least without first undertaking a thorough examination of the costs and benefits.
- Avoid providing new specific subsidies to the industry, and do not prolong the phasing-out of the existing production grants and the phasing-in of the final excise duty.
- Re-evaluate the arbitrary decision to set the final excise duty for biofuels at no more than 50 per cent of the energy-weighted excise duty applied to petrol and biodiesel.
- Remove barriers on trade in ethanol.
- Adopt neutral policies favouring all options to reduce reliance on petroleum in the transport sector or greenhouse gases.
- Improve the information available on transfers provided to the biofuels industry and the effects of such assistance.
- Establish a transparent evaluation process to assess:
  - the cost-effectiveness of support policies at all levels of government in attaining the declared objectives behind biofuels policy, and
  - the long-term economic viability and international competitiveness of an Australian biofuels industry, in the absence of assistance and trade protection.

1 Introduction and outline of the report

1.1 Biofuels in Australia

In FY 2006–07, Australia produced around 83 million litres (ML) of ethanol and 77 ML of biodiesel.[4] These volumes constituted a tiny fraction of total national consumption of petrol, which amounted to (19 251 ML) and diesel (17 028 ML) in the same year (ABARE, 2007). Overall, the transport sector accounts for almost 40 per cent of final energy consumption in Australia, with three-quarters of that demand originating from road transport (Short and Riwoe, 2004).

In part because of the importance of transport fuels in Australia's energy economy, biofuels have received much political attention over the last couple of years. High oil prices have spurred interest in alternative fuel sources for powering vehicles, especially if the substitution of those alternatives for petroleum-based fuels would at the same time reduce emissions of greenhouse gases and improve air quality.

The prospect of turning agricultural products into fuels has also generated ferment within the farming sector—both among crop farmers, who would benefit from higher prices, and livestock farmers, who are worried about the effects of higher feed products on their own operations. Higher prices would be particularly welcomed by the Australian sugar industry, which has undergone significant difficulties in recent years due to low world sugar prices, the exclusion of sugar from the Australia-U.S. Free Trade Agreement and adverse weather conditions (Canegrowers, 2006a). Many policy makers have been attracted to biofuel production as a means to boost agricultural demand by providing a new domestic market.

For the moment, the biofuel industry remains small compared with that of the leading producers—Brazil, the United States, China, Germany and France. But it could grow rapidly, particularly if feedstock prices were to fall. The total annual production capacity of existing and planned new plants could approach two billion litres by the end of FY 2010–11, distributed between the two biofuels roughly evenly.

Nonetheless, the long-term viability of the industry remains in question. For the moment, the industry remains dependent on subsidies. As explored in this study, these have helped both underwrite the costs of building biofuel-production capacity and enabled them to compete with petrol and diesel at the bowser.

The recent downturn of the Australian biodiesel industry demonstrates that even significant government support can be insufficient to keep operations profitable when feedstock prices are high. Whether Australian farmers can produce adequate feedstock at low enough prices to sustain a major expansion of ethanol, especially if it is based on current production methods (Box 1.1), is also in doubt. As summarized by Darby (2006):

> The cyclical nature of Australian grain production, which includes prolonged drought periods, together with increased domestic demand for grain, has caused much concern regarding the development of an ethanol industry. Not all agricultural sectors believe that there will be enough domestic grain to satisfy the emerging ethanol industry.

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4 Australian Bureau for Agricultural Research and Economics (ABARE) estimates based on voluntary reporting of biofuel production to the Department of Resources, Industry and Tourism. E-mail communication from Clara Cuevas-Cubria to Tara Laan, 6 February 2008.

Box 1.1 Biofuels and how they are produced in Australia[1]

Ethanol, or ethyl alcohol, can be used as a fuel in spark-ignition engines, either neat or blended with gasoline. The energy content of fuel ethanol is only around two-thirds that of gasoline (regardless of the feedstock used), but it has a significantly higher octane rating.

Fuel ethanol can be either hydrous (also called “hydrated”) or anhydrous. Hydrous ethanol typically has a purity of about 95 per cent and has been used in Brazil since the late 1970s as a fuel in vehicles with modified engines. Further processing to remove the water produces a high-purity anhydrous ethanol that is typically blended with petrol for use in unmodified engines. Since 1 July 2003, the maximum permissible limit on the ethanol component in petrol in Australia has been 10 per cent. This blend is known as E10.[2] More than 95 per cent of the world’s ethanol is produced from plant-derived matter, mainly sugars and starches. The rest is produced synthetically, from petroleum or coal.

Some ethanol in Australia is made by fermenting molasses. This involves the decomposition of glucose into ethanol and carbon dioxide, then heating to distil the ethanol. Bagasse (sugar-cane residue) is typically burnt to generate the heat needed for processing.

Other plants produce ethanol from sugars and starch entrained in the wastewater resulting from the production of gluten and starch. Starch-derived ethanol can be made from crops such as maize (corn), wheat, rye, potatoes or sorghum. Manufacturing facilities making ethanol as their principal product usually use either a dry-milling or a wet-milling process. In dry milling, the grain is ground and water added to form a mash, to which enzymes are added to convert the starch to dextrose. The mash is fermented, yielding a “beer” containing ethanol, carbon dioxide, water and solids. Further processing concentrates the ethanol and dehydrates the solids, yielding dried distillers’ grains, a high-protein feed for livestock. In wet milling, the grain is broken down using water and dilute sulphuric acid, and then processed to yield germ, fibre, gluten and starch. The starch is fermented and distilled as in the dry-milling process and gluten meal is produced as stock feed.

These processes are known as *first-generation* technologies. *Second-generation* technologies are under development to commercialise production of ethanol from cellulosic material, such as crop waste, wood and grasses. In second-generation ethanol manufacturing plants, the cellulose and hemi-cellulose constituents of the biomass are typically converted into simple sugars either biologically, using enzymes, or chemically, using acids and high temperatures.

Biodiesel is typically produced from vegetable oil or animal fat. In a process known as transesterification, the fat or oil is reacted with an alcohol (usually methanol synthesized from natural gas) in the presence of a catalyst to yield biodiesel and glycerine. Other by-products can include fatty acids, fertilizer and oilseed meal. Many of these by-products have a value, particularly the glycerine and oilseed meal (e.g., soybean meal used for both human and animal food).

The energy content of biodiesel varies between 88 and 99 per cent that of diesel, depending on the feedstock and esterification process used. Subject to engine manufacturers’ advice, biodiesel can be used as a direct replacement for diesel, or in a blend of five or 20 per cent biodiesel fossil diesel. All biodiesel sold in Australia must meet the Fuel Standard (Biodiesel) Determination 2003.

Biodiesel manufacturing typically started out using low-value oils, such as used cooking oil or tallow as feedstocks. Because of the limited supply of these sources, manufacturing plants based on them rarely exceed annual capacities of 30 million litres, and most have capacities of five million litres per year or less. As low-cost supplies of these fats are exhausted, additional capacity has been based on virgin vegetable oils. These facilities can be much larger (i.e., annual capacities greater than 325 million litres per year) or small-scale production facilities by farmers to produce fuel for their own farm operations.[3]

Over 50 plant species produce extractable oils. All have potential for use as fuel, but most are prohibitively expensive. In southern Australia, oilseeds, such as canola or mustard, are being investigated as feedstocks. Another possible source, still at the research and demonstration phase, is oil-rich microalgal feedstocks.

Several alternative technologies are vying to replace transestification, the costs of which are highly sensitive to rises in the prices of oils and fats. One new process uses existing equipment at oil refineries to create a diesel substitute (called “renewable diesel”) from animal fats or vegetable oils. Longer term, diesel substitutes may be synthesized from almost any type of low-moisture biomass using the Fischer-Tropsch (F-T) process. Although the F-T process is well developed (to make liquid fuels from fossil-fuel feedstocks), production from biomass is still at the research and demonstration stage.

1. The text for this box is adapted from Love and Cuevas-Cubria (2007), pp. 212–213.

2. Australian Government (2005).

3. Potter and McCaffery (2006).

Integrated production facilities for biofuels (such as on-site production of biofuels from dairy or milling waste) can improve the economic viability of production. However, the trend in other countries has been for dedicated biofuel production facilities. In the United States, for example, most new facilities are dry mills that yield a fixed ratio between the main co-products, ethanol and distillers grains (sold as animal feed).

Unlike many of its ethanol plants, Australia's biodiesel plants are generally located at or near ports, and at least could supplement local supplies of oils and animal fats with imported tallow or oils, such as palm oil, if required (Love and Cuevas-Cubria, 2007).

1.2 Outline of the report

The second section of this report provides a chronological overview of the liquid biofuels industry in Australia. The governmental legislation, programmes, and support measures which gave birth to the industry are highlighted in Chapter 2, as are industry milestones and major recent announcements. Chapter 3 follows with an overview of Australia's biofuel industry, along with production costs and revenues from by-products. This chapter is intended to familiarize the reader with the business of biofuels in Australia and to provide business cost figures to compare against government support figures listed in other sections. Current forms of support are expanded upon in Chapter 4 (Ethanol) and Chapter 5 (Biodiesel), including output-linked support, market price support, renewable fuels standards, tariffs, and all subsidies related to consumption and production. Chapter 6 contains estimates of the aggregate levels of support for each biofuel, key indicators such as subsidy intensity and per-unit of fossil fuel displaced. Chapter 7 concludes with discussion and recommendations.

1.3 Framework of the analysis

Figure 1.1 illustrates the framework used in the report to discuss subsidies provided at different points in the supply chain for biofuels, from production of feedstock crops to final consumers. Defining a baseline requires deciding how many attributes to look at, and determining what programmes are too broadly cast to consider in an analysis of a specific industrial sector. In our analysis, we have focused on subsidies that are significant to the cost structure of biofuels, including subsidies to producers of intermediate inputs, namely crop farmers. More remote subsidies, such as those for particular modes of transport used to ship biofuels or their feedstocks, were beyond the boundaries of this analysis.

Support for production and consumption is provided at many points in the supply chain. For the purpose of this report, the dividing line between production and consumption is taken as the point at which the biofuel leaves the manufacturing plant.

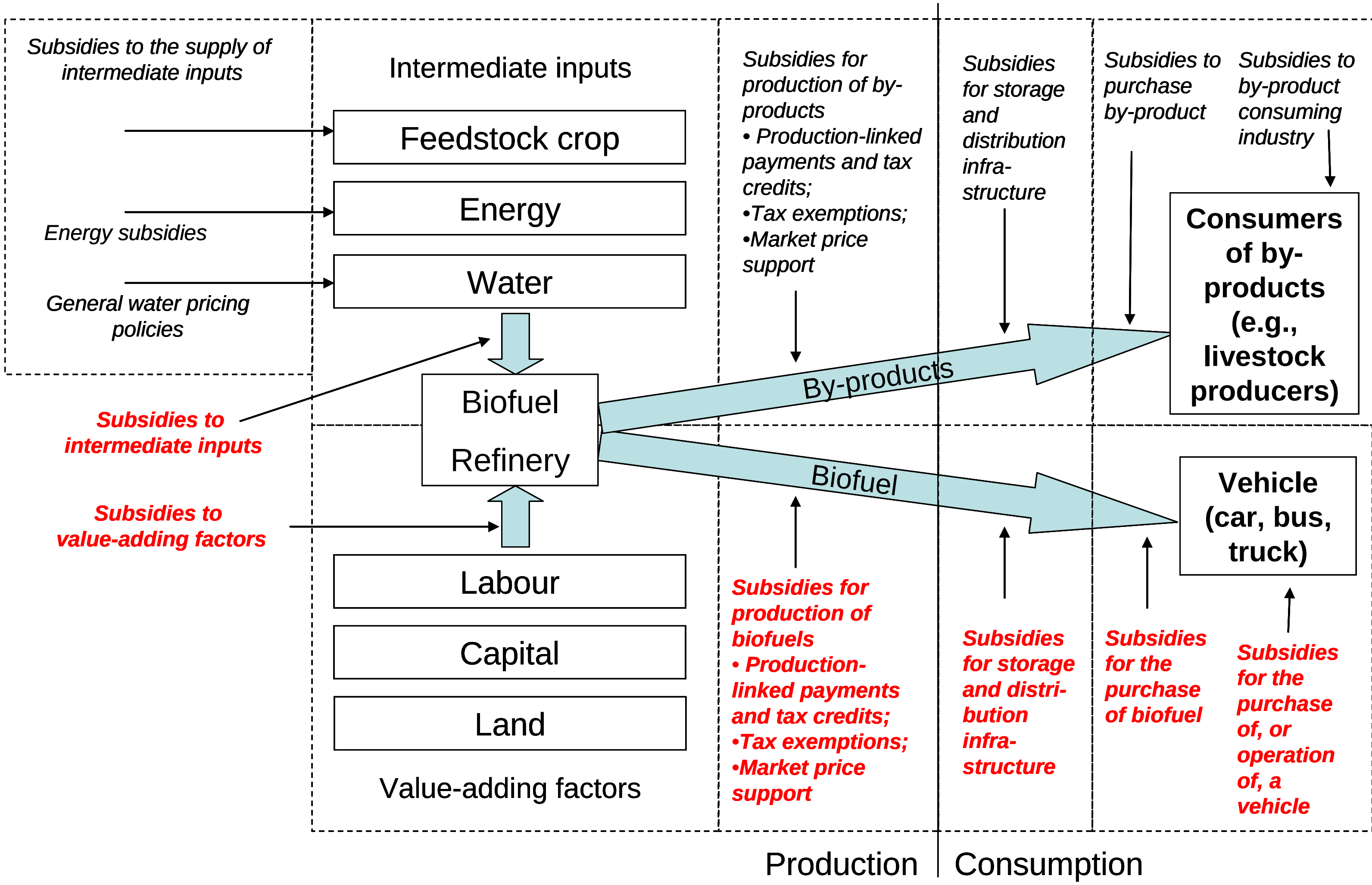
At the beginning of the supply chain are subsidies for what economists call "intermediate inputs"—goods and services that are consumed in the production process. In other countries, the largest of these often are subsidies awarded to producers of feedstock crops used to make biofuels, particularly sugar and wheat (for ethanol), as well as oilseeds (for biodiesel). In Australia, however, the little amount of support provided is decoupled from production and neither substantially raises nor depresses the price of domestically produced crops below those of imported or exported crops.

Subsidies for intermediate inputs may be complemented by subsidies to value-adding factors—capital goods; labour employed directly in the production process; and land. In the case of Australia, most of the subsidies that have supported value-adding factors used in biofuel production have been linked to productive capital. These have mainly taken the form of grants for construction or expansion of biofuel manufacturing plants. These types of subsidies lower both the fixed costs and the investor risks of new plants, which thereby improve the return on investment.

Further down the chain are subsidies directly linked to output. Production subsidies offsetting fuel-excise taxes for biofuels, provided at the federal level, are the main types of subsidies that fall under this category. Such support enables ethanol and biodiesel to be sold at retail prices that are roughly at parity with the prices of their taxed fossil-fuel counterparts. Full application of the customs tax to imported ethanol, without a compensating subsidy, also currently means that the policy works as a barrier to imports.

Assistance downstream of biofuel production supports two activities: fixed capital formation in facilities to blend, store or distribute biofuels (especially blends containing ethanol); and the consumption of biofuels themselves. Some of the latter is provided through policies requiring fleet operators (including government and university-owned vehicles) to purchase biofuels where practical; the bulk is provided through subsidies for fuel used by particular categories of final consumers, such as off-road vehicles. These subsidies do not benefit biofuels exclusively, but do include biofuels. So far, government support for vehicles capable of operating on biofuels has been small, and mainly confined to the conversion of bus fleets to use biodiesel and trials for use in passenger ferries (Sydney Biodiesel Users Group, 2005).

Figure 1.1 Subsidies provided at different points in the biofuel supply chain



2 Overview of the liquid biofuels industry in Australia

2.1 Historical support for biofuels

Australia has a long history of providing support for ethanol, through capital grants, production grants, rebates and exemption from excise duty. As early as 1921, the *Excise Tariff Act 1921* (Article 2(R)) declared as excise-free "denatured ethanol for use as a fuel in internal combustion engines, as prescribed by by-law."[5] All subsequent amendments to the Act have retained this article.

In 1980, ethanol's status as excise-free was reaffirmed and a new class of distilling licence was introduced, known as an "experimenters" licence. This licence authorized the distillation of spirits from any raw material for the purposes of conducting research into the production of ethanol for use as a transport fuel.

Ethanol, however, did not begin to be produced on a commercial scale until 1992 with the installation of distillation units at one of the flour mills owned by the Manildra Group, one of Australia's largest processors of grain. A couple of years later, the Government enacted the *Bounty (Fuel Ethanol) Act 1994,* which made available a total of A$ 25 million over a three-year period in the form of an A$ 0.18 bounty for each litre of new ethanol produced from biomass feedstocks in excess of (or equal to) 350 000 litres per year.[6] In total, these bounties could have supported as much as 139 million gallons of ethanol production over the 1994–97 period. Actual uptake of the subsidy was less than that amount, however.

From 1 July 2000, biofuels (along with most other goods) became subject to the Goods and Services Tax (GST). The GST is a broad-based tax of 10 per cent on most goods, services and other items sold or consumed in Australia. It is a form of Value Added Tax (VAT) and was introduced by the federal government with the *A New Tax System (Goods and Services Tax) Act 1999*. The GST has a bigger impact on prices in the cases of imports because the GST is, in effect, levied on top of the *ad valorem* and customs duties.

2.1.1 The Fuel Taxation Inquiry of 2001–02

On 1 March 2001, the then federal Prime Minister, John Howard, announced the establishment of an inquiry into fuel taxation in Australia (the "Fuel Taxation Inquiry"), to be co-ordinated by the federal Treasury. The terms of reference given to the inquiry required that it examine the existing structure of federal and state taxation of petroleum products and petroleum substitutes (including ethanol and biodiesel), as well as related rebates, subsidies, grants and other fuel-related measures proposed as part of its package of *Measures for a Better Environment*. Furthermore, given the government's concern about the impact of rising world oil prices, the inquiry was instructed specifically *not* to consider any options that might involve long-term real increases in the effective level of diesel or petrol taxes paid by businesses or private consumers.

Half-way through the inquiry, the Government announced that it would provide a capital subsidy for new or expanded domestic production capacity of A$ 0.16 cents per annual litre of biofuel, until total domestic annual production capacity reached 350 million litres, or by the end of FY 2006–07, whichever arrived sooner. This target figure was derived from a study undertaken by the Australian Bureau of Agricultural and Resource

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[5] www.comlaw.gov.au

[6] The totals made available for the three financial years (FY) were: FY 1994–95: A$ 6 million; FY 1995–96: A$ 8 million; and FY 1996–97: A$ 11 million. Any unused amounts in an allotted year could be rolled over into the following year. The *Customs, Excise And Bounty Legislation Amendment Act 1995*, however, reduced the total amounts payable as bounty by the following amounts in order to cover the costs of administering the act: FY 1994–95 and 1995–96: A$ 177 000; and 1996–97: A$ 262 000. These reductions did not affect the rate at which the bounty was paid.

Economics that had determined that an additional 310 million litres of ethanol alone (on top of the 40 ML per year then being produced) could be introduced into the Australian fuel supply from low-cost sources by 2010 (Howard and Anderson, 2001). From then on, the target of biofuels making a contribution of least 350 million litres (ML) to the nation's total transport fuel supply by 2010 became official policy.[7]

When it released its Final Report (Commonwealth of Australia, 2001a), in March 2002, the Inquiry called for instituting "a comprehensive and neutral fuel tax base." As it explained (p. 19):

> To remove the current distortions in the consumption and production of fuel types, the Inquiry recommends that the fuel tax base be extended and the taxation of fuels be placed on a neutral basis:
>
> • all liquid fuels should be included in the fuel tax system, **including ethanol, biodiesel**, LPG, liquefied natural gas (LNG) and CNG; and
>
> • fuel tax rates should be based on relative energy content of fuels, with the rate of diesel excise remaining unchanged at the time of implementation.
>
> Taxation of fuels by energy content, which maintains the current rate of excise on diesel, will allow for a reduction in the excise on petrol of around four cents per litre.
>
> [Emphasis added.]

Part of the Inquiry's terms of reference included assessing the impact of its recommendations. Regarding biofuels, it said:

> The Inquiry acknowledges that its recommendations may have a significant impact on some sectors of the economy, particularly industries involved in the production, distribution and supply of petroleum product substitutes.
>
> The extent of these impacts is difficult to assess. For some sectors, **such as ethanol and biodiesel**, where the industries are at an early stage of development, the imposition of excise will affect their future viability, even though it was based on an artificial tax advantage. However, the extent of investment in the industry is relatively small.

Many of the Inquiry's recommendations were subsequently acted upon over the next four years, including removing ethanol's tax-free status, and making both it, and biodiesel, subject to the same excise taxes as other fuels falling within their energy-content bracket.

While implementation of the Inquiry's recommendations was still being debated, in August 2002, news of an impending shipment of ethanol from Brazil reached Australia. One distributor of ethanol was hoping to import lower-cost Brazilian ethanol and benefit from the excise-tax exclusion. Domestic ethanol producers asked for protection, and they received it. The Australian Government rushed through legislation, the *Ethanol Production Grants* programme (EPG), which imposed the same excise and customs duty rate of A$ 0.38143 per litre on ethanol as was being applied to petrol and diesel. To offset this new tax, a production subsidy equal to the excise duty was created, paid on each litre of ethanol produced within the country.[8] Crucially, imported

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7 Some critics at the time pointed out that there are single plants in the United States which produce 350 ML a year or more. However, according to *Biofuels: A Growing Sector,* a joint report produced by Ecco Consulting and EnergyQuest, Australia's biofuel production capacity was likely to exceed the target by the end of 2007 if then current industry projects were completed. See www.naftc.wvu.edu/NAFTC%20eNews/December%2006/aroundtheworld.html and www.eccoaustralia.com

8 As a consequence, the ship carrying Brazilian ethanol was diverted from Australia and, according to one report (Kelly, 2003) eventually sold at a loss of A$ 1 million.

ethanol could not benefit from the subsidy. The EPG, which went into effect on 18 September 2002, was originally supposed to run for only one year.[9]

In May 2003, however, the Government announced that the grants would continue to be provided until 30 June 2008 (Australian Taxation Office, 2006a). It proposed that the effective excise duty rate on ethanol would then be increased in five steps, through declining producer payments, beginning 1 July 2008. The final excise rates for all fuels, which would take into account differences in energy content, would thus start to be applied from 1 July 2012. The Government, however, did not at the time say what the final rates would be (Webb, 2004).

Meanwhile, something had to be done about the tax treatment of biodiesel. While biodiesel sold neat (i.e., B100) did not attract excise duty, when added to normal diesel the resulting blended fuel did. The *Energy Grants (Cleaner Fuels) Scheme Act 2004*, which went into force on 18 September 2003, eliminated this anomaly, and applied a similar approach to supporting biodiesel as had been applied to ethanol—namely, making it subject to the same excise duty as its petroleum counterpart, diesel (A$ 0.38143 per litre), but offsetting this duty with a production subsidy of equal magnitude. In contrast to the way in which ethanol had been treated (a result of strong political lobbying against imports), imported biodiesel could also benefit from the subsidy (Australian Taxation Office, 2006b).

In response to criticism of its proposed changes to the fuel tax regime, the Australian Government announced, on 16 December 2003, several important changes to its previous proposals. Those relevant to biofuels included:

- adopting a banded excise system with different rates for high, medium and low energy-content fuels;
- keeping the excise duty on (low-sulphur) diesel and petrol at the same, then current rate of A$ 0.38143 per litre;
- applying an excise duty rate on "alternative fuels" (biodiesel, CNG, ethanol, LNG and LPG) at half the rate that would apply if excise were levied proportional to the energy content of the fuel band to which they were assigned (Table 2.1).

Table 2.1 Selected fuel excise rates to apply at the end of the phase-in period

Fuel type	Energy content (MJ/litre)	Normal excise rate (A$/litre)	Excise duty on alternative fuels (A$/litre)
High-energy-content fuels			
Petrol, diesel, biodiesel, GTL diesel	above 30	0.38143	0.191 (biodiesel; GTL diesel)
Mid-energy-content fuels			
LPG, LNG, ethanol, dimethyl ether	20 to 30	0.25	0.125 (LPG, LNG, ethanol)
Low-energy-content fuels			
Methanol	below 20	0.17	0.085 (methanol)

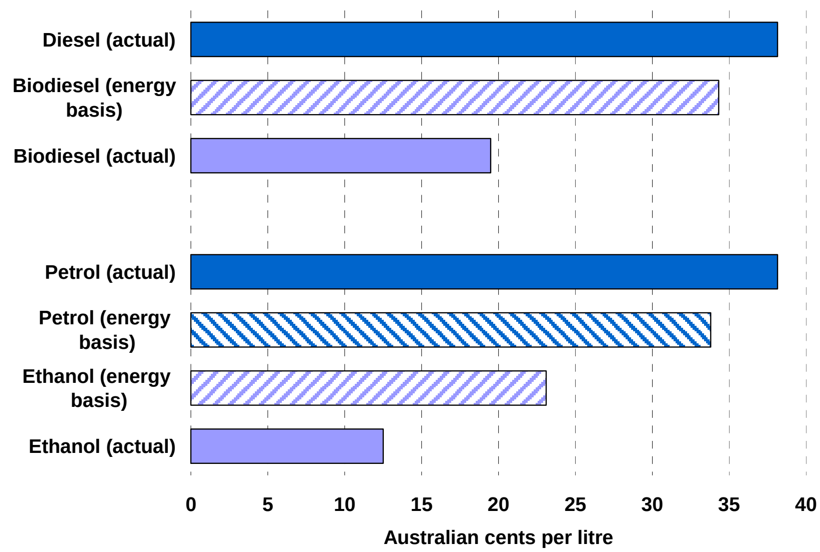
Source: Australian Government, *Securing Australia's Energy Future*, Canberra, 2004, p. 96.

9 The grants are administered by the Department of Resources, Energy and Tourism (DRET) and funded through a line item in the budget of the Australian Government.

However, implementation of these new proposed rates was delayed yet again when, on 25 March 2004, the government extended the producer subsidies for both ethanol and biodiesel beyond 2008 through the end of June 2011.[10] Production of these fuels would thus continue to be effectively excise-free until 1 July 2011, when full excise duty on these fuels would apply.

Webb (2004) commented at the time that the 50 per cent lower excise duty rates on alternative fuels appeared to be an arbitrary decision and bore the hallmarks of a political compromise. For example, for reasons of administrative simplicity, the government set the final effective rate for LPG and ethanol at the same level of A$ 0.125 per litre. Like ethanol, LPG was expected to deliver improved environmental and energy security outcomes relative to traditional fuels. As Webb points out, setting final effective rates for LPG and ethanol at half their energy-based rates would have yielded rates of A$ 0.13 and A$ 0.116 respectively. But, equally significant, had the excise duty on petrol been set proportional to *its* energy value compared with diesel, its rate would have been A$ 0.338, rather than equivalent to low-sulphur diesel (A$ 0.38143). As a result, when the full excise duty is applied to ethanol, it will be only one-third the rate actually applied to petrol (Figure 2.1).

Figure 2.1 Comparison of final actual excise duty rates with energy-adjusted rates for selected transport fuels in Australia



Note: Energy-adjusted rates are normalized to the excise duty rate on diesel.

Source: GSI based on data in Webb (2004).

2.1.2 The Biofuels Capital Grants Programs

While the excise tax treatment of transport fuels was being debated, the Federal Government gave a further boost to biofuel production through the creation of the Biofuels Capital Grants Program. Announced on 25 July 2003, the programme made available a total of A$ 37.6 million to fund one-off capital grants (up to A$ 10 million per project) for projects that would create new or expanded biofuels production capacity in Australia. Grants were provided at a rate of A$ 0.16 per litre for new capacity or capacity expansions of at least

[10] These measures form part of the reforms to the fuel-tax arrangements, which aim to bring all currently untaxed fuels used in internal combustion engines into the excise system by 2011.

five million annual litres per project. The grants were awarded competitively in two rounds (one ending in May 2004, the other at the end of August 2004), allocating A$ 12.4 million among three ethanol plants, and A$ 25.2 million among four biodiesel plants.

2.1.3 The Biofuels Taskforce

By 2005, world prices for petroleum had surpassed US$ 50 per barrel and, in Australia as elsewhere, interest in alternatives to supply the world's ever-growing demand for transport fuels reached fever pitch. In May 2005 the Australian Government, responding to this concern, established a high-level Biofuels Taskforce and commissioned it to evaluate the appropriateness of the 350 ML biofuels target, as well as examine a range of related technical issues, such as the effects of biofuel production on human health and the environment, and the effects of biofuel use on vehicle engine performance.

The taskforce worked quickly and, in September 2005, issued its report. Among its major findings were:

- there are potentially significantly greater health benefits from ethanol use than had previously been thought; and
- greenhouse and regional benefits are similar to previous research undertaken; but that
- the biofuels industry faces considerable market barriers, including low consumer confidence and high commercial risk; and
- on current settings the Government's biofuels production target of 350 megalitres (ML) by 2010 will not be met.[11]

In response to the Taskforce's report, then Prime Minister Howard reaffirmed the Government's commitment to the 350 ML target and announced a new package of measures mainly aimed at overcoming market barriers to biofuels (especially ethanol) and restoring consumer confidence in the biofuels industry.

2.1.4 The *Fuel Tax Act of 2006*

The recommendations of the 2001–2002 Fuel Taxation Inquiry took several years to formalize in legislation. This was partially completed with the passage of the *Fuel Tax Act 2006* and the *Fuel Tax (Consequential and Transitional Provisions) Act 2006*, both of which came into force on 1 July 2006.

The main purpose of the *Fuel Tax Act 2006* was to establish a single fuel-tax credit scheme. The act did not implement the proposed excise rates listed in Table 2.1, which would still have to be introduced and voted on in parliament in future legislation. As of March 2008, the approach to implementing the new excise rate has yet to be determined. Rather than adjust the excise rates, the government can only decide to adjust tax credit level to achieve the desired net effective excise rate (Webb, 2007).

Assuming that legislation implementing the new excise duty rates is passed before they go into effect, starting on 1 July 2011, the excise duty rates on ethanol and biodiesel will be partially offset for four years by declining per-litre payments under the Cleaner Fuels Grants scheme. Once the phase-in period is completed, on 1 July 2015, the full excise duty would apply to both ethanol and biodiesel.

The Energy Grants (Credits) Scheme Amendment Regulations 2006, passed as part of the *Fuel Tax Act 2006*, clarified a number of issues relating to biodiesel, by removing the stipulation that a blend of biodiesel and diesel must consist principally of diesel to qualify as "off-road diesel fuel", and that a blend of biodiesel and diesel must consist principally of biodiesel to qualify as "on-road alternative fuel". In addition, it established the grant rates for each year in the period 1 July 2006 to 30 June 2010 for each of the fuels that were currently prescribed as "on-road alternative fuel".

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[11] www.agric.wa.gov.au/content/SUST/BIOFUEL/BiofuelsTaskforceReport2005.pdf

2.2 State-level biofuel mandates

The response by the Australian biofuels industry to the change in new excise rate structure was highly negative. The industry and its proponents, especially those of biodiesel, claimed that phasing to a 50 per cent discount (formerly 100 per cent) on the excise duty constituted a reduction in support that would significantly deter long-term investment in new capacity.

One policy long advocated by the biofuels industry and its supporters has been to mandate levels of use, or a percentage blend ratio. Mandatory blending ratios for ethanol or biodiesel had already been adopted in several countries around the world, and has formed an integral part of Brazil's Proalcool programme since the 1970s. Even before that, according to Wells (2005), Queensland required mandatory blending of ethanol (supplied by Australian National Power Alcohol (ANPA) in Sarina) sold in the state from 1935 through 1957.

As of March 2008, the federal government had so far resisted turning the 350-ML target into a mandated volume. But, in 2006, both New South Wales and Queensland announced they would require that petrol sold within their borders contain, respectively, at least 10 per cent and 5 per cent ethanol by the beginning of 2011.

As an initial step in implementing the mandate, the New South Wales Parliament enacted legislation that requires two per cent of the total volume of petrol sold in New South Wales to be ethanol, which commenced in 1 October 2007.[12] Not all petrol sold in New South Wales will be a two-per-cent ethanol blend, but petrol wholesalers must ensure that ethanol makes up a minimum of two per cent of the total volume of sales (though increased distribution of E10). The mandate can be lifted for any given quarter at the discretion of the relevant minister, taking into account factors such as the price of producing ethanol compared with the average price of petrol in any given quarter, the availability of ethanol, the availability of water or feedstock to produce ethanol, consumer acceptance and matters pertaining to health or public safety.

In April 2007, the Victorian Government announced a commitment to a five per cent non-mandatory biofuels target by 2010. At around the same time, the state commenced a parliamentary inquiry into mandatory blending rates for biofuels. The inquiry released its final report in February 2008, with the key recommendation that Victoria should *not* impose a mandatory consumption requirement for biofuels (Parliament of Victoria, 2008). The rationale for this decision was that the potential for the costs associated with the introduction of a biofuels mandate would exceed the overall benefits, particularly when considering limited feedstock availability and the potential for increased biofuels production to place upwards pressure on feedstock and food prices.

None of Australia's other states or territories have plans to mandate or set a target for biofuel use.

2.3 Support for particular users of biofuels

Biofuels have also benefitted at times from programmes designed to lower the costs of fuel used by certain classes of businesses, or in rural areas. For example, ethanol was one of the fuels included in the *Diesel and Alternative Fuels Grants Scheme Act 1999* (DAFGS). The Act, which came into force on 1 July 2000, initially offered rebates for the use of ethanol, petroleum diesel, compressed natural gas (CNG) or liquefied petroleum gas (LPG) in commercial vehicles with a gross vehicle mass of 4.5 tonnes or more. In each year, ethanol benefitted from the highest rates (Table 2.2). For one year only, that is, before indexation was abolished in 2002, the applicable amounts were indexed to the consumer price index (CPI), hence the subsidy rates were four per cent higher in FY 2001–02 than in the previous year. A total of A$ 558 million[13] was paid out in FY 2000–01 and A$ 753 million in FY 2001–02 under the scheme. The allocation of those amounts to the individual fuels has not been reported, but it is unlikely that the scheme had much of an effect on ethanol use, especially given that a) most of the vehicles that would have been eligible for this subsidy were powered by diesel fuels and b) that the scheme ran for only two years.

12 *Biofuel (Ethanol Content) Act 2007* and Biofuel (Ethanol Content) Regulation 2007.

13 From August 2000 through June 2001.

Table 2.2 Grants available under the Diesel and Alternative Fuels Grants Scheme Act 1999 (Australian cents per litre)

Fuel type	FY 2000–01	FY 2001–02
Ethanol	20.009	20.809
Diesel	17.798	18.510
Compressed natural gas (CNG)	12.132	12.617
Liquefied petroleum gas (LPG)	11.466	11.925

Source: DAFGS Regulations Amendment 2000 No. 1; DAFGS Regulations Amendment 2001 No. 2.

The government of the day was keen to continue providing tax relief for businesses and off-road consumers of fuel, such as farmers and mining companies (see Box 2.1). But any new legislation had to await the outcome of the Fuel Taxation Inquiry, which did not conclude the results of its deliberations until after the DAFGS expired. The *Energy Grants (Credits) Scheme Act 2003* (EGSA) was what eventually emerged. The EGSA essentially combined two previous schemes into a single scheme, which replaced the by-then-expired *Diesel and Alternative Fuel Grants Scheme 1999* and the *Diesel Fuel Rebate Scheme* (under the *Customs Act 1901* and the *Excise Act 1901*). It further provided a grant to businesses for fuel used for specified on- and off-road activities by extending the scope of the DAFGS and providing clarity on eligible activities. In order to alleviate potential cash-flow problems for users, the Act also made provisions for them to be able to claim the grant ahead of use. Payment rates under the Energy Grants (Credit) Scheme (EGS) started to be phased out on 1 July 2007. They end definitively on 1 July 2010.

The *Fuel Tax Act 2006* was complemented by a *Fuel Tax (Consequential and Transitional Provisions) Act 2006*, also passed in June 2006. The latter revised and simplified the *Energy Grants (Cleaner Fuels) Scheme Act 2004* with a fuel tax credits system that will be progressively implemented over a six-year period from 1 July 2006. Final rebates paid by the new scheme to eligible users will also account for a road-user charge for heavy on-road transport vehicles. On-road use by vehicles over 4.5 tonnes GVM (gross vehicle mass) will pay a fuel tax up to the amount of the road user charge, with the remainder offset by the fuel tax credit.

Box 2.1 Subsidies for transport and fossil fuels in Australia

Governments in Australia provide substantial financial support for motor-vehicle transport, and for the production and use of fossil fuels, through direct payments, favourable tax treatment and other actions. Riedy (2007), in a recent study for Greenpeace Australia-Pacific, estimated that assistance to the petroleum sector in 2005–06 included A$ 262 million in the form of special corporate tax deductions for petroleum exploration and A$ 250 million in the form of exemption of petroleum condensate from excise taxes.

Road transport is subsidized through various schemes, but the biggest elements that Riedy found were the deficit between government expenditure on roads and revenues collected from road users (A$ 4.6 billion) and the availability of statutory formula method for determining the Fringe Benefits Tax (FBT) on employer-provided cars. Over 90 per cent of the identified transport and fossil-fuel subsidies were assessed as likely to increase greenhouse gas emissions.

Batten and O'Connell (2007) note that the above estimates include subsidies to motorists (such as the Fringe Benefits Tax concession) that would still apply if the motorists were running their vehicles on alternative fuels instead of fossil fuels.

Riedy (2007) estimated that eliminating the support measures identified in his study (worth the equivalent of A$ 0.38 per litre) would raise the cost of motor-vehicle transport by 32 per cent, which over the long term would yield an 18 per cent reduction in fuel demand for transport and an emission reduction of 12.5 Mt CO_2 equivalent (assuming the majority of transport is fossil-fuel based—which is highly likely in the foreseeable future).

Sources: Riedy (2007) and Batten and O'Connell (2007).

2.4 Biofuel quality standards

Biofuel-quality standards have played a crucial role in the development of the industry. The *Petroleum Excise Amendment Act 2000*, though its primary purpose was to combat the evasion of excise duty through the substitution of other fuels into petrol and diesel (such as toluene), also defined what blended petroleum products would be subject to excise tax. As well, it recognized excisable blended petroleum products as diesel fuel for the purposes of the DAFGS.

By around 2000, concerns began to be raised regarding the damage (mainly corrosion) that ethanol was believed to cause to automotive engines, particularly in older cars. Certain outlets in New South Wales had been selling petrol containing up to 20 per cent ethanol by volume. Motoring lobby groups, such as the National Roads and Motorists' Association (NRMA) and the Royal Automotive Club of Queensland (RACQ), were very vocal in their opposition to the blending of ethanol into petrol. Public alarm was also caused by reports of the spontaneous combustion of at least one car (allegedly on account of high ethanol content in the petrol tank). Reports of spontaneous combustion were later dismissed as unsubstantiated. But the damage to consumer confidence had been done.

The federal government responded by limiting ethanol blends to a maximum of 10 per cent (E10). The *Fuel Quality Information Standard (Ethanol) Determination Act 2003* defined an ethanol blend as petrol containing more than one per cent ethanol, and required standardized labelling of such fuel at retail outlets and upon provision to retailers. In 2005, the Government announced that up to five per cent ethanol could be blended in petrol before labelling would be required.[14]

The Fuel Quality Standards Amendment Regulations 2003 included ethanol under the definition of fuel. This enabled a fuel-quality standard to be set for ethanol blended with petrol and ensured that blending of ethanol with petrol was not excluded from the definition of a blend once ethanol became defined as a fuel. This ensured also that other fuel blends, such as diesel blended with biodiesel, were covered by the legislation. The regulations also broadened the definition of diesohol to include compositions of diesel and alcohol other than diesel and hydrated ethanol.

The federal government set a fuel quality standard for neat biodiesel (B100) in September 2003 as part of its responsibilities under the *Fuel Quality Standard Act 2000*. The Energy Grants (Credit) Scheme (EGCS) and the *Fuel Tax Act 2006* require biodiesel to meet this standard in order to be eligible for fuel grants or credits. Producers must therefore meet the standard, which can be costly to achieve, or forego the tax benefits.

In its November 2006 paper "Standardising Diesel/Biodiesel Blends", the federal environment department called for submissions to help create biodiesel blend quality standards (Department of Environment and Heritage, 2007). Some industry respondents considered that blend standards would impose additional market constraints on biodiesel producers by requiring further costly and time-consuming testing regimes. Such a regime could be impractical to implement if the onus were on biodiesel producers to conduct further testing and ensure that biodiesel/mineral diesel blends meet blend specifications, where they do not have direct control over the mineral diesel quality (Australian Renewable Fuels Limited 2007). The Government has also sought comment on the labelling of biodiesel.

Both Queensland and New South Wales have introduced higher limits on the Reid vapour pressure (RVP) of fuels sold in urban areas over summer months in order to accommodate E10. RVP is the commonly used measure of fuel volatility (its ability to change from a liquid to a gas). The higher the RVP of a fuel, the more likely it is to vapourize and boil in the fuel system at high operating temperatures. If too much vapour is formed, this can cause a decrease in fuel flow to the engine, which results in vapour lock—loss of power, rough engine operation or complete stoppage. This represents an obvious safety issue for vehicles.

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14 In addition, labelling would notify consumers that blends of ethanol-petrol blends of greater than five per cent had satisfied vehicle test requirements.

3 The liquid biofuels industry in Australia: structure and production costs

3.1 Industry structure

Compared with major producer nations such as the United States and Brazil, the Australian transport biofuel industry started later and its output is much smaller. Production of ethanol is dominated by companies already involved in processing sugar cane or cereals, whereas production of biodiesel is being undertaken by companies ranging from farmer co-operatives to firms with prior experience in the rendering industry.

3.1.1 Ethanol

3.1.1.1 Production capacity

Ethanol has been produced in Australia for use as a fuel for at least a century. As in many countries, for most of the period this production took place on an artisanal scale, mainly in remote rural areas. The first large-scale facility for producing ethanol in Australia was built in 1992 by the Manildra Goup in connection with its flour mill at Gunnedah, NSW. Together with its companion plant at the town of Manildra (near Orange, NSW), it processes over 1 000 000 tonnes of wheat per year.[15] The Manildra plant alone ranks as the ninth-largest flour mill in the world (Honan, 2001). Ethanol, produced primarily at its plant at Bomaderry, near Nowra on the NSW South Coast, is a by-product of the company's manufacture of gluten and industrial starch. Some starch and sugars are lost to the liquid effluent stream, which Manildra then ferments and distils into ethyl alcohol.

Manildra remained the sole producer of fuel ethanol for the next nine years and marketed the product mainly through independent fuel stations. Two other producers joined the Australian ethanol business around 2000, CSR Ethanol and W.H. Heck & Sons. CSR Ethanol is a profit centre of CSR (originally Colonial Sugar Refineries), one of Australia's oldest sugar refiners. The company began distilling ethanol from molasses in the early 1900s, but only recently moved into the production of fuel ethanol. Its plant at Sarina, Queensland, has the capacity to produce 50 to 60 ML of ethanol a year, though, until recently, sales for fuel were running at only about four ML annually. In 2006, the company expanded its fuel-making production capacity to 32 ML per year. The Heck plant, at Woongoolba, Queensland, began producing 1.2 ML of fuel-grade ethanol in 2001. It expanded its capacity to around 20 to 25 ML in early 2008.

Since 2005, numerous other companies announced their intention to build new ethanol production facilities (Table 3.1). Several of these companies are agricultural-processing companies, such as Manildra and Mackay Sugar, while others, such as the planned Dalby Biorefinery (a joint venture between Petro Fuel and Lubricants and the Queensland Fuel Group), are connected to the oil industry. The location of new plants will be based partly on proximity to feedstocks, rail lines, roads, and other links in the supply chain, but also proximity to the end-users. The majority of Australia's population is concentrated in the south-eastern quarter of Australia.

The construction of several of the plants has yet to begin. Much of the proposed new ethanol capacity, which would be based entirely on grain feedstock, appears to be contingent on the federal government mandating ethanol blending. Without a national mandated level of blending, several of the companies appear reluctant to invest in new capacity. In October 2007, Agri Energy Limited decided to defer its Australian biofuel projects (five facilities) citing uncertainty over feedstock costs, biofuel markets, government legislation and consumer acceptance in the Australian market.[16]

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15 www.manildra.com.au

16 www.indcor.com.au

Table 3.1 Existing and planned fuel-ethanol plants in Australia

Operator	Location	Production Capacity (ML/year)	Feedstock(s)	Status
Plants operational as of 1 January 2008				
Manildra Group	Bomaderry (near Nowra), NSW	100	waste wheat starch, some low-grade grain	Operational since 1992
CSR Distilleries	Sarina, QLD	30	C-molasses	Operational since 2000; expanded in August 2006
W.H. Heck & Sons—Rocky Point	Woongoolba, QLD	16.2	C-molasses, cane juice, sorghum	Operational since 2001 (expanded from 1.2 ML per year in March 2008)
Tarac Technologies	Barossa Valley, SA	0.5	grape marc (waste grape skins)	Operational since June 2006
Ethtec	Maclean, NSW	Pilot	cellulosic, from wood waste	Processing from December 2007
Plants under construction or planned				
Dalby Biorefinery	Dalby, QLD	55	sorghum	Expected August 2008
Primary Energy-BP	Kwinana, WA	160	wheat	Expected in 2008
Lemon Tree Ethanol	Millmerran, QLD	33.6	sorghum and wheat	Expected in 2008; *current status unknown*
Manildra Group	Bomaderry (near Nowra), NSW	100	waste wheat starch, some low-grade grain	Planned expansion, expected to be completed in 2009
Primary Energy-BP	Gunnedah, NSW	120	coarse grains (mostly sorghum) and wheat	Expected in 2009
Primary Energy-Pinkenba	Brisbane, QLD	160	unspecified grain	Expected in 2009
Grainol Ltd.	East Rockingham, WA	190	wheat	Expected in 4Q 2009
Mackay Sugar	Mackay, QLD	60	sugar cane	Planned for 2010
Grainol Ltd.	Picton, WA	190	wheat	Planned
Four Arrows (integrated with a dairy)	Coleambelly, NSW	300	Unknown	Planned (government approval provided in January 2008)
Cancelled or suspended				
Agri Energy Limited	Swan Hill, VIC	100	wheat, corn, barley	Expected in 2Q 2008; *cancelled in October 2007*
Agri Energy Limited	Condobolin, NSW	200	wheat	Originally planned for 4Q 2009; *cancelled in October 2007*
Agri Energy Limited	Oaklands, NSW	200	high-starch wheat	Originally planned for 4Q 2009; *cancelled in October 2007*
Agri Energy Limited	Murtoa, VIC	200	wheat	Originally planned for 4Q 2009; *cancelled in October 2007*
Agri Energy Limited	Coleambelly, NSW	200	wheat	Originally planned for 4Q 2009; *cancelled in October 2007*

Sources: Senate (2007); ABARE (2007); Mathews (2007); company web sites and e-mail communications with companies.

3.1.1.2 Blending and distribution

Initially, the distribution of ethanol in Australia was mainly undertaken by independent, non-integrated oil companies. In its testimony to the 2001–02 Fuel Taxation Inquiry, the Manildra Group claimed that its persistent overtures to the major fuel companies in Australia (mainly BP oil, Caltex, Mobil, and Shell) to sell its ethanol had so far been rebuffed (Honan, 2001). In 2001, the Group entered into a joint venture with Park Petroleum, a privately owned oil-distribution company, to market its ethanol in the Sydney-Wollongong area.

The integrated oil companies, however, are no longer ignoring ethanol. One company, BP Australia, is poised to distribute over half of the national target for biofuels by as early as 2008 (F.O. Lichts, 2007a).[17] In August 2007, it entered into an agreement with Manildra to purchase 40 ML of ethanol over the subsequent year, with the possibility of extending the arrangement for another two years. This was in addition to BP's existing 15 ML per year ethanol supply arrangement with CSR (BP Australia, 2007). BP Australia sells unleaded petrol blended with up to 10 per cent ethanol in 91 fuel outlets in Queensland and has entered the market in the Australian Capital Territory and New South Wales. Likewise, Caltex Australia has contracted with the Dalby Bio-Refinery (DBRL) to supply it with ethanol from the plant that is being constructed at Dalby, in Queensland. Under the terms of the deal, DBRL will supply Caltex with a minimum of 30 ML of ethanol annually for three years from the date of plant completion, which is expected to take place in 2008 (F.O. Licht, 2007b).

3.1.2 Biodiesel

3.1.2.1 Production capacity

Biodiesel started to be produced on a small scale in Australia during the early part of the 2000s at several pilot plants. Production was based on locally-sourced used cooking oil or virgin vegetable oils. In 2006 and early 2007, the industry grew quickly with the addition of several new plants with annual production capacities of 15 to 45 ML (Table 3.2). While most of these plants process some used cooking oil, their main feedstocks are either canola oil or tallow,[18] which can be supplied reliably in greater volumes. The 138 ML per-year plant at Darwin, Northern Territory, which came on stream in late 2006, differs from the others in that it was sited near a port in order to import its primary feedstock, palm oil, from Malaysia.[19] However, the plant suspended biodiesel production in December 2007, due to high feedstock costs and uneconomic market conditions for biodiesel production; it is now solely focussed on the production of refined glycerine (Fremlin, 2008).

As was the case for ethanol, a flurry of announcements of planned biodiesel plants during 2005 and 2006 pointed towards an imminent boom in construction. Detailed market assessments showed that the underlying economics of the industry looked even better than they did for ethanol. But these assessments depended on assumptions made about the price and availability of feedstocks that did not give adequate consideration to the combined effects on a global scale of increased demand for biodiesel feedstock oils and fats. These price increases have not only affected vegetable oils, but also tallow prices. Traditionally, rendered animal fat is the cheapest biodiesel feedstock available in the country. However, increased international demand and poor weather led to prices jumping by A$ 300 per tonne in one month (F.O. Licht, 2007c), with prices spiking to A$ 860 per tonne in June 2007 (Beer *et al.*, 2007). By January 2008 they had surpassed A$ 950 per tonne.[20]

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17 Included is the 23 ML of ethanol that BP contracted from CSR over a two-year period (BP Australia, 2006).

18 Tallow is a hard animal fat typically taken from body parts of cattle, horses, and sheep.

19 The pace of expansion in Malaysia's biodiesel industry may be slowing down. The price of crude palm oil more than doubled since 2006, while the price of crude petroleum declined. Government support in Malaysia for biofuels is also uncertain. In view of these considerations, the number of new entrants to the biofuels production market is expected to decrease from previous outlooks.

20 www.mla.com.au/TopicHierarchy/MarketInformation/DomesticMarkets/Processing/Coproducts/Co-products+monitor.htm

The changed tax situation for biodiesel as a result of the *Fuel Tax Act 2006*, particularly the phasing out of the Energy Grants (Credit) Scheme payments, also slowed expansion of the industry.[21] What is certain is that many of the plants planned as of 2005 have been either cancelled or suspended.

Table 3.2 Existing and planned biodiesel plants in Australia

Operator	Location	Production Capacity (ML/year)	Feedstock(s)	Status
Operational as of 1 January 2008				
Future Fuels	Moama, NSW	30	Canola oil	Operational since 2002
Biodiesel Industries Australia	Rutherford, NSW	15	Tallow, used cooking oil, canola oil	Pilot opened May 2003; expanded in December 2006
Smorgon Fuels (Biomax)	Laverton, VIC	12	Not known	Operational since 4Q 2004; expanded to 100 ML/year in 2006
Evergreen Fuels	Mossman, QLD	1	Used cooking oil	Operational since at least March 2006
Australian Farmers Fuels	Adelaide, SA		Canola oil, tallow, used cooking oil	Pilot plant since 2006
Eco Tech Bio Diesel	Narangba, QLD	30	Tallow, used cooking oil	Operational since May 2006
Biosel	Riverstone, NSW	4	Canola oil	Operational since 2007
Under construction or planned				
Australian Farmers Fuels	Adelaide, SA	15	Canola oil, tallow, used cooking oil	Expansion expected 2008
Riverina Biofuels	Deniliquin, NSW	40	Tallow	Originally planned for 2007 (construction had not yet commenced as of August 2007)[1]
Biodiesel Producers Limited	Albury-Wodonga, VIC	60	Tallow, used cooking oil, canola oil	Expected in 2008
Axiom Energy	Geelong Port, VIC	150	Used cooking oil, tallow, palm oil	Expected in 2008
BP Australia (renewable diesel)	Bulwer, QLD	110	Tallow ('renewable diesel')	Expected to commence operation in 2009
AJ Bush and Sons	Beaudesert, QLD	60	Tallow	Planned, *current status unknown*
Riverina Oils and Bioenergy	Wagga Wagga, NSW	165	Canola and safflower	Planned, *date unknown*

[21] For example, on 13 March 2007, Australian Biodiesel Group Limited announced it would seek an additional A$ 15.9 million in financing through an issue of stock in an effort to adjust to the changes in the biodiesel excise-tax structure.

Operator	Location	Production Capacity (ML/year)	Feedstock(s)	Status
Cancelled or suspended				
Australian Biodiesel Group	Berkeley Vale, NSW	(5)	Not known	Small batch plant, operated between 2001 and 2002; *suspended December 2006*
	Narangba (Caboolture), QLD	160	Tallow, canola oil, cottonseed oil	Operational since July 2006; *suspended November 2007*
Australian Renewable Fuels	Port Adelaide, SA	45.5	Canola oil, tallow, used cooking oil	Operational since March 2006; *suspended November 2007*
	Picton, WA	44	Canola oil, tallow, used cooking oil	Operational since early 2007, *suspended November 2007*
Natural Fuels Australia Ltd	Darwin, NT	138	Imported palm oil, soybean oil	Operational since November 2006, *suspended November 2007*
	Port Botany, NSW	140	Imported palm oil	*Plans cancelled late 2007*

1. See ABC News, "Riverina Biofuels restates Deniliquin commitment", 13 August 2007, at www.abc.net.au/news/stories/2007/08/13/2003555.htm

Sources: ABARE (2007); Mathews (2007); Fremlin (2008); company web sites.

3.1.2.2 Blending and distribution

The distribution of biodiesel in Australia is carried out both by independent oil companies and the oil majors. Recently, however, Caltex Australia Petroleum signed an agreement with Australian Renewable Fuels (ARF) Limited under which ARF will supply up to five ML of biodiesel a year from each of its plants (F.O. Licht, 2007d). The status of this agreement is unknown since ARF suspended its operations in November 2007.

A large but unknown percentage of biodiesel is sold directly to operators of private or government-owned fleets. Australian mining and earthmoving contractor Piacentini & Son, for example, committed to purchase up to eight ML directly from ARF over a 12 month period (F.O. Licht, 2007e). Despite successful trial results, the company is likely to review its commitment given ARF's suspension of activities.[22] RailCorp in NSW and Queensland Rail have expressed interest in running diesel-electric locomotives on B20 (Queensland Rail, 2006). Trials have also been done for use in passenger ferries in Sydney Harbour.

3.2 The long-term potential for biofuels in Australia

Recent analysis by the Rural Industries Research and Development Corporation (O'Connell *et al.*, 2007) suggests that biofuels based on first-generation feedstocks are likely to remain a minor contributor to

[22] See *Business Spectator*, "Fuelling change in transport", 14 February 2008, http://www.businessspectator.com.au/bs.nsf/Article/Fuelling-change-in-transport-BT2GQ?OpenDocument?OpenDocument

Australia’s transport fuel needs (between two per cent and five per cent of total consumption). However, second-generation technologies could lead to a greater role for biofuels in Australia's transport fuel consumption (10 to 20 per cent or higher) (O’Connell *et al.,* 2007).

3.2.1 First-generation technology

The cost of feedstock is the main factor likely to limit first-generation biofuel production. Traditionally, Australian biofuels were produced from by-products such as C-molasses, waste starch and used cooking oil. Because these are in limited supply, growth in first-generation biofuel production would have to be based on sugar, grains or oilseeds. Such feedstocks are more expensive and are in more direct competition with domestic food and animal feed users. The scope to import cheap feedstock is also limited, given that rapidly expanding biofuels industries in other countries is putting upwards pressure on prices.

If one considers only average market conditions, the Australian federal government’s target of 350 ML of ethanol consumption by 2010 could be met by diverting export grains into ethanol production, without affecting domestic grain prices to a significant extent. Urbanchuk, Barker and Wells (2005) assessed that Queensland alone could produce 400 ML of ethanol per year from molasses and sorghum that is currently exported, plus five per cent of sugar exports.

If the entire export fraction of Australia’s wheat and course grains production were converted to ethanol production, between 11 per cent and 22 per cent of Australia’s current petrol usage could be substituted by domestic ethanol. In the case of biodiesel, the conversion of all domestic waste cooking oil, tallow and oilseed exports could provide four to eight per cent of Australia’s current diesel usage (O’Connell *et al.*, 2007).

However, such levels of production are unlikely to be realized. Actual production of grains and oilseeds can fall well below the long-term average in some years due to rainfall variation. For example, if an E10 blend based on wheat were to be met in drought years wheat would need to be imported to meet demand requirements. Grain imports are restricted under Australia’s stringent quarantine standards, though processing near the port might be allowed as it presents a lower biosecurity risk.

The Centre for International Economics (2005) found that, based on current prices, the most economically efficient mechanism to meet a mandatory ethanol blending requirement would be to import ethanol from Brazil or produce ethanol domestically from imported feedstocks (CIE, 2005). However, this approach would thwart some policy objectives of mandatory blending.

Assuming that ethanol was produced locally from domestic feedstocks, the CIE study found that mandatory blending of ethanol at 10 per cent for petrol and 15 per cent for diesel would permanently increase the average price of grain in Australia by over 25 per cent. This would reduce the international competitiveness of Australia's livestock industry, which relies on grain for finishing (fattening) stock. If prices rose sufficiently, other grain users could seek to import grain. This option would not be available to many producers due to quarantine restrictions. A mandatory blending policy could therefore have an overall negative impact on the balance of payments because of lower exports of livestock products, a severe contraction in grain exports, and increased imports of grain.[23]

Factors that could increase the availability of feedstocks include: the expansion of crops such as wheat (into higher rainfall areas), sugar beet, sweet sorghum or mustard, and the planting of oil-bearing trees such as *Pongamia pinnata*, or genetically modified crops. The reallocation of all cotton land to sorghum production, for example, could increase Australian grain production by up to six per cent. However, the average sorghum price would need to be over A$ 400 per tonne to persuade cotton growers to switch crops (the average price of

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[23] The analysis in the CIE report suggests that in a non-drought year, mandatory blending of locally produced ethanol would lead to a reduction in imports of petrol and diesel valued at around $ 1.3 billion (at a US$ 40 per barrel price of oil). But the economy would forego exports valued at around A$ 2.1 billion and incur additional imports of $ 380 million to achieve this saving.

sorghum in 2007 was approximately A$ 200 per tonne). New irrigation developments in tropical regions such as the Ord and Daly River catchments have also been suggested for biofuel crops (Matthews, 2007).

Some changes to crop production, such as the use of genetically modified crop varieties, would need to gain government approval, including for sustainability. The RIRDC considers that if the biofuel industry remains at the margins in Australia (two to five per cent of total transport requirements), sustainability issues would be similar to those facing current agricultural systems. Any major expansion of irrigated agriculture in tropical areas of the country could have significant environmental consequences (Erskine *et al.*, 2003).

3.2.2 Second-generation technology

Biofuels could become a more significant contributor to Australia's transport fuel needs (greater than 10 to 20 per cent) if second-generation technologies were to make significant advances. Biomass feedstocks (ligno-cellulosic materials such as crop residues, grasses, farm forestry crops, forest products, and urban woodwaste) are plentiful in Australia. Crop residues alone could potentially support an ethanol blend in Australia of E43-E57 (O'Connel *et al.*, 2007a). If all potential second-generation feedstocks were directed to ethanol, domestic production could reach up to 140 per cent of Australia's current petrol usage.

An Australian Senate inquiry into Australia's future oil supply and alternative transport fuels concluded that production from lingo-cellulose appeared to be the only realistic way to make ethanol a mainstream fuel in Australia (Australian Senate Standing Committee on Rural and Regional Affairs and Transport, 2007). Cummine (2003) argues that second-generation technologies offer greater benefits to forestry, other rural industries, regional communities and the environment. As a result, he recommends that public funds should be focused on commercializing these technologies. Sustainability issues for second-generation feedstocks remain to be assessed, such as the effects of removing crop and forest residues on ecosystem carbon and biodiversity. The potential impacts would increase with the size of the industry, but the effects might not necessarily be negative. Bartle and Shea (2002), for example, argue that a large-scale industry in low rainfall areas based on native woody species could provide benefits for salinity reduction, ecological habitats and erosion control. On the other hand, a large-scale industry based on high-input agricultural systems could result in diverting water, human food and animal feed, and poor greenhouse gas outcomes due to high upstream energy requirements.

3.3 Biofuel production costs and revenues from by-products

One of the key summary points that emerged from the Biofuels Taskforce report was lack of data. There are currently no mechanisms in place for accurately measuring and reporting trends in production, sales, stocks, imports and exports of biofuels.

The following describes the method and data used by the CIE and GSI to estimate effective rates of assistance and volumes, and the ex-factor value (i.e., value added) of biofuel production. In producing these estimates, the CIE and GSI used a combination of publicly available data, such as information provided in company annual reports, together with data synthetically derived from known production relationships and rules of thumb.

3.3.1 Ethanol

The cost of producing ethanol depends on the volumes and prices of the ethanol produced, feedstock requirements and costs, other input costs, and revenues from by-products.

The factory return for ethanol for transport fuel is a critical factor in establishing the profitability of an ethanol plant. The average return from ethanol at the beginning of 2006 is estimated to have been around 50 cents per litre in Australia (Table 3.3). The Australian market is far too thin to observe a spot price and much of the ethanol is sold under contract to distributors. In the absence of this highly confidential information on a factory-by-factory basis, information from two sources can be used:

- parity pricing with petrol; and
- unit export data.

Ethanol has to compete with petrol and diesel as a source of energy, and therefore its competitiveness ultimately depends on the world price of crude oil. Australia uses the Malaysian Tapis crude price as its benchmark. This study uses a value chain to translate the world price of oil, used for Australian petrol, back to terminal gate price plus excise and thereby estimate the maximum price of ethanol possible if priced against petrol on an energy parity basis.[24]

The other source of information is trade data. However, unit export prices for ethanol on a FOB basis must be used with caution. Trade data identifies two ethanol categories: undenatured ethyl alcohol of an alcoholic strength of 80 per cent by volume or higher, and ethyl alcohol and other spirits, denatured, of any strength. Undenatured alcohol is relatively high in value and exported for use in alcoholic beverages in Japan and the Philippines. Fuel ethanol fits into the denatured category which provides the closest anecdotal evidence available.

3.3.1.1 Prices summary

Table 3.3 summarizes our estimates of the ethanol price for transport fuel. There is significant divergence between the two price series, something which probably reflects the tenuous state of the market. Demand for ethanol blends has remained at a low level despite very high petrol prices.

Table 3.3 Estimates of ex-factory ethanol prices

(A$ per litre)

Year	Parity petrol price		Export price
	With excise rebate	Without excise rebate	
2000–01	0.72	0.52	0.50
2001–02	0.68	0.48	0.69
2002–03	0.70	0.49	0.56
2003–04	0.85	0.47	0.44
2004–05	0.93	0.54	0.39
2005–06	1.03	0.65	0.53
2006–07	1.02	0.64	0.60

Note: Prices adjusted to equivalent ex-factory.

Source: ABS trade data and CIE calculations, updated by the GSI.

[24] Key assumptions in constructing the value chain were: a) the Singaporean refiner margin, freight and wharfage, and terminal margin were each US$ 4 per barrel, b) the excise on petrol was A$ 0.38143 cents per litre, c) the energy content of ethanol equalled 68 per cent of petrol, and d) the ethanol transport from plant to terminal cost A$ 0.04 per litre.

3.3.1.2 Feedstock costs

Feedstock is the largest per-unit cost item in ethanol production costs. For ethanol, the feedstock inputs currently being used in Australia are C-grade molasses (a molasses with low sugar content and therefore low energy content) and waste starch from the processing of grains, chiefly wheat and sorghum.

Both of these feedstocks are very low-cost inputs resulting from the production of some other primary product such as sugar. Their availability is therefore largely dependent on the production of the parent product. It is doubtful that production of either feedstock will emerge as a viable business in its own right. As a result, supply constraints will likely dampen further expansion of ethanol production from these sources.

C-grade molasses has experienced an increase in price in recent years and is currently valued at around A$ 80 to A$ 100 per tonne (Mulvay, 2008). Waste starch is much harder to value. However, the Australian Tax Office has estimated its worth at approximately A$ 0.10 per litre of ethanol produced (CSIRO *et al.*, 2003).

There is currently an insufficient supply of waste wheat starch and C-grade molasses to achieve the growth in production of ethanol envisaged by the Australian Government's policy objective of producing 350 ML of biofuels by 2010. An additional feedstock will therefore be required. Previous studies have shown that the most viable additional feedstock for a significant expansion of ethanol production in Australia would be feed grains, such as wheat or barley (CIE, 2005; ABARE, 2004).

3.3.1.3 Grain feedstock

The yield of ethanol from grain is around 380 litres per tonne. In the ABARE (Short and Riwoe, 2004) analysis, a sorghum price of A$ 137 per tonne was used based on the medium-term forecast price on an ex-farmgate basis. In their submission to the Biofuels Taskforce, the Stock Feed Manufacturers' Council of Australia (2005) noted that this price was well below the revised forecast price by ABARE of around A$ 170 per tonne. The Council also noted that the ex-farmgate price needed to be adjusted upwards in order to reflect a number of factors.[25] Together, these factors could account for between A$ 20 and A$ 50 per tonne. The upper end of the range would apply where grain has to be transported long distances and stored for long periods. The Stock Feed Manufacturers' Council of Australia submission to the Biofuels Taskforce, used an average sorghum price of A$ 260 per tonne delivered, which is around the level at which domestic grain swaps for May 2008 were trading in April 2008.[26]

3.3.1.4 Molasses feedstock

The yield of ethanol from molasses is 280 litres per tonne. The FOB price of molasses exports has recently ranged between A$ 80 and A$ 100 a tonne. A critical issue with investing in molasses-based capacity is the high variability of supply in the "C" molasses feedstock on both a seasonal and an annual basis (Short and Riwoe, 2004, and ABARE, 2007). Most of these plants are located next to a sugar mill that is active up to a maximum of six months a year. This presents a problem for ethanol producers because ethanol plants need to operate nearly the entire year to be profitable. In order to use molasses as a feedstock, therefore, an ethanol producer would either have to secure supplies of molasses out of the normal milling season or store the molasses for extended periods. Both of these options are very expensive.

Storing the ethanol for extended periods is possible, but because ethanol is hydroscopic (i.e., absorbs water from the atmosphere) it rapidly absorbs moisture from the air and therefore requires specialist storage facilities.

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25 Factors include the following: freight to deliver grain from the farm to the plant; handling and storage costs and losses to ensure the plant would be operational not just at harvest time;finance costs in holding grain from harvest until use; and grain supply marketing margins.

26 See CommonwealthBank Agribusiness, "Agricultural Commodity – Indicative Prices", 7 April 2008, at http://commodities.commbank.com.au/GAC_File_Metafile/0,1687,22956%255Fgrains%252520%2526%252520cotton%252520price%252520sheet%252520%252D%25252007%25252004%25252008,00.pdf

The other option is to close the plant during the cane off-season—the option costed here. This effectively doubles the capital cost of the plant on a per unit of output basis.

3.3.1.5 Capital costs

The initial investment in an ethanol plant is between A$ 0.97 and A$ 1 per litre of annual capacity. For example, the Dalby Bio-Refinery in Queensland, with a production capacity of 82 ML per year, is on record as costing A$ 80 million to build. After adjusting for the capital subsidy provided under the Biofuel Capital Grants Program (which was capped at A$ 10 million per project), the cost of the plant falls to A$ 0.85 per litre.

Following ABARE (Short and Riwoe, 2004), we have imputed the capital cost using a real rate of return of seven per cent and a plant life of 20 years. This translates to a capital cost, after subsidy, of A$ 0.084 per litre.

3.3.1.6 By-product revenues

The by-product of using feed grains to make ethanol is so-called distillers' grain, which has a yield of around 0.9 kg per litre of ethanol output. The wet grain meal that is commonly produced typically contains 27 per cent protein but little or no energy.[27] Potentially the sale of distillers' grain as animal feed, in its own right has the scope to improve the profitability of an ethanol operation. In its analysis, ABARE (Short and Riwoe, 2004) assumed a price for distillers' grain of A$ 220 per tonne, which contributed significantly to the profitability of ethanol production from that analysis. Since distillers' grains have virtually no energy content, they are generally included in feedlots to a maximum of 20 per cent of the dry ration.

In their submission to the Biofuels Taskforce, the Stock Feed Manufacturers' Council of Australia (2005) reported that the price for DDGS used by ABARE was far too high and not representative of the market. The Council stated that distillers' grain competes directly with other sources of protein such as canola meal. On this basis, the Council holds that a more appropriate return is between A$ 120 and A$ 150 per tonne ex-plant where the higher price reflected spot sales prices at the time. With only one producer of distillers' grain in the market at the moment, there is significant scope for downward pressure on price as new producers commence operations.

Distillers' grain that comes directly from an ethanol plant is a wet product that has a limited storage life and is costly to transport. To be transported off-site or stored, the moisture content must be reduced to 10 to 12 per cent and the effluent disposed of using a suitable method. This involves additional costs that reduce the return to the ethanol plant.

The by-product of molasses feedstock is dunder. Urbanchuk *et al.* (2005) state that dunder has some limited value as animal feed and possibly as a fertilizer. In our analysis we follow Urbanchuk *et al.* and assume a by-product value of 10 per cent of the input cost, but this is somewhat optimistic.

3.3.1.7 Labour and other costs

A rough estimate for employment at ethanol plants is one person per 2.4 ML of capacity. At an average annual wage of A$ 58 000[28] and 14 per cent on-costs, this translates to a labour cost of A$ 0.028 per litre. Other operating costs, including labour, range from 7.5 to 9.3 cents per litre of ethanol produced.

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27 Both wet distillers grain (WDGS) and dried distillers grain (DDGS) are produced in Australia. Protein content depends on the type of grain used and whether it is processed wet or dry. For instance, DDGS made from Australian sorghum is estimated to contain nearly 39 per cent protein (Urbanchuk *et al.*, 2005). To date, no DDGS has been imported from outside of Australia, though this may change owing to recent and dramatic drought-related declines in major domestic grain supplies.

28 Based on Australian Bureau of Statistics Average Weekly Earnings 2006–07 (total earnings for adult, full-time persons). Accessed on 20 February 2008 from www.abs.gov.au

3.3.2 Biodiesel

Typically, operators of small commercial and amateur-run biodiesel plants do not effectively account for labour costs, making it difficult to appreciate the total costs of production. Though many of these ventures have already proved successful, the commercial viability of larger plants is not assured. Outside labour may be needed, which forces proper accountability of these costs. Local sources may no longer be sufficient to supply feedstock requirements, thus leading to higher input costs and transport charges. Monitoring of larger plants becomes more difficult and results in the need for sophisticated and expensive monitoring equipment. Though important, it is difficult to assess the viability of plants on these criteria and establish a critical capacity at which regional plants are no longer viable.

3.3.2.1 Factory return for biodiesel

Biodiesel is a direct substitute for diesel and has approximately the same energy value. Various feasibility studies indicate there may be an issue with regard to the maximum blend of biodiesel possible (e.g., see Pahl, 2005). Some vehicles, including buses and private cars, are now running on 100 per cent biodiesel (B100), but the market penetration is limited by engine technology and manufacture's warranties, as well as the tendency of biodiesel to gel in cold weather.

Following the ethanol example, we estimate the biodiesel price off the diesel price using a value chain developed from import prices on a CIF basis and appropriate mark-ups and taxes along the distribution chain. Key data and assumptions in constructing the value chain are:

- the average landed price of diesel per litre was A$ 0.34 in 2003-04, A$ 0.49 in 2004-05, A$ 0.66 in 2005-06, and A$ 0.64 in 2006-07;
- the excise tax on diesel was A$ 0.38143 per litre over the whole period;
- biodiesel has an energy content 90.8 per cent that of diesel; and
- the average biodiesel transport ex-factory to terminal for blending is A$ 0.4 per litre.

This results in an average ex-factory value of A$ 1.27 per litre in 2006-07.

3.3.2.2 By-product revenues

The main by-product of biodiesel production is glycerol. Most commonly referred to as glycerine, it is used in countless products including drugs, soaps, toothpastes, foods and plastics (Pahl, 2005).

The emergence of the biofuel industries on a worldwide scale, although small in terms of total world fuel usage, has suppressed glycerine prices from highs of nearly A$ 2 000 per tonne in the third quarter of 2000 down to around A$ 800 per tonne in the corresponding quarter of 2005. Beer *et al.* (2007), in their analysis of biodiesel costs, assume a price of A$ 850 per tonne. With a yield of eight per cent per litre of biodiesel produced, that amounts to a little under A$ 0.06 per litre in by-product revenue. However, recent prices quoted in the U.S. press indicate prices for unrefined glycerine in the of less than US$ 100 per tonne. For the purposes of this analysis, we assume the price of glycerine was A$ 850 per tonne in 2003-04, but decline to A$ 88 per tonne (corresponding to US$ 0.04 per pound) in 2006-07.

Biodiesel production from canola also produces canola meal. Canola meal, like distillers grain, is a high-protein livestock feed supplement. Approximately 2.4 kilograms of meal is obtained from every litre of biodiesel produced. In terms of revenue, this is equal to A$ 0.348 per litre of biodiesel using an optimistic price of A$ 145 a tonne. Reducing the price to A$ 120 per tonne lowers this revenue to A$ 0.288 per litre of biodiesel.

3.3.2.3 Capital costs

Capital costs for biodiesel production facilities are much lower than those in the ethanol industry. Two proposed plants in Western Australia (both now cancelled or suspended) were expected to cost A$ 16.38

million and A$ 18 million for, respectively, 35 ML and 44 ML per year capacities. In simple terms, this is the equivalent of A$ 0.44 per annual litre.

By employing the methodology applied above, the capital cost can be calculated using a real rate of return of seven per cent and a life of 20 years in order to obtain a capital cost of approximately $A 0.35 per litre.

3.3.2.4 Labour and other costs

Like capital costs, labour requirements are lower for biodiesel than ethanol. For example, the biodiesel plant at Darwin's East Arm business park has a potential capacity of 150 million litres annually (but biodiesel production is currently suspended). The plant employs 20 people in on-going roles when operating, while a 40 million litre plant in Rutherford, NSW employs 12 people. Again, using an average salary of A$ 58 000 and on-costs of 14 per cent, this equates to a labour component of around A$ 0.012–A$ 0.088 per litre of biodiesel.

3.3.3 Nominal and effective rates of assistance

Table 3.4 summarizes the calculations made by the CIE, and updated by the GSI, of the nominal and effective rates of assistance to different biofuels. The nominal rate of assistance (NRA) measures the change in income as a result of both price and direct income support as a proportion of income in a situation of no support policies (the "no-policy situation"). The effective rate of assistance (ERA) measures the same change relative to value added under a no-policy situation. A negative ERA indicates that the unassisted value of inputs to the production of a good is greater than the unassisted value of the good itself.

Table 3.4 Summary of nominal and effective rates of assistance for Australian biofuels (per cent)

Biofuel	2003–04	2004–05	2005–06	2006–07
Ethanol from waste wheat starch				
Nominal rate of assistance on outputs	145	139	96	89
Effective rate of assistance	293	268	142	128
Ethanol from molasses				
Nominal rate of assistance on outputs	131	126	88	82
Effective rate of assistance[1]	-256	-1102	1296	-1580
Ethanol from sorghum[2]				
Nominal rate of assistance on outputs	97	100	73	69
Effective rate of assistance	207	304	240	240
Biodiesel from tallow				
Nominal rate of assistance on outputs	57	47	40	42
Effective rate of assistance	4723	152	102	201
Biodiesel from waste cooking oil				
Nominal rate of assistance on outputs	57	47	40	42
Effective rate of assistance	109	72	58	70
Biodiesel from canola oil				
Nominal rate of assistance on outputs	57	47	39	40
Effective rate of assistance[1]	-68	-165	-209	-74

Notes: 1. When negative, the unassisted value of inputs is greater than the unassisted value of outputs.

2. Until recently, there was no biofuel production in Australia using this feedstock.

Source: CIE and GSI calculations.

One clear observation from this analysis is that Australia's biofuels industry is heavily supported compared with other industries in Australia. Nominal rates of assistance for ethanol (70–90 per cent or greater) are roughly double those for biodiesel (around 40 per cent), but both would be considered high by normal standards. The same goes for the ERA. According to the Productivity Commission's *Trade & Assistance Review* for 2006–07 (Productivity Commission, 2008), the ERA for agriculture and for manufacturing as a whole now averages around five per cent, while the two most heavily assisted industries, (dairy cattle farming, and textiles, clothing, footwear & leather) each had ERAs of under 16 per cent in 2006–07. By contrast, the ERAs for all biofuels have been 50 per cent or more.

What is also interesting is that the unassisted value of several of the inputs to biofuel production in Australia has often been greater than what the outputs (ethanol and biodiesel) would have been valued at in the absence of assistance. As indicated by their negative ERA values, this has been especially true for ethanol made from C-molasses, and biodiesel made from canola oil. This suggests, in effect, that biofuel policies are diverting some feedstocks away from more economically viable uses.

4 Current support for ethanol

4.1 Output-linked support

The two ways in which governments support output of a good directly is through *market price support* and direct subsidies, or bounties (including subsidy-like instruments, such as tax exemptions), that are provided in a manner proportional to the volume produced. Market price support normally involves transfers from consumers to producers through higher prices, and is typically provided through tariffs or other border measures. It is measured by comparing a reference price—e.g., an import unit value before an import tariff is applied—with the price received by the producer.[29]

In the market for biofuels, the existence of market price support is complicated by domestic policies, especially mandated blends or volumes. When only a tariff is in place, competition from foreign suppliers of ethanol will be reduced, but domestic manufacturers must still compete with non-ethanol alternatives, notably petrol. However, a mandate forces the use of ethanol. With a mandate but no tariff, the amount of ethanol sold domestically would be possibly higher than otherwise, but its price would be constrained by foreign competition. A mandate plus a tariff both raises the threshold price at which foreign-sourced ethanol becomes competitive, and protects domestic suppliers from being undercut by the price of petrol.

At present, the Australian federal government has established a voluntary biofuels target (not distinguished further by type of biofuel) of 350 ML by 2010, but as of March 2008 it had so far avoided making this target mandatory. At the state level, however, New South Wales will require that all unleaded petrol produced and wholesaled within its borders contain 10 per cent ethanol by 2011; Queensland has mandated a 5% blend by 2011.[30] New South Wales has also set an interim requirement that fuel wholesalers blend a minimum of two per cent ethanol into the total volume of petrol they sell in New South Wales. A parliamentary inquiry in the state of Victoria recently recommended against mandatory blending of biofuels in that state (although the government has yet to release its response to the inquiry's report). No other Australian other state or territory has set a target for ethanol use. (See section 2.2 for more detail.)

Given that the ethanol mandates will be taking effect after the last budget year (2006–07), it is premature to estimate what, if any, market price support will be generated by government policies.

4.1.1 Support based on current output

Since September 2002, ethanol produced in Australia has been subjected to an excise duty of A$ 0.38143 per litre (equivalent to petrol).[31] Domestic producers are given a grant that exactly offsets the excise duty, but this grant is not available for imported ethanol.

The domestic production grant will be progressively phased out between 2011 and 2015. On 1 July 2011, the excise duty on ethanol will drop to A$ 0.125 per litre, and the Ethanol Production Grant will disappear and be replaced by payments under the Energy Grants (Cleaner Fuels) Scheme. The Cleaner Fuels Scheme grants will pay a bounty to final distributors on each litre of ethanol it sells for fuel, at a declining rate over time. This rate is scheduled to start at A$ 0.10 per litre in 2011 and disappear on 1 July 2015.

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[29] A complicating factor for ethanol is that it can be both a complement to petrol when it is used as an additive, and a substitute for it when used as an extender. This makes estimating the appropriate reference price more difficult.

[30] Both states made these announcements in August 2006. Contemporaneously, New South Wales announced the establishment of an Ethanol Mandate Taskforce, charged with examining a number of key issues related to implementing the proposed mandate. For more details, see Thompson (2008).

[31] Excise is a tax the federal government imposes on certain goods sold in Australia.

In addition to the production grants, the discount on the excise duty confers a subsidy. Following Short and Riwoe (2005), we estimated that if ethanol were charged excise duty proportional to petrol on an energy equivalent basis once the energy-based excise regime goes into effect, it should be charged A$ 0.259 per litre, rather than A$ 0.125 per litre. Thus the total benefit may be estimated as the difference between the "normal," non-discounted excise duty and the effective excise duty, as reduced from the actual excise duty by the production grants.

Table 4.1 summarizes the official and effective fuel excise rates for biofuels from 2002 out to full implementation of final excise rates in 2015–16. These rates are given in nominal terms since indexing the excise duty to inflation was abandoned by the Australian Government in 2003.[32]

Table 4.1 Effective fuel-tax rates for ethanol in Australia, 2002–2015 (Australian cents per litre or per cent)

Year starting 1 July	Actual excise duty	Ethanol production grant	Energy Grants (Cleaner Fuels) Scheme payment		Effective excise duty	"Normal" non-discounted excise duty	Net rate of subsidy
			As a % of excise duty	In cents per litre			
2002 to 2010	38.143	38.143	0	0.0	0.0	38.143	38.143
2011	12.5	0.0	80	10.0	2.5	25.9	23.4
2012	12.5	0.0	60	7.5	5.0	25.9	20.9
2013	12.5	0.0	40	5.0	7.5	25.9	18.4
2014	12.5	0.0	20	2.5	10.0	25.9	15.9
2015 and after	12.5	0.0	0	0.0	12.5	25.9	13.4

Note: Assumes that production subsidies are passed on to users.

Source: CIE and GSI.

The incidence of excise duty on fuels, and therefore the value of the fuel subsidies, works slightly differently in Queensland. There, since it was introduced in 2000, a subsidy of A$ 0.08354 per litre is paid to qualifying bulk end users (BEUs)[33] and retailers of petrol and diesel in order to offset part of the federal excise duty. (Before that, Queensland motorists did not pay fuel franchise tax.[34]) Retailers are required to pass on the entire value of

[32] The net effective excise duty for ethanol as faced by different categories of end users will depend on the incidence of the energy grants to producers and the eligibility of users for the relevant rebate schemes (see Section 4.4.3).

[33] Between 1 July 2000 and 31 May 2006, the subsidy for diesel was limited to road vehicles with diesel engine that were designed solely or principally for transporting persons, goods or animals by public road. On 1 June 2006, eligibility for the subsidy was extended to the diesel consumed when travelling on a public road by certain vehicles or equipment (such as concrete-pumping trucks, mobile cranes, elevating work platforms, truck-based drillers, and truck-based street sweepers) that previously were not eligible for the subsidy because of their design. For further information see: www.osr.qld.gov.au/fuel

[34] On 6 August 1997, the federal government increased the excise on petrol and diesel by 8.1 cents to 42.797 cents per litre in response to a High Court ruling that cast doubt on the constitutional validity of state franchise fees (including on petrol). On 6 August 1997, the Commonwealth announced 'safety net' arrangements to protect state finances including an increase in the rates of excise (and customs duty) on petroleum products. All revenue collected under these arrangements were returned to the states as revenue-replacement payments. Queensland was the only state that did not impose franchise fees and the increase in the excise on petrol meant that petrol prices in Queensland rose by

this subsidy to their final consumers in the form of lower prices. Effective 1 December 2006, the types of fuel that could be claimed by either a BEU or a retailer were expanded to include fuels that can be used as a replacement fuel for motor spirit or diesel of a type ordinarily sold by a retailer—i.e., ethanol and biodiesel, or blends containing these fuels—as long as the fuel complies with the fuel standard in force under the *Fuel Quality Standards Act 2000*.[35]

Table 4.2 provides estimates of the total net value of the Ethanol Production Grant bounties from 2002 through 30 June 2011, and the Cleaner Fuels Grants and excise duty discount in FY 2011–12. The total value of these subsidies will rise with expansion of output, but will fall beginning in mid-2011 as the new excise duty is applied and the production grants begin to decline. Nevertheless, if planned new capacity gets built, the value of the bounties could reach several hundred million dollars per year before the end of the decade.

Table 4.2 Estimated value to Australian producers of ethanol of the combined effects of production grants and excise-tax discounts, FY 2002–03 through FY 2010–11

Budget year (1 July – 30 June)	Net benefit (A$/litre)	Volume produced (ML)	Total value (A$ millions)[1]
2002–03	0.38143	56.9	21.7
2003–04	0.38143	28.3	10.8
2004–05	0.38143	22.5	8.64
2005–06	0.38143	40.3	15.6
2006–07	0.38143	83.5	31.9
2007–08 projection	0.38143	100–165	38–63
2008–09 projection	0.38143	165–240	63-90
2009–10 projection	0.38143	480–600	180–230
2010–11 projection	0.38143	550–800	210–300

1. From 2008–09 onwards, values have been rounded to the nearest A$ 10 million.

Source: • production volumes, 2002–03 through 2004–05: Senate (2006a and 2007); production volumes 2005–06 and 2006–07: ABARE (2008);• total values, 2002–03 through 2005–06: Webb (2007b); • all other calculations: GSI.

4.1.2 Tariffs and other border measures

Ethanol imported into Australia (except, since 1 January 2005, from the United States[36]), whether undenatured or denatured, attracts a five per cent *ad valorem* tariff that is applied to the FOB value of imports[37] before the customs duty is levied. Since September 2002, that customs duty has replicated the excise duty imposed on

A$ 0.081. The Queensland Government decided to use the revenue-replacement payments to subsidise petrol prices so that Queensland consumers noticed no change in prices.

35 www.osr.qld.gov.au/fuel

36 In 2004, Australia and the United States signed the Australia-United States Free Trade Agreement (AUSFTA). This FTA came into effect on 1 January 2005, from which point onwards imports of ethanol from the United States could enter the country without paying the five per cent tariff.

37 FOB refers to "free on board", i.e., the value of a good once it has been placed on board the vessel at the named port of origin (loading).

domestic petrol and ethanol (A$ 0.38143 per litre). While domestic producers are given a grant that offsets the excise duty, this grant is not available for imported ethanol. The combined effect of identical tax treatment but differential subsidy treatment is as if imported ethanol were subject to an A$ 0. 38143 per litre specific-rate tariff. While this discrimination against imports may confer some market price support, this study does not count both the production credit and the customs duty as support for ethanol—only the former. The assistance conferred by the customs duty is likely to be relatively small, given low actual and potential trade.

Table 4.3 Effective import duties on ethanol

(Australian cents per litre)

Year starting 1 July	Excise Duty	Tariff (%)
2002 to 2010	38.143	5
2011	2.5	5
2012	5.0	5
2013	7.5	5
2014	10.0	5
2015 and after	12.5	5

Source: Fuel Tax Bill 2006, Customs Tariff Schedule.

When the excise duty on ethanol begins to be phased out from 1 July 2011, the customs duty on imported product will also fall. At that point, different effective tax treatment between imported and domestically produced ethanol will end. Ethanol from both sources will benefit from grants under the Cleaner Fuels Grants Scheme, which will start at A$ 0.10 per litre and decline by A$ 0.025 per litre per year, finally disappearing on 1 July 2015. These grants will be paid to the last licensed entity in the supply chain, which in most cases will be the entity dispensing the fuel.

4.2 Subsidies to factors of production

Ethanol plants have benefitted from a number of federal programmes that have subsidized the capital costs of creating new or expanded production capacity. This study was not able to determine whether state or local governments have assisted ethanol companies in the process of land acquisition for new plant sites.

4.2.1 Grants under renewable energy programs (1999 to 2003)

All the existing plants producing ethanol for fuel in Australia have benefitted from some form of government assistance with regard to the cost of building the plants or providing key equipment. Others have also received grants in order to partially offset the costs of feasibility studies or engineering and design work.

In 1999–2000, the Manildra Group was successful in securing a grant of A$ 1 million under the Renewable Energy Commercialisation Programme (RECP) for the commercial demonstration of two production technologies, viz., continuous fermentation and molecular-sieve dehydration. These technologies enabled the plant to reduce its energy use (by more than 50 per cent) and to achieve other efficiency gains that reduced the cost of producing a litre of ethanol by approximately 26 per cent.[38]

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[38] www.greenhouse.gov.au/renewable/recp/biomass/two.html

In April 2001, the then Department of Environment and Heritage announced it would fund up to A$ 7.35 million (out of of a total project cost of A$ 33.91 million) of an ethanol plant that was to be built in northern Queensland. As originally conceived, the project would have included an ethanol production plant using by-products from a sugar mill. Though a Deed of Agreement was signed in September 2001, no funding was transferred to the ethanol production aspect of the proposed project. Indeed, in 2005 the ethanol component was removed from the project at the request of the proponent.

In 2003, W.H. Heck and Sons Pty Ltd received a A$ 350 000 grant under the Renewable Energy Industry Program (REIP) in order to undertake trials involving the burning of biomass at its existing sugar mill at Rocky Point, Queensland and to conduct extensive research into sources of biomass fuel other than bagasse that could be used outside the normal bagasse-burning season (Australian Greenhouse Office, 2003). The project went on to be awarded a Renewable Energy Showcase grant of A$ 3 million towards the construction of a A$ 55 million biomass cogeneration plant attached to the mill.[39] The new plant operates year-round, using not only bagasse, but also locally sourced waste to provide electricity to the Queensland grid. Year-round energy supply from the cogeneration plant has made it possible for the sugar mill to distil fuel alcohol outside of the period when only bagasse would be available as a fuel source.

4.2.2 Support under the Biofuels Capital Grants Program (2003–04)

More recently, the Biofuels Capital Grants Program (BCPG) provided grants at a rate of A$ 0.16 per litre of installed capacity for new and expanded projects producing a minimum of five ML of biofuel a year. These grants were limited to a maximum of A$ 10 million for each project. Seven projects were offered grants, awarded in two rounds during 2004, worth in total A$ 37.6 million. Of this amount, A$ 12.4 million supported three ethanol projects:

- A$ 4.16 million to CSR Distilleries for a fuel ethanol plant at Sarina, Queensland;
- A$ 2.4 million to W.H. Heck and Sons Pty Ltd for an ethanol plant at its Rocky Point Sugar Mill and Distillery in Woongoolba, Queensland;
- A$ 5.85 million to Lemon Tree Ethanol Pty Ltd for an ethanol plant at Millmerran, Queensland.

The grants are payable in three installments: (1) 25 per cent on evidence of final investment decision and the commencement of construction, (2) 25 per cent on commissioning of the plant, and (3) 50 per cent on the first commercial sale into the domestic transport fuels market.[40] As of the first quarter of 2008, only the first two plants had commenced construction, and none had yet been commissioned.

4.2.3 Grants under programmes targeted at the sugar industry (2002 to 2006)

Several other ethanol projects have received funding under the A$ 10 million dollar Sugar Industry Innovation Fund (SIIF), which was announced in September 2002 as part of an integrated sugar-assistance package and continued through December 2006. CSR Limited, for example, was awarded A$ 250 000 (plus GST[41]) to help pay for engineering design work on its dehydration plant at the Sarina Mill. These funds were also used to help the company purchase the latest ethanol dehydration technology from the United States. Several other ethanol-related projects received grants under the SIIF:

- Mackay Sugar Co-operative Limited was awarded A$ 50 000 (plus GST) to investigate ways to integrate the world's best-practice ethanol technology into its sugar-refining operations.

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39 www.greenhouse.gov.au/renewable/projects/showcase.html

40 www.ausindustry.gov.au/content/content.cfm?ObjectID=8B98D9B4-D244-43EF-A4AA7D42B39DFE1B

41 Most of the financial assistance included an additional contribution to offset the Goods and Services Tax (GST). The GST is tax on the supply of goods and services in Australia that functions in a similar fashion to a value-added tax.

- Bundaberg Sugar received A$ 50 000 (plus GST) for a pre-feasibility study and A$ 200 000 (plus GST) to help finance the design phase of developing ethanol production at its Arriga mill site on the Atherton Tableland in northern Queensland.
- A consortium of Burdekin cane growers, Austcane Ltd., was awarded A$ 250 000 (plus GST) for a feasibility study into setting up an integrated sugar mill, cogeneration plant and ethanol distillery.[42]

Yet another source of grants supporting investment in ethanol plants has been money provided by the federal Department of Agriculture, Fisheries and Forestry (DAFF) to designated "Sugar Industry Regional and Community Projects" under the Regional and Community Projects (RCP) Scheme. The RCP in turn forms part of the Government's Sugar Industry Reform Programme 2004.

In the first round of RCP grants, no ethanol projects were directly targeted. However, in the second round, announced in April 2006,[43] DAFF made available up to A$ 11.65 million to Bundaberg Sugar Ltd to construct a flexible-feedstock fuel-ethanol facility adjacent to its Arriga mill site on the Atherton Tableland in northern Quensland. The plant would have also produced a liquid fertilizer and a vinasse-based fertilizer. In October 2006, however, the company announced that it could not secure a buyer for the ethanol and that it was therefore planning to shelve its plans to build an ethanol plant.[44] The A$ 11.65 million grant was subsequently returned to the DAFF, and thus became available for use in the third round of RCP grants,[45] announced in December 2006. The recipients in that round included:

- Mackay Sugar Co-operative Association Ltd., which will receive up to A$ 12 million to help the company build a cogeneration plant in Queensland based on renewable energy. According to DAFF, the project involves producing electricity in the shorter term and ethanol in the medium term.
- W.H. Heck and Sons Pty Ltd, which will receive up to A$ 500 000 to modify infrastructure at its Rocky Point Mill in Queensland. According to DAFF, this work will improve ethanol production, as well as the extraction of organic sugar and high-quality conventional sugar from cane.

In its announcement for the final round of RCP grants, the DAFF indicated that it be seeking to provide funding for smaller projects that can be quickly implemented and fully operational by June 2008.[46]

4.2.4 Grants under the Greenhouse Gas Abatement Programme (2002 to 2006)

The *Greenhouse Gas Abatement Program* (GGAP), created in 2000, is another source of funding for the biofuels industry. The objective of GGAP is to reduce Australia's net greenhouse gas emissions by supporting activities likely to result in substantial emission reductions or sink enhancement. While Australia only signed the Kyoto Protocol in December 2007, the previous federal government had also undertaken to meet its targets.

Projects funded under GGAP are also expected to provide complementary benefits, such as opportunities for rural and regional Australia, ecologically sustainable development, employment growth, or the use of new technologies and innovative processes, and non-government investment. A$ 400 million was allocated to the program. Two significant biofuels projects were funded: A$ 7.35 million for development of an ethanol plant in north Queensland and A$ 8.8 million to BP Australia Ltd for the production and marketing of E10 in the Brisbane region (Bioenergy Australia, 2001). (BP subsequently suspended its trials in the wake of public concerns about the corrosive effect of ethanol on cars.)

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42 The study was conducted by Dedini, a Brazilian company that builds sugar-cane mills.

43 "$36 million boost to sugar industry's future", www.maff.gov.au/releases/06/06039pm.htm

44 www.abc.net.au/news/australia/qld/summer/200610/s1763384.htm

45 "$33 million to boost sugar industry's future", www.maff.gov.au/releases/06/06180pm.html

46 "$14 million for final Sugar RCP Grants", www.maff.gov.au/releases/07/07035pm.html

Table 4.4 CVC REEF investments and government contributions (Australian $)

Recipient	Total investment from CVC REEF	Estimated Australian Government contribution to CVC REEF	Date capital contributions were awarded to recipients
Agri Energy Ltd	262 500	175 000	December 2004
	100 000	66 667	August 2005
	2 627 500	1 751 667	May 2006
	1 000 000	666 667	December 2006
Alternative Fuels Corporation Pty Ltd, NSW	180 675	120 450	November 2006
	146 175	97 450	February 2007

Source: CIE estimates.

At least two companies involved in, or planning to become involved in, the production of fuel ethanol have benefitted from equity injections under the *Renewable Energy Equity Fund* (REEF), which is administered by AusIndustry on behalf of the Australian Greenhouse Office (AGO). This fund is managed by CVC REEF Investment Managers Ltd., a private investment company, and details of investments are treated by the AGO as commercial-in-confidence. However, according to AusIndustry, approximately two-thirds (A$ 18 million) of the funds invested through the REEF originate from the Australian Federal Government.[47] Based on this ratio, it is estimated that government support to ethanol via REEF amounted to approximately A$ 2.9 million between December 2004 and February 2006 (Table 4.4).

4.3 Policies affecting the costs of intermediate inputs

Policies affecting biofuel inputs include measures that influence the price and availability of raw materials and intermediary products used in the production of biofuels. At present, two biomass feedstock sources are used commercially in order to produce ethanol in Australia. Approximately 90 per cent of Australian ethanol is currently produced from waste starch from grains (mainly wheat and sorghum), and the remaining 10 per cent is produced from C-grade molasses. Moreover, all the planned ethanol plants would use starch derived from grains as their feedstock. Ethanol production from ligno-cellulosic material or woody plant mass is currently in the research and development stage in several countries.

4.3.1 Assistance to grain producers

The price of feed grain is a very important factor in the production of ethanol in Australia. Feed grain prices are volatile owing to the susceptibility of grain production to the effects of drought. At times, feed grain must be sourced from grain for human consumption, or from overseas.

Currently, there are no direct or indirect subsidies provided to the grain industry through marketing schemes or government support programs. Potential impacts on the ethanol industry from current support or regulation in the grains sector during normal (non-drought) years is estimated to be minimal.

[47] www.ausindustry.gov.au/content/azindex.cfm?Keyword=renewable%20energy%20equity%20fund%20%28reef%29

Two mechanisms have the potential to impact on input costs of the ethanol sector during a drought year: the single export desk[48] for wheat (AWB—previously the Australian Wheat Board), and the quarantine regulations that severely restrict the import and use of feed grains to areas near the coasts.

In Australia, the majority of feed grain comes from coarse grains, such as sorghum and feed barley, and from feed wheat. Typically, the feed wheat used is of low quality; either it is downgraded premium wheat or else grown from soft-wheat varieties. During drought years, feed-grain users and potentially ethanol users often seek to procure feedstock from the lower grades of wheat used for human consumption—i.e., from the category Australian Standard White (ASW). A high proportion of ASW is exported and is controlled by the AWB, which maintains a statutory export monopoly.

The problem of low grain production years is compounded by constraints placed on grain imports by quarantine regulations. In times of severe drought, lack of access to imported grains means that domestic prices can rise significantly above export parity and beyond import parity prices.[49] The ability of grain users to import is dictated by geography. Import protocols permit the import of grain for processing to seaboard areas.

While not quantified in this analysis, the effective rate of protection for the grain sector, given current market conditions and government policies, could be considered negligible.

4.3.2 Assistance to the sugar industry

The Australian sugar industry has been characterized by high levels of government assistance relative to other agricultural sectors. It was subject to the *Sugar Industry Act 1999*, which imposed regulations on most stages of cane production, harvesting and milling. While not involving land assignments, as used previously, harvesting was based on cane production areas (CPA) and centrally controlled by regional committees. CPAs effectively licensed a grower to supply cane from a designated area to a particular mill. Mills would often only operate in the peak harvest season when profit margins were highest, and growers therefore had no incentive to increase production outside of this season because their designated mill would not process the cane. Many believed that these regulations were uncompetitive and stifled innovation and productivity growth in the industry.

The *Sugar Industry Reform Bill 2004* was a comprehensive regulation package introduced by the Queensland Government that made voluntary many of the structures set out in the *Sugar Industry Act 1999*. The centrepiece of the act removed CPA from the legislation from 1 January 2005 and enabled growers to sell cane to more than one mill, allowing more-efficient growers and millers to increase sugar production, However, the industry can decide locally to maintain a voluntary, CPA-style system in order to coordinate supply. Many consider the reform bill to be equivalent to industry deregulation because it allowed more competitive mills to expand and less efficient mills to close down.

Legislative change at the state level has been offset by changes in programs by the Australian Government. In September 2002, a *Sugar Industry Assistance Package* (SIAP), worth up to A$ 150 million, was announced. This package was formulated in response to very low world prices for sugar that at the time were around US$ 0.04 per pound, which translated into farm-gate prices for cane of less than A$ 100 per tonne. The assistance package involved a levy of A$ 0.18 per kilogram on domestic sugar sales and facilitation of other uses for sugar cane and income opportunities, including ethanol. In particular, the support involved up to A$ 36 million in income support payments, up to A$ 60 million in support for targeted regional projects that would facilitate adjustment, interest rate subsidies on new loans for replanting purposes, and assistance to exit the industry of up to A$ 45 000 per grower.

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48 The single desk is the term used to describe monopoly selling powers held by several statutory marketing authorities in Australia (including the AWB).

49 Parity refers to the equality of prices in two different markets, in this case the Australian domestic supply for export and the overseas supply for import.

Box 4.1 Would increased ethanol production help the sugar industry?

There have been suggestions that the Australian sugar industry could be a direct beneficiary of an expansion of the domestic ethanol production. While intuitively this suggestion would appear to be reasonable, there are other financial considerations.

Ethanol now produced from the Australian sugar industry comes from C-molasses, a low-value waste product. A redirection of first express juices (the primary sugar cane product) or higher grades of molasses to ethanol production would greatly increase the price of ethanol feedstock and hence the cost of producing ethanol. At prevailing prices, these feedstocks are not an economically viable option for ethanol producers, hence sugar farmers would not benefit.

National mandatory use of ethanol would cause a substantial permanent increase in demand for ethanol. But this may not necessarily benefit sugar farmers either. Ethanol producers would be unwilling to pay more than the prevailing world price if they were to buy sugar as a feedstock. Thus the only effect of increased domestic consumption of sugar due to ethanol production on sugar farmers would be displacement of exports. The price received for sugar would remain the same and, overall, sugar farmers would be no better off.

Competition between feedstock suppliers and ethanol producers could be expected to drive up prices of for C-grade molasses, which would deliver some economic benefits to the sugar industry. However, it could not be concluded that such a development would be a panacea for the sugar industry.

Source: Extracted from Roarty and Webb, 2003.

In 2004, the *Sugar Industry Reform Program* (SIRP) provided up to A$ 444 million for additional assistance to sugar producers. This was the fourth assistance package for the sugar industry since 1998 and brought the total assistance from 1998 to 2004 to more than half a billion dollars (Canegrowers, 2006b). Observers of the industry often comment that the continued assistance provided to the industry reflects the political significance of cane growing regions in state and federal elections (Pritchard, 2005).

The components of the SIRP comprise sustainability grants, income support (including business planning for income-support recipients), business planning (growers, harvesters and mills), grants for re-establishment, retraining and grower restructuring, grants for industry oversight and regional advisory groups, contributions to regional and community projects, and crisis counselling.

Drawing conclusions about the legislative and policy environment for the sugar industry is difficult. At very low sugar prices, there may have been an incentive to recover less sugar from cane and to produce ethanol from A-or B-grade molasses. Since the government packages have been put in place, there has been a substantial recovery in the world sugar market, with prices during the first half of 2006 rising to over US$ 0.16 per pound. This recovery, combined with strong demand from livestock producers, has lead to a substantial increase in the price for both sugar and molasses. As of the end of January 2008, the International Sugar Organization daily price for sugar was trading at just over US$ 0.12 per pound.

The assistance currently provided to the sugar sector is significant but variable in its impact across the sector. In addition, there exists a buoyant market for sugar and molasses. The combination of spread-out support and a strong market suggests that flow-through impacts to the biofuels industry—from assistance provided to the sugar sector—are most likely minimal.

4.4 Policies related to distribution and consumption

4.4.1 Subsidies to capital related to fuel blending and distribution

Both the federal and state governments have for several years been helping to fund equipment used in the blending and distribution of ethanol in Australia. Since ethanol is hydroscopic and corrosive, it often requires special tanks and equipment to handle it.

The first government-funded project of this kind was the East Coast Renewable Fuels Project, created to develop and implement a renewable fuels programme for the East Coast of Australia, in order to displace the petrol produced at the British Petroleum (BP) Bulwer Island Refinery in Brisbane with a 10 per cent ethanol-petrol blend (E10) for the Queensland East Coast market. According to the Department of Environment and Heritage, funding up to A$ 8.8 million was approved as a contribution to the total project cost of A$ 14.3 million when the Deed of Agreement was signed on 26 September 2001.[50] In the event, BP received only A$ 500 000 for the test phase of the programme. This was because BP stopped producing the E10 blend in February 2003 as a result of consumer fears over the possible danger the blended fuel presented to car engines.

A much larger programme to support ethanol infrastructure, the Ethanol Distribution Program (EDP), was announced in August 2006. One of the goals of the programme was to increase the number of retail service stations selling E10.[51] The Government allocated A$ 17.2 million in funds, around half of which[52] will is to Infrastructure Upgrade Grants. These grants provide up to A$ 10 000 for retail service stations that upgrade existing equipment or install new equipment to provide for the sale of E10. The work must be completed between 1 October 2006 and 31 March 2008. Applications for grants will then be accepted on a continuous basis from 1 October 2006 to 30 January 2009.

Assistance to ethanol blending and distribution has also been provided by some State Governments. In April 2005, for example, Queensland's Premier Beatty launched the *Ethanol Industry Action Plan (EIAP) 2005–2007*. Under this plan, the Queensland Government provided A$ 7.3 million over two fiscal years (2005–06 and 2006–07) for programs to support the development of the Queensland ethanol industry. The budget for the EIAP included A$ 1.46 million for rebates for cleaning storage tanks so they could hold E10, plus assistance for the conversion of bowser equipment and signs; A$ 2.28 million for a marketing campaign to boost public confidence in ethanol; A$ 2.2 million for blending and distribution facilities for E10 and diesel-ethanol blends; and A$ 0.2 million to employ two staff to help implement the strategy.

In April 2007, the Victorian Government launched the Biofuels Infrastructure Grant (BIG) programme as part of its Biofuels Road Map. BIG is an A$ 5 million fund to assist development of infrastructure necessary for biofuel projects. In September 2007, the Minister for Regional and Rural Development announced the first grant allocation of A$ 400 000 to contribute to an upgrade of road infrastructure in the area surrounding the Agri Energy ethanol plant at Swan Hill. Despite this grant and other government support for ethanol, Agri Energy suspended the project in October 2007 due to uncertainty in feedstock costs, biofuel markets, government legislation and consumer acceptance in the Australian market.[53]

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50 See also www.bp.com/genericarticle.do?categoryId=9012771&contentId=7024905.

51 "Ethanol Distribution Program", www.ausindustry.gov.au/content/level3index.cfm?ObjectID=98EC4473-7714-4B62-BE0B4E4577CDA083&L2Parent=AEB901E5-7CB8-4143-A3BF33B2423F9DA6

52 GSI estimate.

53 www.indcor.com.au/index.php

4.4.2 Support for vehicles capable of running on ethanol

In 2000, Ventura Bus Lines Pty Ltd (which serves Melbourne's eastern and south-eastern suburbs) was granted A$ 16 500 by the Federal Government's Greenhouse Office in order to purchase two ethanol-powered buses from Sweden.[54] In 2001–02, it received an additional A$ 4 500 to assist with the purchase of a third ethanol bus. This amounted to 50 per cent of the total capital cost of the bus.

In addition to helping to fund projects related to the distribution of ethanol blends, Queensland's Ethanol Industry Action Plan (EIAP) 2005–2007 also assists fleet operators undertake technical conversions so as to allow them to use of diesel—ethanol blends in their diesel engines. A$ 1.14 million to aid the introduction of operational guidelines for diesel—ethanol blends, engine conversion and related issues was provided over a two-year period. Another key part of Queensland Government support includes requiring the use, where possible, of ethanol-blended fuel in its "Qfleet" vehicles.

4.4.3 Support for consumption of ethanol

Ethanol is one of the fuels favoured under the *Energy Grants (Credits) Scheme Act 2003*. This scheme, which essentially combines two previous schemes[55] into a single scheme, provides a grant to businesses for fuel used for specified on- and off-road activities. In order to alleviate potential cash-flow problems for users, the Act also makes provisions for users to be able to claim the grant ahead of use. For eligible users who can claim against the Energy Grants (Credit) Scheme, if all subsidies are passed on, the outcome could be a net subsidy for ethanol use that would phase to zero by 2010 (Table 4.5). The Biofuels Taskforce (2005) concluded that the impact of the EGS on ethanol is limited because of the small volumes of the fuel claimed by eligible users.

Table 4.5 Energy Grants (Credit) Scheme payments, 2002 to 2010

(Australian cents per litre)

Year starting 1 July	Energy Grants (Credit) Scheme payment[1]
2002	N/A
2003	16.647
2004	16.647
2005	16.647
2006	16.647
2007	12.485
2008	8.324
2009	4.162
2010	0.00

Notes: N/A = Not Applicable.

Source: Table 4.2 and Energy Grants (Credits) Scheme Amendment Regulations 2006 (No. 1).

A more general subsidy to consumers is provided under the Australian Government's Ethanol Distribution Program (EDP). In addition to financing the number of retail service stations selling E10, one of its goals is to increase the total volume of E10 sold by encouraging the sale of blended fuel at a price lower than regular

[54] www.environment.gov.au/minister/ps/2000/psmr1dec00.html

[55] The *Diesel Fuel Rebate Scheme under the Customs Act 1901* and the *Excise Act 1901* and the Diesel and Alternative Fuel Grants Scheme 1999.

unleaded petrol also being sold at service stations.[56] The federal Government allocated A$ 17.2 million for 2006–07 funds, around half of which[57] will go to Sales Target Grants. These grants paid up to A$ 10 000 to retail service stations that have both upgraded their sites to be able to sell E10, and have reached an E10 sales target within 12 months of completing the upgrade.

In Round 3 of the Queensland Sustainable Energy Innovation Fund, announced in May 2001, CSR Ltd was awarded A$ 75 000 to construct blending, storage and distribution facilities for trial production of a diesel-ethanol fuel blend (so-called "diesohol") containing 15 per cent hydrous ethanol produced at its Sarina distillery.[58] Part of the funding was also used to monitor engine performance and emissions. The trial indicated that production and sale of diesohol fuel would break even financially when the cost of diesel fuel was 80 cents a litre and ethanol was excise-free (QSEIF, 2003).

Indirect support for the consumption of ethanol is provided through government procurement. The New South Wales Government, for one, has endorsed the use of E10 blends in its own government fleet, when that fuel is available. Executive officers and public-service staff who are issued government-owned vehicles are required to obtain E10 fuel "where this is practicable, available and cost effective." No information is available on what, if any, extra expenses have been included by the NSW government in pursuing this policy.

4.5 Government funding related to research and development

One of the earliest forms of direct support for research and development came out of the *Appropriation Act 1993*–94, in which approximately A$ 1.6 million was earmarked for ethanol research and development. This development occurred in connection with the decision to remove lead content from petrol. Ethanol is considered to be a more environmentally benign, octane-enhancing substitute for tetra-ethyl lead.

Assistance for commercialization of new techniques and technologies has also been provided through two programmes administered by AusIndustry: the Renewable Energy Development Initiative (REDI) and the Commercial Ready programme. REDI is a seven-year, A$ 100 million federal programme launched on 8 July 2005 that offers grants to eligible renewable energy research, development, and early commercialization projects. REDI provides matching funds from A$ 50 000 to A$ 5 million per project and, over three rounds of applications, allocated A$ 52 million to 25 projects. In Round 2, announced in July 2006, REDI provided A$ 5 million to CSR Ltd to develop a novel, high-yield sugarcane feedstock for ethanol production.[59] The Round 3 awards, announced in December 2006, provided approximately A$ 2.48 million to MicroBiogen Ltd of New South Wales to develop a way of producing ethanol from plant-waste biomass using industrial-quality yeasts.[60]

Commercial Ready is a competitive, merit-based grant programme supporting innovation and its commercialization in industry. In its FY 2006–07 budget, Commercial Ready awarded Alternative Fuels Corporation Pty Ltd of NSW A$ 1 216 900 in order to develop a commercially viable continuous processing technology for the co-production from grain-starch hydrolysates of high-value, food-grade yeast-derived products and fuel ethanol.

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[56] "Ethanol Distribution Program", www.ausindustry.gov.au/content/level3index.cfm?ObjectID=98EC4473-7714-4B62-BE0B4E4577CDA083&L2Parent=AEB901E5-7CB8-4143-A3BF33B2423F9DA6

[57] GSI estimate.

[58] www.epa.qld.gov.au/environmental_management/sustainability/energy/queensland_sustainable_energy_innovation_fund_qseif/qseif_previous_rounds/qseif_round_3_projects/#gen3

[59] REDI Round 2 Successful Applicants. Accessed on 6 August 2008 from:

www.ausindustry.gov.au/library/REDI__Round_2_Successfuls_for_media_releaselandingPg20060720101642.pdf

[60] http://news.researchcentre.com.au/rndinfo/newsletter.php?issue=2006-12-12

The federal government is also supporting R&D through its environment department. The FY 2006–07 budget includes new funding over five years (i.e., through FY 2010–11) for various biofuels projects. Out of that budget, A$ 4.4 million will be used to pay for two major studies relating to ethanol. One of the studies will explore the suitability of low-ethanol blends for wider use and recommend whether E5 blends (five per cent ethanol, 95 per cent petrol) may be sold unlabelled; the other will investigate the health effects of ethanol blends. The study will also investigate the way in which the evaporative performance of ethanol blends affects the formation of ground-level ozone. E85 has been found to significantly increase ozone, a prime ingredient of smog, which can cause respiratory-related health problems (Jacobsen, 2007).

5 Current support for biodiesel

5.1 Output-linked support

5.1.1 Tariffs

References to biodiesel were first inserted in Australia's Customs Tariff, with effect from 18 September 2003. At that time, Australia considered biodiesel derived from animal and vegetable fats and oils should be classified in Chapter 15 of its Customs Tariff. In 2005, however, the World Customs Organization provided a classification opinion that biodiesel is correctly classified under Chapter 38 of the Harmonized Commodity Description and Coding System (HS), to which Australia adheres. In accordance with this advice, the Customs Authority created a new subheading (3824.90.20) in Chapter 38 for biodiesel, effective 1 July 2006. This change in classification did not alter the tariff treatment of biodiesel, which retained its duty rate of "Free".

Imported biodiesel, like imported ethanol, is nonetheless subject to a customs duty of A$ 0.38143 per litre. Unlike imported ethanol, however, imported biodiesel also benefits from offsetting grants under the Energy Grants (Cleaner Fuels) Scheme (Australian Taxation Office, 2006b). Starting on 1 July 2011, the excise tax drops to A$ 0.191 per litre, and the percentage of the excise duty covered by the EGS grants declines by 20 percentage points each year, so that, by 1 July 2015, all biodiesel will be subject to the final energy-adjusted excise duty rate.[61]

5.1.2 Government blending mandates

There is no nationally mandated volumetric or blending mandate specifically for biodiesel. The State of Victoria, however, has set a voluntary biofuels target of five per cent of the fuel market by 2010 (400 ML per year). This target is expected to be met mainly by biodiesel. If the target is not met, the Victorian Government's recent Road Map and Action Plan for the industry states that it may consider mandating a five per cent biofuel level. A parliamentary inquiry in Victoria recently recommended against a mandate but the government has yet to respond to the inquiry report (Parliament of Victoria, 2008).

5.1.3 Payments based on current output

5.1.3.1 Reduced effective rates for excise taxes

Since 2002, the excise duty on biodiesel has been A$ 0.38143 per litre, but this duty is fully offset for domestic producers and licensed importers defined under the *Energy Grants (Cleaner Fuels) Scheme Act 2004* (Table 5.1). The grant is paid to the last licensed entity in the supply chain, which, in most cases, is the entity that dispenses the fuel. Starting on 1 July 2011, the effective excise duty drops to A$ 0.191 per litre, and the Cleaner Fuels Grants start declining from their previous level of 100 per cent to 80 per cent, and then by 20 per cent increments thereafter until the grant expires on 1 July 2015.

As with ethanol, the discount on the excise duty confers an additional subsidy after 30 June 2011. Following the approach of Short and Riwoe (2005), we have estimated that, if biodiesel were charged excise duty proportional on an energy-equivalent basis with diesel, once the energy-based excise regime goes into effect, it should be charged a rate closer to that for diesel. We assume an energy content for biodiesel of 90.8 per cent

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61 The A$ 0.38143 figure was fixed in two previous Acts: the *Excise Tariff Amendment (Fuels) Act 2003,* which, in certain provisions, extends to biodiesel exemptions applying to diesel, and the *Customs Tariff Amendment (Fuels) Act 2004*, which imposed a customs duty rate in line with other transportation fuels.

of diesel. That ratio suggests that the full, reference excise duty should be A$ 0.346 per litre, rather than A$ 0.125 per litre. Thus the total benefit may be estimated as the difference between the "normal", non-discounted excise duty and the effective excise duty, as reduced from the actual excise duty by the production grants.

Table 5.1 Effective fuel-tax rates for biodiesel in Australia, 2002 to 2015 (Australian cents per litre or per cent)

Financial Year (1 July through 30 June)	Actual excise Duty[1]	Energy Grants (Cleaner Fuels) Scheme payment[1]		Effective excise duty[2]	Relevant excise baseline (nominal terms)	Net rate of subsidy[2]
		As a % of the excise duty	In cents per litre			
2002–03	0.0	N/A	N/A	0.0	38.143	38.143
2003–04	38.143	100	38.143	0.0	38.143	38.143
2004–05	38.143	100	38.143	0.0	38.143	38.143
2005–06	38.143	100	38.143	0.0	38.143	38.143
2006–07	38.143	100	38.143	0.0	38.143	38.143
2007–08	38.143	100	38.143	0.0	38.143	38.143
2008–09	38.143	100	38.143	0.0	38.143	38.143
2009–10	38.143	100	38.143	0.0	38.143	38.143
2010–11	38.143	100	38.143	0.0	38.143	38.143
2011–12	19.1	80	15.3	3.8	34.6	30.8
2012–13	19.1	60	11.5	7.6	34.6	27.0
2013–14	19.1	40	7.6	11.4	34.6	23.2
2014–15	19.1	20	3.8	15.3	34.6	19.3
1 July 2015 and after	19.1	0	0.0	19.1	34.6	15.5

N/A = Not Applicable.

1. As of 1 July.

2. Assuming that production subsidies are passed on to users.

Source: adapted from Short and Riwoe (2005).

In its 2006–07 budget, the federal government set aside A$ 100.1 million over four years in order to allow so-called "renewable diesel"—a diesel substitute made from tallow or other animal fats using technologies other than the esterfication process—to receive the same tax treatment as biodiesel (Costello and Minchin, 2006). Since all operating plants use the esterfication process, the actual uptake of this subsidy, at least during the first two years it is in operation, is likely to be small.

As mentioned in Chapter 4, the existence of the A$ 0.08354 per litre fuel subsidy on transport fuels sold in Queensland means that the effect of the above excise duties and subsidies on the final price of diesel[62] and

[62] Between 1 July 2000 and 31 May 2006, the subsidy for diesel was limited to road vehicles with diesel engines that were designed solely or principally for transporting persons, goods or animals by public road. On 1 June 2006, eligibility for

biodiesel[63] works differently in that state. Although the final prices paid for diesel and biodiesel by consumers in Queensland are reduced by the same amount per litre, it does mean that the maximum ex-factory prices of biodiesel must be A$ 0.08354 per litre lower than they would be in other states in order to compete with diesel fuel.

Table 5.2 provides estimates of the value of the Biodiesel Production Grant bounties from 2003 through to 30 June 2012. These will rise in proportion to output, but will fall in mid-2011 as the new excise duty is applied and the production grants begin to decline. Because of poor data on production levels, and uncertainty regarding the amount of capacity under construction between now and 2012, the values in the table beyond 2006 should be regarded as highly speculative.

Table 5.2 Estimated value to Australian producers of Biodiesel Production Grants (2002–03 through 2010–11) and Cleaner Fuels Grants (2010–11)

Budget year (30 June–1 July)	Production grant (A$/litre)	Volume produced (ML)	Total value (A$ millions)[1]
2002–03	N/A	1.0	N/A
2003–04	0.38143	1.0	0.4
2004–05	0.38143	4.4	1.7
2005–06	0.38143	21.2	8.1
2006–07	0.38143	77	29
2007–08 projection	0.38143	60–90	23–34
2008–09 projection	0.38143	100–200	40–80
2009–10 projection	0.38143	150–260	60–100
2010–11 projection	0.38143	200–300	80–120

1. From 2008–09 onwards, values have been rounded to the nearest A$ 10 million.

Source: production, 2003–04 through 2005-06: Australian Taxation Office (2007); production, 2006–07: ABARE (2008); total values, 2002–03 through 2005–06: Webb (2006); • all other calculations: GSI.

the subsidy was extended to the diesel consumed when travelling on a public road by certain vehicles or equipment (such as concrete-pumping trucks, mobile cranes, elevating work platforms, truck-based drillers, and truck-based street sweepers) that previously were not eligible for the subsidy because of their design. For further information see: www.osr.qld.gov.au/fuel

63 Effective 1 December 2006; the types of fuel that could be claimed by either a BEU or a retailer was expanded to include fuels that can be used as a replacement fuel for motor spirit or diesel of a type ordinarily sold by a retailer—i.e., ethanol and biodiesel, or blends containing these fuels—as long as it complies with the fuel standard in force under the *Fuel Quality Standards Act 2000*.

5.2 Subsidies to factors of production

5.2.1 Support for productive capital

5.2.1.1 Grants provided under the Renewable Energy Equity Fund (2003–2006)

Assistance for the construction of biodiesel plants was provided on a piecemeal basis during the early years of this decade. At the state level, New Soth Wales' Sustainable Energy Development Agency (now part of the Department of Energy, Utilities and Sustainability) provided A$ 205 000 in 2002 to the Australian Biodiesel Group towards the construction of its first biodiesel production plant at Berkeley Vale.

Several biodiesel plants also benefitted from grants provided under The Renewable Energy Equity Fund (REEF). This fund, created in 1997 and administered by AusIndustry on behalf of the Australian Greenhouse Office (AGO), helped finance renewable energy developments via a private company, CVC REEF Investment Managers Ltd. Details of specific investments are treated by the AGO as commercial-in-confidence. However, according to AusIndustry, approximately two-thirds of the Fund's capital originates from the Australian Federal Government. It is estimated on that basis that government support to biodiesel producers via REEF amounted to approximately A$ 2.08 million between May 2003 and December 2006 (Table 5.3).

Table 5.3 CVC REEF investments and government contributions for biodiesel plants

Recipient	Total amount of investment from the CVC-REEF (A$)	Estimated contribution from the Australian Government to the CVC-REEF (A$)	Date capital contributions were awarded to recipients (A$)
Australian Biodiesel Group	150 000	100 000	May 2003
	150 000	100 000	August 2003
Australian Renewable Fuels	1 050 000	700 000	December 2004
Australian Farmer's Bio-fuels[1]	200 000	133 333	May 2005
	70 000	46 667	December 2006
Biodiesel Producers Ltd.[2]	1 500 000	1 000 000	October 2005

Notes: 1. "Seed funding" for the scaling-up and construction of the first commercial continuous biodiesel machine in Australia.

2. "Early-stage funding" for the completion of the design and construction of the company's first commercial plant.

Source: GSI estimates.

5.2.1.2 Grants provided under the Biofuels Capital Grants Program (2003–2004)

The Biofuels Capital Grants Program (BCPG), which was completed in 2006, provided grants at a rate of A$ 0.16 per litre of installed capacity for new and expanded projects producing a minimum of five ML of biofuel a year. These grants were limited to a maximum of A$ 10 million for each project. Seven projects were offered grants totalling A$ 37.6 million, of which A$ 25.2 were offered to biodiesel projects. Successful applicants under the two rounds of the BCPG were:

- Biodiesel Industries Australia, for a 15 ML per year biodiesel plant at Rutherford, NSW (A$ 1.28 million);
- Biodiesel Producers Ltd, for a 60 ML per year biodiesel plant at Barnawartha, VIC (A$ 9.6 million);

- Australian Renewable Fuels, for a 45 ML per year biodiesel plant at Port Adelaide, SA (A$ 7.15 million);
- Riverina Biofuels Pty Ltd, for a 40 ML per year biodiesel plant at Deniliquin, NSW (A$ 7.15 million).

As of July 2007, all these biodiesel plants had commenced construction and thus had received their first payment of 25 per cent of the total grant approved, and at least one had received its final payments. To judge from the total construction cost of the Riverina plant (A$ 16 million[64]), these grants were worth around 45 per cent of the investment required for each plant.

5.2.1.3 Special grant under the Dairy Regional Assistance Programme

In March 2005, the federal government's then Department of Transport and Regional Services (DOTARS) agreed to provide Australian Renewable Fuels with a grant worth up to A$ 531 080 under the Dairy Regional Assistance Programme (Australian Renewable Fuels, 2005). The funds were used to assist ARF in constructing its Picton plant in Western Australia, which suspended operations in November 2007.

5.2.2 Support for land used for biodiesel plants

State and local governments sometimes assist biodiesel companies in acquiring land for a new plant site. Typically, they are seeking to stimulate local economic growth or to increase the local tax base. The amount of support provided usually depends on the plant's stage of planning or construction and to what degree the plant will benefit the surrounding area. For example, in September 2006, the state of South Australia announced that it would contribute A$ 10 000 to investigate whether the mid-north town of Gladstone could be the site of a new canola-crushing and biodiesel plant.

Similarly, the 10 hectares of industrial land on which the Australian Renewable Fuels' (ARF Limited) Picton plant is sited (about five kilometres from the inner harbour at Bunbury) was provided by the West Australian Government through a conditional grant. Under the land purchase and grant agreements, the state provided ARF Limited with an interest-free loan of A$ 650 000, which will convert to a grant if by 2009 ARF establishes a biodiesel plant that will directly employ at least 10 full-time employees and create indirect employment for at least 30 people (Australian Renewable Fuels, 2005).

5.3 Policies affecting the costs of intermediate inputs

Biodiesel production in Australia is based largely on used cooking oils and tallow. All these feedstocks have low (nearly zero) rates of protection as a result of government policies. Some production facilities, and several new or planned plants, are designed to use virgin oils as feedstocks. These, too, have low rates of protection. However, phyto-sanitary restrictions may limit the ability of biodiesel manufacturers to import and process oilseeds except in coastal areas.

5.4 Support related to distribution and consumption

The Queensland Sustainable Energy Innovation Fund (QSEIF) provides industry with financial support to develop and commercialize innovative technologies that reduce the use of fossil fuels, either by increasing efficiency or utilizing renewable energy sources. Among the projects announced in Round 7 (paid out in FY 2005–06) was a grant of A$ 128 700 to Brisbane City Council's (BCC) Traffic & Transport Branch, part of

[64] www.mpigroup.com.au/downloads/RiverinaBiodiesel.pdf

which was used to establish the first commercial supplier of biodiesel fuel in Southeast Queensland (supporting subsequent general use of biodiesel fuel by the BCC and other transport operators).[65]

The Victorian Government launched a A$ 5 million Biofuels Infrastructure Grant (BIG) programme in April 2007, as part of its Biofuels Road Map. As of February 2008, no grants had been dispersed for biodiesel.

5.4.1 Support for vehicles capable of running on biodiesel

A number of local governments have been actively interested in biofuels for some time. The Newcastle, Brisbane City and Camden local government authorities, for example, have all been involved in biodiesel trials in garbage trucks and other diesel vehicles.

Part of the money provided under the QSEIF project in Brisbane, described above, was used to evaluate the feasibility of using 100 per cent biodiesel fuel (B100) and a 20 per cent biodiesel-diesel mixture (B20) in five BCC council buses and two river ferries, and to assess air pollution emissions from these vehicles.

The city of Newcastle, NSW, began a biodiesel programme in November 2001 when the city council adopted a plan, dubbed Greenhouse Action in Newcastle (GAIN), as part of its commitment to the Cities for Climate Protection (CCP) program. In mid-2002, the city tested B20 in a garbage truck and B100 in a city van. The programme was expanded in November 2003 when B20 biodiesel was introduced into 228 diesel-powered vehicles and pieces of equipment.[66] The Newcastle City Council received an A$ 100 000 grant from the NSW Department of Environment and Conservation as part of the Clean Air project.[67] In addition, the NSW Roads and Traffic Authority (RTA) provided assistance conducting emissions testing on 13 Newcastle City vehicles.

5.4.2 Support for consumption of biodiesel

Biodiesel is one of the fuels favoured under *The Energy Grants (Credits) Scheme Act 2003*. This scheme provides a grant to businesses for fuel used for specified on- and off-road activities. In order to alleviate potential cash flow problems for users, the Act also makes provisions for users to be able to claim the grant ahead of use. For eligible users who can claim against the Energy Grants (Credit) Scheme, if all subsidies are passed on, the outcome could be a net subsidy for biodiesel use that would phase to zero by 2010 (Table 5.4). In financial years 2004–05 and 2005–06, around A$ 2.6 billion was paid out under the off-road scheme, and A$ 0.9 billion under the on-road scheme.[68] It is not known how much of these payments related to biodiesel, but they could not have exceeded A$ 3 million a year in FY 2005–06, especially given the total volume sold in the country in that year was 21 ML.

Support for the consumption of biodiesel is also provided through government procurement. In South Australia, all diesel-powered metro trains and buses have been required to operate on blends containing five per cent biodiesel (B5) since 1 March 2005.[69] That proportion is to be increased progressively to B20.

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[65] www.epa.qld.gov.au/environmental_management/sustainability/energy/queensland_sustainable_energy_innovation_fund_qseif/qseif_previous_rounds/qseif_round_7_projects/

[66] www.rmi.org/sitepages/pid1096.php

[67] www.iclei.org/fileadmin/user_upload/documents/ANZ/CCP/CCP-AU/Projects/Biodiesel/CaseStudies.pdf

[68] www.ato.gov.au/content/downloads/81183_2005EGS1.pdf and www.ato.gov.au/content/downloads/81183_2005EGS2.pdf

[69] http://www.agric.wa.gov.au/content/SUST/BIOFUEL/Biofuels_FSG_SA.htm

Table 5.4 Energy Grants (Credits) Scheme payments, 2002 to 2015 (Australian cents per litre)

Period, FY ending 30 June	Energy Grants (Credit) Scheme payment
2002–03[2]	N/A
2003–04[3]	14.808
2004–05	14.808
2005–06	14.808
2006–07	14.808
2007–08	11.106
2008–09	7.404
2009–10	3.702
2010–11	0.0

1. After Energy Grants (Cleaner Fuels) Scheme payment.

2. As of 18 September 2002.

3. As of 18 September 2003.

Source: Table 5.1 and Energy Grants (Credits) Scheme Amendment Regulations 2006 (No. 1).

5.5 Government funding related to research and development

The Renewable Energy Development Initiative (REDI) is a seven-year A$ 100 million federal programme launched on 8 July 2005 that offers grants to eligible renewable energy research, development, and early commercialization projects. REDI provides matching funds from A$ 50 000 to A$ 5 million. Over three rounds of applications it has allocated A$ 52 million to 25 projects. In Round 2, announced in July 2006, REDI awarded A$ 348 100 to the South Australian Government's South Australian Research and Development Institute (SARDI) to develop bioreactor systems for use in intensive production of microalgal feesdstock for biodiesel production (see Box 1.1).[70] Matching funds were provided by Australian Renewable Fuels Ltd (AFR, a biodiesel producer). Together with a 2005 federal grant of A$ 300 000 from the Centre for Natural Resource Management (CNRM), total funding for the project was A$ 1 000 000 over three years.

In another project, until late 2007 SARDI and AFR were evaluating new crops as oilseed feedstocks for biodiesel production. Funding for this project is A$ 1 100 000 over five years.[71] Cessation of ARF's activities in Australia in late 2007 had a major impact on the SARDI programme. The ARF funding contribution ceased in November 2007. As a consequence, the oilseeds research was terminated and the REDI grant was put on hold pending identification of another industry partner. The microalgae work is continuing through its CNRM grant (ending in June 2008), A$ 100 000 from the South Australian Department of Water, Land and Biodiversity Conservation, and a one off payment from the South Australian Premier's Science and Research Fund 2007–08 of A$ 75 000 seed funding shared between SARDI and Flinders University to develop a more substantial proposal for 2008–09). SARDI has two further proposals pending.[72]

70 REDI Round 2 Successful Applicants

71 http://www.sardi.sa.gov.au/pages/biofuels/biofuels_research_program.htm:sectID=877

72 Details of the two pending proposals were not publically available as of February 2008. Source for recent SARDI grant information: Nayar (2008).

The SARDI biofuels research programme has also been awarded A$ 5 million to develop a National Photobioreactor Facility in South Australia. The site is supported by the National Collaborative Research Infrastructure Strategy (NCRIS), a programme administered by the federal government and co-sponsored by the SA Government. The facility is one of two NCRIS facilities that will create new research infrastructure focused on developing new technologies for producing biodiesel and bioethanol from non-food biomass. [73]

In New South Wales, Sydney Ferries are currently conducting a biodiesel trial that includes analysis of carbon dioxide, nitrogen oxide and particulate matter emissions. The trial commenced in 2006, and will be expanded to other watercraft following completion of initial studies. These studies have looked at using B20, with B80 and B100 to be assessed in future. The NSW Greenhouse Office provided a grant of A$ 50 000 for the trial.

The federal government is also supporting R&D related to biodiesel, through its environment department. The FY 2006–07 budget provided new funding over five years (i.e., through FY 2010–11) for various biofuels projects, including A$ 400 000 for a biodiesel trial in Kakadu National Park, and a study investigating whether a fuel standard for biodiesel blends should be created.

73 www.sardi.sa.gov.au/pages/biofuels/biofuels_research_program.htm:sectID=877

6 Aggregate support for ethanol and biodiesel

To develop a better sense of how all the individual subsidy programmes affect the overall commercial environment for biofuels, this chapter presents several aggregate measures of support. The aggregate data provide important insights into a variety of policy questions. These range from the financial cost of the subsidy policies to taxpayers, to estimates of the costs of achieving particular policy goals. Among arguments put forward in support of biofuel subsidies are that they help a country to diversify from fossil fuels in general, and petroleum in particular; and that they have a better environmental profile than fossil fuels. We discuss in turn total financial support to the industry; subsidies per unit of energy output; subsidies per unit of fossil energy displaced; and the subsidy cost for greenhouse gas reductions. Policy implications and recommendations, as well as areas for additional research, are discussed in Chapter 7.

6.1 Total transfers and assistance

We estimate that total transfers[74] for fuel ethanol has grown rapidly, from roughly A$ 10.5 million in FY 2004–05, to around A$ 55 million in FY 2006–07 (Table 6.1). The largest transfer element is the Ethanol Production Grant that offsets the excise duty charged on ethanol. Because this transfer rises proportionally with output, it could soon exceed A$ 100 million per year if all the planned new ethanol facilities get built.

Table 6.1 Total transfers for ethanol in Australia, FY 2004–05 through FY 2006–07 (millions of Australian dollars)

Transfer element	2004–05	2005–06	2006–07
Output-linked support	8.65	15.38	31.85
Support for intermediate inputs	NC	NC	NC
Support for value-adding factors	1.82	1.82	13.77
Grants for investment in fixed capital	1.82	1.82	13.77
Support related to distribution and consumption	0.0	2.52	4.75
Support for fixed capital formation in blending & distribution	0.0	1.95	4.18
Support for ethanol-consuming vehicles	0.0	0.57	0.57
Support for ethanol-consumption	0.0	0.0	0.0
Support for R&D	0.0	0.0	4.58
Total transfers	**10.46**	**19.72**	**54.95**
Production (millions of litres)	22.67	40.32	83.5
Total transfers per litre (A$/litre)	0.46	0.49	0.66

NC = Not calculated.

Source: GSI estimates.

On a per-litre basis, total transfers (including support for R&D) have historically been running in the mid-40 cents per litre. In FY 2006–07, it was driven above A$ 0.60 per litre, mainly because of grants paid out under the Biofuels Capital Grants Scheme, and additional support to help pay for installation of E10 pumps at filling

[74] The terms "transfers" and "assistance" both encompass market price support and subsidies. In this report, total transfers refer to all government support provided in a given year, whereas annualized assistance distributes grants for capital, land, research and development over several years, to reflect the benefits they confer over time.

stations. Assuming no new programmes are announced in the remainder of FY 2007–08, total transfers amount of support per litre should drop down again to a level more typical of recent years.

Total transfers for biodiesel have historically been below that of ethanol, mainly because it was produced in lower volumes. Australia also traditionally has had few passenger cars with diesel engines, although their numbers are increasing. From less than A$ 3 million in FY 2004–05, support has grown to an estimated A$ 39 million in FY 2006–07— i.e., at a similar rate of growth as for ethanol (Table 6.2). The total value shown in the table may be an under-estimate, as we were not able to identify expenditure related to distribution and consumption.

Table 6.2 Total transfers for biodiesel in Australia, FY 2004–05 to FY 2006–07 (millions of Australian dollars)

Support element	2004–05	2005–06	2006–07e
Output-linked support	1.69	8.09	29.4
Support for intermediate inputs	NC	NC	NC
Support for value-adding factors	1.15	5.76	8.76
Grants for investment in fixed capital	1.15	5.76	8.11
Grants for land	0.00	0.00	0.65
Support related to distribution and consumption	0	0.01	NC
Support for fixed capital formation in Blending & distribution	NC	0.01	NC
Support for ethanol-consuming vehicles	NC	NC	NC
Support for biodiesel-consumption	NC	NC	NC
Support for R&D	0	0.01	1.38
Total transfers	**2.84**	**13.98**	**39.51**
Production (million litres)	4.4	21.2	77
Total transfers per litre (A$/litre)	0.64	0.66	0.51

Source: GSI estimates.

As with ethanol, the largest transfer element is for production: through the Cleaner Fuels Grants Scheme. Grants for investments in new capacity were also several million dollars in FY 2005–06 and FY 2006–07. These helped to keep the per-litre transfers above A$ 0.60 per litre in the former year. However, with the ending of the Biofuels Capital Grants Scheme, the transfers per litre should drop to around A$ 0.53 per litre in FY 2007–08, which is at approximately the same level as for ethanol. Given the much higher rates of transfers in previous years, however, we consider the per-litre transfers in FY 2006–07 as better reflecting policies than expected transfers in FY 2007–08.

Because of the uneven distribution of government support for R&D and various capital items (biofuel plants, dedicated infrastructure, and vehicles designed to run on fuels containing high concentrations of biofuels), annual estimates of total transfers may over- or under-state the effective support provided to the sector in any given year. For that reason, we produced a separate set of estimates, referred to as total annualized assistance, which amortizes support for capital over the effective life of that capital, and averages support for R&D over several years. This has been done by transforming capital grants in each year into an annuity at the prevailing rate of interest, which is estimated as the average of the quarterly weighted-average interest rates on credit outstanding (for variable rate loans) published by the Reserve Bank of Australia. For the purposes of these calculations, grants for fixed capital formation in biofuel plants were amortized over 20 years; all other grants (for capital formation in blending and distribution, and for vehicles) were amortized over 10 years. The annual value of grants for the purchase of land was estimated as a perpetual annuity (i.e., the value of the grant multiplied by the rate of interest). Finally, government expenditure on biofuel-related R&D was smoothed by assigning the average of expenditure in the current year and the previous two years to the current year.

Table 6.3 shows total assistance for ethanol in Australia in FY 2004-05 through FY 2006–07. For the first two years, the per-litre values are only 5–8 cents lower than the corresponding total transfers per litre, but for FY 2006–07 it is 23 cents lower, reflecting the large number of capital-related grants provided in that year. Total assistance is also considerably lower.

Table 6.3 Total assistance for ethanol in Australia, FY 2004–05 to FY 2006–07 (millions of Australian dollars)

Support element	2004–05	2005–06	2006–07
Output-linked support	8.65	15.38	31.85
Support for intermediate inputs	NC	NC	NC
Support for value-adding factors	0.56	0.74	1.69
Support related to capital for blending and distribution	0.08	0.36	0.97
Support for ethanol-consuming vehicles	0.00	0.09	0.17
Support for ethanol-consumption	0.00	0.00	0.00
Support for R&D	0.00	0.00	1.53
Total assistance	**9.3**	**16.6**	**36.2**
Production (millions of litres)	22.67	40.32	83.5
Assistance per litre (A$/litre)	0.41	0.41	0.43

NC = Not calculated.

Source: GSI estimates.

Total assistance for biodiesel (Table 6.4) was less than for ethanol until FY 2006–07, when it rose to A$ 31.4 million, compared with A$ 36.2 million for ethanol in the same year. On a per-litre basis, the levels of assistance are essentially the same for the two fuels: around A$ 0.42 per litre.

Table 6.4 Total assistance for biodiesel in Australia, FY 2004–05 to FY 2006–07 (millions of Australian dollars)

Support element	2004–05	2005–06	2006–07
Output-linked support	1.69	8.09	29.37
Support for intermediate inputs	NC	NC	NC
Support for capital formation in production	0.15	0.71	1.51
Support for the purchase of land	0.00	0.00	0.05
Support related to capital for blending & distribution	0.00	0.01	0.01
Support for biodiesel-consuming vehicles	0.00	0.00	0.00
Support for biodiesel consumption	0.00	0.00	0.00
Support for R&D	0.00	0.02	0.48
Total assistance	**1.8**	**8.8**	**31.4**
Production (millions of litres)	4.42	21.21	77.0
Assistance per litre (A$/litre)	0.42	0.42	0.41

NC = Not calculated.

Source: GSI estimates.

6.2 The intensity of assistance

Estimates of transfers and assistance provide only a crude measure of a potential market distortion. A large amount of assistance, spread across a very large market, can have less of an effect on market structure than a much smaller amount of assistance focused on a small market segment. So-called "subsidy-intensity metrics" normalize assistance for the size of particular energy markets, and for differential heat rates of similar volumetric units (i.e., litres).

One measure of the degree to which a product is supported is the share of assistance as a percentage of its market value. That ranges from between roughly 40 per cent and 60 per cent of the estimated market value for ethanol,[75] to between 30 per cent and 40 per cent of the estimated market value for biodiesel, based on average prices during FY 2006-07 (Table 6.5). That is to say, if all the support were reflected in the price of these biofuels, these fuels would cost consumers 30 per cent to 60 per cent more than their actual market value. Since none of the support elements changes in response to changes in the prices of either petrol or diesel fuels, lower or higher prices for petroleum fuels will generate correspondingly higher or lower values of support as a share of market prices than those indicated here.

Table 6.5 Subsidy-intensity metrics for ethanol and biodiesel, 2006-07

Indicator	Unit	Ethanol		Biodiesel	
		Low	High	Low	High
Assistance per litre	A$/litre	0.43		0.41	
Estimated market value, Average, 2007[1]	A$/litre	0.71	1.06	1.09	1.20
Assistance as a % of market value[2]	%	40%	60%	30%	40%
Assistance per gross GJ of biofuel produced	A$/GJ	20.00		12.50	
Assistance per litre of petrol or diesel equivalent[3]	A$/litre equiv.	~0.65		~0.45	

Notes: (1) The higher reference market value for ethanol is the price of RON (91) unleaded petrol, including excise taxes, but not including GST. The lower reference value assumes the price for ethanol would be proportional to the relative thermal value (67 per cent) of ethanol compared with RON (91) unleaded petrol. The average price for biodiesel is assumed to be proportional to the relative thermal value (90.8 per cent) of biodiesel compared with non-commercial petroleum diesel sold for non-commercial purposes, including excise taxes but not including GST.

(2) The range for ethanol reflects support per litre divided by, respectively, the highest and lowest market values in the previous line.

(3) For ethanol, the lower value in the range is based on an assumption that there would be no loss in vehicle performance if used in a low-ethanol (less than E5) blend; the higher value assumes a penalty proportional to the ratio of the lower heating values of ethanol (21.41 MJ/litre) and petrol (31.88 MJ), which is more typical of vehicle performance when used in a higher ethanol blend. For biodiesel, support per litre estimates are grossed up by the ratio of the lower heating values of biodiesel (32.65 MJ/litre) and petroleum diesel (35.95 MJ/litre). The range in values thus represents the range in support under different assumptions.

Sources: •**support estimate:** GSI; • **heat values:** Zah *et al.* (2007); • **prices of petroleum fuels:** International Energy Agency, *Energy Prices & Taxes—Quarterly Statistics: Fourth Quarter 2007*, Paris: OECD Publications, 2008.

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75 The rather wide range in the values for ethanol reflects two different assumptions. One assumes that there is no penalty in fuel economy (per litre) using ethanol in ethanol-gasoline blends containing up to five per cent ethanol. The other assumes that there is a penalty proportional to the ratio of the heating values of ethanol and gasoline multiplied by the share of ethanol in the blended fuel. Ratings of fuel economy in the United States, for example routinely show that distances travelled in flex-fuel vehicles on an equal volume of E85 are on average 25 per cent less than on gasoline, which is only slightly better than the 30 per cent reduction in performance one would expect from comparing ethanol's and gasoline's heating values.

Another way to look at assistance is per unit of energy and per unit of fossil-fuel equivalent. Since ethanol has a heating value per litre that is 67 per cent that of biodiesel, normalizing each in terms of A$ per gigajoule (GJ) raises the rate of assistance to ethanol considerably above that of biodiesel: A$ 20.00 per GJ for ethanol, compared with A$ 12.50 per GJ for biodiesel. Translating these into litres of petrol and petroleum diesel equivalent also shows that the rates of assistance are higher for ethanol than for biodiesel: around A$ 0.65 and A$ 0.45, respectively. In the case of ethanol, its rate of assistance on a petrol-equivalent basis was equivalent to the ex-tax market price for regular unleaded (RON 91) petrol in the fourth quarter of 2006, which dropped during that period to A$ 0.633 (IEA, 2008). That means, effectively, that the government could have obtained the same amount of energy by buying petrol on the open market as subsidizing ethanol.

6.3 Assistance per unit of fossil-fuel-equivalent displaced

Public financial support for biofuels is often proposed as a way to wean a country from its dependence on fossil fuels in general, and petroleum in particular. To estimate how efficiently biofuels subsidies help to reduce reliance on petroleum, or on fossil fuels in general, one needs to avoid crediting the ethanol or biodiesel with the expenditure of fossil fuels used to create and deliver them.

The degree to which the use of biofuels displaces fossil fuels varies fairly widely across estimates by different researchers, even when system boundaries have been standardized. Generally, fossil-fuel displacement factors are greater for biofuels made from waste or low-grade materials (C-molasses, waste starch, tallow, waste cooking oil) than from biofuels made from grains or oilseeds. That is chiefly because in the latter case more fossil fuels are used in producing and processing the feedstocks.

We have side-stepped this controversy by using a range of values from Zah *et al.* (2007a and 2007b). Such life-cycle analyses express either the fossil (or non-renewable) energy input required to produce a GJ of biofuel, or the net energy yield as a share of the gross energy content of the biofuel. The higher the net displacement, the more of the gross energy content remains as a base over which to spread the biofuel subsidy numbers.

The amount of support per litre of petrol or diesel equivalent avoided is not much less than the market value of the fuels that they displace. For ethanol, the assistance ranges between A$ 0.80 and A$ 2.05 per litre of gasoline-equivalent avoided, with the lower end of the range reflecting a low-grade feedstock processed in a plant that co-generates heat and power, and the high range a grain feedstock (such as maize or wheat) in a plant that does not co-generate heat and power (Table 6.6).

Table 6.6 Support for ethanol per unit of fossil fuel displaced, 2006–07

Indicator	Unit	Ethanol from C-molasses or waste starch		Ethanol from grains	
		Low	High	Low	High
Assistance per litre of gasoline equivalent[1]	A$/litre equiv.	0.65			
Displacement factor [2]	GJ fossil-fuel input/GJ output	0.18		0.32	0.68
Net gain in non-fossil energy	%	82%		32–68%	
Support per litre of gasoline equivalent of fossil fuels displaced [3]	A$/litre equiv.	0.80		0.90	2.05

(1) For explanation of the ranges, see note (3) to Table 6.3.

(2) Ranges reflect ranges in literature for, respectively, ethanol from sugarcane in Brazil, and ethanol from sweet sorghum in China and from rye in the EU.

(3) Equals total assistance per litre of petrol equivalent divided by the percentage net gain in non-fossil energy.

Sources: • **assistance estimates:** GSI; • **displacement factors:** GSI estimates, based on Zah *et al.* (2007).

For biodiesel (Table 6.7), the subsidy cost of displacing fossil fuels is lower, i.e., around A$ 0.55 per litre of diesel-equivalent for biodiesel made from used cooking oil, and between A$ 0.80 and A$ 1.00 per litre of diesel-equivalent for biodiesel made from virgin canola oil. The subsidy cost of displacing fossil fuels through the production and use of biodiesel from tallow would be somewhere within this range.

Table 6.7 Support for biodiesel per unit of fossil fuel displaced, 2006–07

Indicator	Unit	Biodiesel from used cooking oil		Biodiesel from canola	
		Low	High	Low	High
Support per litre of diesel equivalent [1]	A$/litre equiv.	0.45			
Displacement factor [2]	GJ fossil-fuel input/GJ output	0.11	0.23	0.45	0.57
Net gain in non-fossil energy	%	77–89%		43–55%	
Support per litre equivalent of fossil fuels displaced [3]	A$/litre equiv.	0.50	0.60	0.80	1.00

Notes: (1) For explanation of the ranges, see note (3) to Table 6.3.

(2) Ranges reflect ranges in literature for, respectively biodiesel from used cooking oil, and biodiesel made from canola (rape) oil (Switzerland and the EU).

(3) Equals support per litre of diesel equivalent divided by the percentage net gain in non-fossil energy.

Sources: • **support estimate:** GSI; • **displacement factor:** GSI, based on Beer *et al.* (2003 and 2007); and Zah *et al.* (2007).

Given that biofuels are not the only courses of action to reduce fossil fuel use (e.g., electric-hybrid cars, improved public transport or increased fuel efficiency) it is not clear how competitive they would be compared with alternative strategies, especially those that take into consideration the potential for demand-side measures.

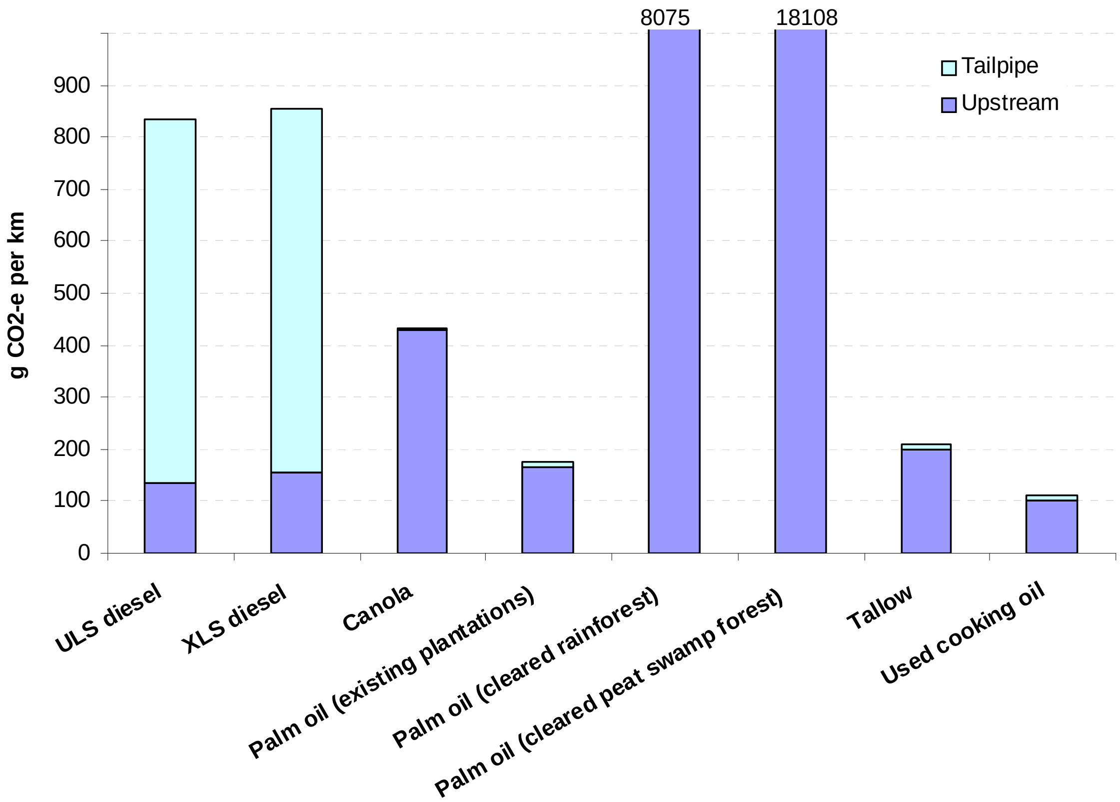
6.4 Support per tonne of CO_2-equivalent displaced

A final issue worth examining is the subsidy per unit of CO_2-equivalent displaced through the substitution of biofuels for their petroleum-derived equivalents. The key policy question is whether these investments are efficient with regard to GHG mitigation.

Beer *et al.* (2007) found that biodiesel made from used cooking oil resulted in a CO_2 "saving" (relative to fossil diesel) of 87 per cent, while the "saving" from canola was 49 per cent (Figure 6.1). When changes in land use were taken into account in the production of feedstocks, the greenhouse emissions of biodiesel can be many times higher than that of fossil diesel. In the case of palm oil sourced from cleared rainforest or peat swamp, the GHG emissions have been found to be eight to 21 times greater (respectively) than those from diesel (Beer *et al.* 2007).

Searchinger *et al.* (2008) found that, at the global level, increases in biofuel production displaces food production on arable land and, as the demand for food is growing, new land would need to be converted for food production. After taking into account emissions from such land-use change, the study found that maize-based ethanol, instead of producing a 20 per cent saving, nearly doubles greenhouse emissions over 30 years and increases greenhouse gases for 167 years. Fargione *et al.* (2008) found by causing the conversion of natural ecosystems to food production, a "biofuel carbon debt" is created, releasing between 17 and 420 times more CO_2 than the annual greenhouse gas reductions these biofuels provide by displacing fossil fuels

Figure 6.1 Full life-cycle GHG emissions from 100 per cent biodiesel (per km for a heavy truck)[76] (truncated Y axis)



Notes: ULS refers to Ultra Low Sulphur diesel; XLS refers to Extra Low Sulfur diesel

Source: Beer *et al.* (2007).

As a measure of cost-effectiveness, the level of support per unit of CO_2-equivalent avoided are compared with the cost of purchasing carbon credits. Buying GHG reductions by subsidizing wheat-based ethanol is not very efficient, costing at least A$ 690 (US$ 550) per tonne of CO_2-equivalent avoided (Table 6.8). The cost per CO_2-equivalent tonne avoided through the ethanol derived from waste starch or C-molasses is much better, in the neighbourhood of A$ 400 (US$ 315), but still high.

[76] The Australian federal National Environmental Protection Measure standard for a rigid diesel truck.

Table 6.8 Assistance per tonne of CO_2-equivalent avoided from using ethanol

Indicator	Unit	Ethanol from C molasses or waste starch		Ethanol from wheat	
		Low	High	Low	High
Baseline emissions (from gasoline or petroleum diesel)	kg of CO_2 equiv./GJ	88.8			
Percentage reduction from baseline	%	55%	61%	29%	34%
Assistance per GJ of biofuel produced	A$/GJ	20.50			
Assistance per tonne of CO_2-equivalent avoided[1]	A$/tonne of CO_2 equiv.	380	410	680	790
	US$/tonne of CO_2 equiv.	300	330	540	630
Price of a CO_2-equivalent offset, Chicago and European Climate Exchanges, FY 2006–07[2]	US$/tonne of CO_2 equiv.	$ 3.91 to $ 24 (€ 17.90)			

(1) Calculated as support per GJ divided by the product of the baseline emissions and the percentage reduction. Ranges reflect the combination of ranges of subsidy values and estimated emission reductions.

(2) Average of daily trades of ECX CFI Futures Contracts on the European Climate Exchange for December 2006 settlement.

Sources: • **assistance estimates:** GSI; • **CO_2-equivalent reduction values:** GSI estimates, based on Beer *et al.* (2001) and CONCAWE et al. (2007); • **CO_2-equivalent futures prices: Chicago Climate Exchange** (www.chicagoclimatex.com/market/data/summary.jsf) and the European Climate Exchange (www.europeanclimateexchange.com/index_flash.php)

In the case of biodiesel, the cost of avoiding a CO_2-equivalent tonne is about A$ 300 (US$ 240) if the biodiesel is made from virgin plant oils, but under A$ 200 (US$ 150) per tonne of CO_2-equivalent for biodiesel made from used cooking oil or tallow (Table 6.9).

Table 6.9 Assistance per tonne of CO_2-equivalent avoided from using biodiesel

Indicator	Unit	Biodiesel from used cooking oil or tallow		Biodiesel from canola oil	
		Low	High	Low	High
Baseline emissions (from gasoline or petroleum diesel)	kg of CO_2 equiv./GJ	87			
Percentage reduction from baseline	%	75%	90%	48%	
Assistance per GJ of biofuel produced	A$/GJ	1			
Assistance per tonne of CO_2-equivalent avoided[1]	A$/tonne of CO_2 equiv.	160	190	300	
	US$/tonne of CO_2 equiv.	130	150	240	
Price for a CO_2-equivalent offset, US Climate Exchange [2]	US$/tonne of CO_2 equiv.	$ 3.91 to $ 24 (€ 17.90)			

(1) Calculated as support per GJ divided by the product of the baseline emissions and the percentage reduction. Ranges reflect the combination of ranges of subsidy values and estimated emission reductions.

(2) Average of daily trades of ECX CFI Futures Contracts on the European Climate Exchange for December 2006 settlement.

Sources: • **total assistance estimates:** GSI; • **CO_2-equivalent reduction values:** GSI estimates, based on Beer *et al.*, 2003; and Beer et al., 2007; **CO_2-equivalent futures prices:** www.europeanclimateexchange.com/index_flash.php

No matter what the biofuel, however, the support levels are not particularly cost-effective. For the same cost of obtaining one tonne of CO_2-equivalent reduction through public support for ethanol (even ethanol produced from C-molasses or waste starch) the government could have purchased around 100 tonnes of CO_2-equivalent offsets on the Chicago Climate Exchange (assuming a price of under US$ 4 per tonne of CO_2-equivalent); the subsidies would have purchased more than 20 tonnes on the European Climate Exchange. For the same cost of one tonne of CO_2-equivalent reduction through public support for biodiesel (even biodiesel made from used cooking oil) the government could have purchased between 5 and 60 tonnes of CO_2-equivalent offsets.

7 Discussion and recommendations

This report set out to provide a comprehensive survey to date of subsidies to liquid biofuels in Australia. Although data and resource limitations prevented us from identifying and quantifying all the subsidies now supporting the country's ethanol and biodiesel industries, we believe we have identified the major ones. By constructing an integrated picture of subsidies to biofuels at both the federal and state levels of government, and examining a wide variety of programmes, we were able to assemble a more comprehensive assessment of the level of public support than has previously existed. We hope that other researchers will be able to build on this study, correct errors and continue the process of quantifying support to the industry.

The picture that emerges from our analysis on biofuels markets shows that the level of support to ethanol and biodiesel is significant in Australia. It is also linked strongly to output. Moreover, this support has been provided through a large number of programmes, often short-term in duration individually, but overlapping over time. In sum, we find that support for biofuels is not a particularly efficient means to achieve many of the policy objectives for which it has been justified.

7.1 Key Findings

Total transfers to the biofuels sector in Australia are currently around A$ 95 million annually

The largest subsidies remain those provided under federal programmes, but many state-level programmes provide significant amounts of support to the industry. In total, transfers provided for liquid biofuels were approximately A$ 55 million for ethanol and A$ 40 million for biodiesel in 2006–07.

Distributing the grants provided to capital, and expenditure on R&D, over several years reduces our assistance estimates for 2006–07 to A$ 36 million for ethanol and A$ 31 million for biodiesel, reflecting the large number of capital-related grants provided in that year. (The effect is lower for previous years.) On a per-litre basis, the levels of assistance are essentially the same for the two fuels: around A$ 0.42 per litre.

The aggregate level of support in Australia is small when compared with GSI estimates of the levels provided in the United States (around A$ 7 billion) or the European Union (A$ 4.5 billion) in 2006 alone (Steenblik, 2007). However, in the case of ethanol, assistance per litre is roughly comparable to that in the United States (Table 7.1). The effective rates of assistance are also high for biofuels compared with other Australian industries; at over 60 per cent for biodiesel and over 100 per cent for ethanol, they exceed the levels for agriculture and for manufacturing as a whole, which now averages around five per cent. The industry with the highest rates of assistance, dairy cattle farming, had an ERA of just 15 per cent in 2006–07.

Table 7.1 Assistance for biofuels per litre of gasoline or diesel equivalent, 2006 (Australian dollars)

Economy	Ethanol (assistance per litre of gasoline equivalent)	Biodiesel (assistance per litre of diesel equivalent)
United States	0.47 – 0.57	0.7 – 0.87
European Union	1.77	0.89
Australia	0.65	0.45

Source: Steenblik, 2007; Koplow, 2007.

Such high levels of domestic support for biofuels are inconsistent with the approach taken by both major Australian political parties in recent years, which have generally advocated deregulation, trade liberalisation, and reduced industry assistance.

There has been a strongly ad hoc characteristic to support for biofuels in Australia

The subsidies provided to the industry appear to result from many independent decisions in different agencies. As a result, some individual ethanol plants, particularly those connected with the sugar industry, have been able to tap into multiple sources of government grants. Coordination among the various funding agencies and between the federal and state governments in the area of biofuel policy is hard to discern.

The largest element of support—production grants—has emerged from complex and piecemeal reforms to fuel taxation. The tax-and-subsidy regime has been stable in recent years and, assuming that there are no further changes to excise duties on fuel, nor to the scheduled production bounties, assistance should begin to decline after 30 June 2011. However, the lower levels of excise duty, even after the production bounties disappear at the end of FY 2014–15, will continue to mean that less revenue will be collected through fuel excise than if biofuels were charged the full excise tax for their respective energy category.

The threat remains that, even with these announced curbs on subsidy growth, the ethanol tariff or production bounties could very well be extended in response to industry or other interest-group pressure.

On a positive note, the bulk of support to biofuels in Australia is focussed on the manufacturing and distribution of the fuel. Direct support for the feedstock biomass used in producing the fuels is largely absent, and no special support is provided to private passenger vehicles capable of running on high blends of biofuels.

Assistance to biofuels is set to grow through 2011

Because the bulk of subsidies are tied to output, and output is increasing, the cost of these programmes will continue to climb—irrespective of the price of petroleum fuels—at least through the period covered under the current excise-duty regime. At an annual consumption level of 400 ML per year (not an unrealistic level by 2010), the production bounties alone could cost the Federal Government over A$ 150 million annually. In addition to distorting product markets, and trade in the case of ethanol, production-linked assistance is also expensive, since public expenditure will rise with output.

Current assistance and protection lack coherence in achieving policy aims

The settings of current the per-litre rates of assistance are arbitrary, and bluntly targeted. Production bounties that completely and exactly offset the excise duty, and then decline to half of what their excise duty would be on an energy-equivalent basis, are unlikely except by accident to reflect an accurate weighing of costs and benefits.

Maintenance of discrimination against imported ethanol (through a five per cent ad valorem tariff, plus the customs duty of A$ 0.38143 per litre), in particular, sits at odds with the professed policy of the Australian Government to encourage the substitution of petrol by ethanol.

The arguments for maintaining assistance to biofuels should be questioned

Government assistance to liquid biofuels, particularly biodiesel, started out in Australia as a way to increase the demand for surplus agricultural products such as tallow. Lately, however, the fuels have been promoted as a way to reduce oil imports and prices, improve the quality of urban airsheds, reduce CO_2 emissions, raise farmer incomes, and promote rural development. That is a tall order for a pair of commodities to live up to. It is highly unlikely that they can.

Evaluating the alternatives to biofuels was beyond the scope of this study. However, the subsidy costs per unit of conventional energy and carbon displaced that we have estimated do suggest that there may be many quicker and cheaper ways to achieve these same goals.

Other studies support this view. In the case of employment, ABARE estimated that meeting the government's target of 350 million litres per year of biofuel consumption would generate an additional 648 direct and indirect jobs in regional areas (Australian Government, 2005). The annual cost (in 2004–05 dollars) of each of these jobs was estimated to be A$ 182 000 in government expenditure and A$ 139 000 in economic costs. This appears high compared with average annual earnings of A$ 51 000 per employee and an estimated cost per job created of A$ 20 000 under the Commonwealth Dairy Regional Assistance Programme (CSIRO *et al.*, 2003).

Biofuels should compete directly for public support with alternative strategies, such as improving fleet efficiency, and encouraging research into alternatives. While government programmes often contain public disbursements in these areas, there has been little evaluation of the relative cost-effectiveness of biofuels vis-à-vis these alternatives.

Subsidies to fossil fuels and road transport also require attention

According to at least one study (Riedy, 2007), Governments in Australia provide substantial financial support for motor-vehicle transport and for the production and use of fossil fuels, through direct payments, favourable tax treatment and other actions. Most of this support likely encourages fossil-fuel use and thus greenhouse gas emissions. If true, that suggests there may still be ways that governments can achieve policy objectives (such as GHG emission reductions or energy security) by spending *less* money, rather than more.

The cost-effectiveness of assistance to biofuels in Australia may be better than in other countries, but is low nonetheless

The absolute value of subsidies to an industry is not the only, and perhaps not the main, indicator of the market-distorting potential of support policies. Per unit of energy produced, the subsidies generated by policies supporting liquid biofuels are high on a thermal-equivalent basis—in the vicinity of A$ 20 per gigajoule for ethanol and A$ 13 for biodiesel. Assistance as a share of market price was close to 40 per cent as of mid-2007.

Such high rates of assistance might be considered reasonable if the industry was new, and ethanol and biodiesel were being made on a small-scale, experimental basis using advanced technologies. But that, for the most part, is not the case: ethanol is being produced using mature technologies that, notwithstanding progressive improvements, have existed for decades. Biodiesel manufacturing may take place at a smaller scale, but it is based on long-established chemical processes that are well enough understood.

Supporting first-generation biofuels is not a cost-effective way to reduce greenhouse-gas emissions

Biofuels may provide some greenhouse gas and local pollution benefits (as well as increased some health risks; see, e.g., Jacobson 2007). But the cost of obtaining a unit of CO_2-equivalent reduction through support for biofuels is high—even in Australia, where current production methods rely on manufacturing processes that have a better GHG balance than in most other countries. We calculate that assistance per tonne of CO_2-equivalent removed is between A$ 380 and A$ 410 for ethanol made from C-molasses or waste starch, even when assuming an efficient plant using low-carbon fuels is used for processing, around A$ 180 for biodiesel made from used cooking oil, and over A$ 300 for biodiesel made from canola oil. One could achieve far more reductions for the same amount of money by simply purchasing the reductions in the marketplace. Even under the best-case scenario assumptions for GHG reductions from biofuels (biodiesel from used cooking oil), the cost per tonne of reductions achieved through public support for biofuels in Australia could have purchased more than five tonnes of CO_2-equivalent offsets on the European Climate Exchange, or more than 20 tonnes on the Chicago Climate Exchange.

Some differential in the excise tax might be appropriate in order to reflect the lower emissions of atmospheric pollutants produced from biofuels, and their (generally) lower life-cycle emissions of greenhouse gases compared with unleaded petrol and low-sulphur diesel. But the differential is likely to be smaller than that currently experienced—especially if annual crops begin to be the dominant feedstocks, and if direct and indirect land-use effects are taken into account. A tax of A$ 30 per tonne of CO_2, for example, would equate to A$ 0.07 per litre of petrol. That is far lower than the current and future effective difference in the excise duty between petrol and ethanol, or diesel and biodiesel. In any case, that differential would represent an upper limit even if biofuels could offset 100 per cent of the CO_2 emissions from petroleum fuels. They do not. Moreover, the life-cycle GHG emissions of biofuels differ enormously, depending on the kind of feedstock used, how it is produced, and how it is processed. Some ethanol produced in Australia currently results in 80 per cent reductions in GHG emissions compared with petrol on a life-cycle basis. But other plants that are planned, such as those that would use wheat as a feedstock and coal for process heat, would yield much smaller GHG emission reductions. Yet all ethanol receives the same excise-duty treatment.

The potential for unintended consequences is large

Assistance to liquid biofuels is being injected into an agricultural economy that, although not highly distorted in Australia, is certainly affected by distortions at the global level and subject to considerable volatility. Risks of unintended consequences are plentiful.

Concerns over competition for crops between fuel and animal feed should argue for caution. To be sure, farmers should be free to plant crops for biofuel production, and manufacturers to make biofuels, as long as they conform to prevailing environmental standards. However, by establishing mandates for biofuel consumption, several state governments have interfered with the workings of a market previously geared to the production of food, animal feed and a small amount of industrial products.[77] While this study has not examined the question of fuel-food competition, we would note that many economic assessments of feedstock outlet markets under increasing demand for biofuels imply declining crop exports. Were demand to grow quickly, it is likely that shifts in the food-fuel balance could also occur quickly, with important economic and social implications beyond Australia's borders.

The aim of government support for emerging industries is ultimately to establish a viable, competitive industry that is profitable without subsidies. The long-term viability of the Australian biofuels industry in the absence of government support and trade protection is by no means certain. More established biofuel industries, including in Brazil, the United States and the European Union, remain dependent on mandates or subsidies, or both. Brazil's industry in particular is much larger than Australia's and, based on current prices, would out-compete Australian production in an open market.

The current support regime for biofuels may be establishing businesses that will only fail once the market is opened, rendering obsolete the public investment already made in the Australian biofuel industry. Even in the presence of subsidies, several biodiesel producers have ceased operating due to high feedstock costs. A salient example is that of Australian Renewable Fuels, which received federal grants totalling A$ 7.68 million,[78] plus an A$ 0.65 million interest-free loan from the Western Australian Government. Yet, despite this assistance, the company suspended its Australian operations only a year after completing construction of its plants.

Favouring biofuels through subsidization also risks injury to other Australian businesses that are already viable in the open market. As demonstrated by the CIE (2005), increased grain prices as a result of biofuel production could reduce the competitiveness of Australian grain and livestock exports. A sustained period of subsidisation to biofuels risks favouring an industry with an uncertain future over existing profitable businesses. Furthermore, the decreased agricultural exports and increased feedstock imports as a result of domestic biofuel production could undermine any benefits to the balance of payments gains from reduced petroleum imports.

Political support for biofuels is clearly strong in Australia, especially from crop farmers, some motorists and segments of the environmental community. Yet there has never been a more-urgent need to examine the claimed benefits of subsidizing biofuels, and to compare it with the costs of meeting the same goals in other ways.

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77 For additional objections to biofuel mandates, see Webb (2008).

78 A$ 7.15 million from the Biofuel Capital Grants Scheme and A$ 0.531 million from the then Department of Transport and Regional Services.

7.2 Recommendations

Our list of recommendations at this stage in the analysis is straightforward. The federal government should:

- Continue to resist calls for establishing national mandatory blending requirements for biofuels, at least without first undertaking a thorough examination of the costs and benefits. The federal government has been wise to resist instituting blending mandates for biofuels so far. Once a mandate is established, it is difficult to abandon, especially since significant investments will have been made on the assumption that the mandate will continue indefinitely. Moreover, it creates a priority for fuel over competing uses of feedstock, which might otherwise have a higher value use.
- Avoid providing new specific assistance to the industry, and do not prolong the phasing out of the existing production grants and the phasing in of the final excise duty.
- Re-evaluate the arbitrary decision to set the final excise duty for biofuels at no more than 50 per cent of the energy-weighted excise duty applied to petrol and biodiesel.
- Remove barriers to trade in ethanol.
- Adopt neutral policies favouring all options to reduce reliance on petroleum in the transport sector or greenhouse gases.
- Commission an economic analysis of the long-term economic viability and international competitiveness of an Australian biofuels industry in the absence of assistance and trade protection.
- Improve the information available on support provided to the biofuels industry, and the effects of such support. More research into the effects of continuing to promote domestic production of liquid biofuels is sorely needed. But good research requires data, and that in turn means that the federal government should collect better data than it has done so far on the production of biofuels and demand for feedstocks. Information on actual support to biofuels, while not yet reported systematically, is at least not difficult to find and assemble in Australia. It is difficult, nonetheless, to obtain an accurate picture of what the public is getting for its money.

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About the Global Subsidies Initiative

The International Institute for Sustainable Development (IISD) launched the Global Subsidies Initiative (GSI) in December 2005 to put a spotlight on subsidies—transfers of public money to private interests—and how they undermine efforts to put the world economy on a path toward sustainable development.

Subsidies are powerful instruments. They can play a legitimate role in securing public goods that would otherwise remain beyond reach. But they can also be easily subverted. The interests of lobbyists and the electoral ambitions of office-holders can hijack public policy. Therefore, the GSI starts from the premise that full transparency and public accountability for the stated aims of public expenditure must be the cornerstones of any subsidy program.

But the case for scrutiny goes further. Even when subsidies are legitimate instruments of public policy, their efficacy—their fitness for purpose—must still be demonstrated. All too often, the unintended and unforeseen consequences of poorly designed subsidies overwhelm the benefits claimed for these programs. Meanwhile, the citizens who foot the bills remain in the dark.

When subsidies are the principal cause of the perpetuation of a fundamentally unfair trading system, and lie at the root of serious environmental degradation, the questions have to be asked: Is this how taxpayers want their money spent? And should they, through their taxes, support such counterproductive outcomes?

Eliminating harmful subsidies would free up scarce funds to support more worthy causes. The GSI's challenge to those who advocate creating or maintaining particular subsidies is that they should be able to demonstrate that the subsidies are environmentally, socially and economically sustainable—and that they do not undermine the development chances of some of the poorest producers in the world.

To encourage this, the GSI, in cooperation with a growing international network of research and media partners, seeks to lay bare just what good or harm public subsidies are doing; to encourage public debate and awareness of the options that are available; and to help provide policy-makers with the tools they need to secure sustainable outcomes for our societies and our planet.