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Prepared by: MQC Management Pty Ltd

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Meat & Livestock Australia Limited
Locked Bag 991
NORTH SYDNEY NSW 2059

Biodiesel additive

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Abstract

MLA and its partners have successfully developed a process and formula for a B5, B20 and B100 Biodiesel additive. The additive overcomes crystallisation and cloud-point issues associated with tallow-based biodiesel. The additive lowers the cloud point of animal fat-based biodiesel from 50 degrees to 21 degrees Fahrenheit (10 degrees to minus 6 degrees Celsius),

This technology increases the potential for using biodiesel made from animal fats in the winter and in colder climates. This is critical for the extended applicability of tallow-based biodiesels and will potentially drive the demand for tallow as a biodiesel feed-stock.

This report details the markets, feed-stocks and manufacture of biodiesel; the economics of biodiesel production from tallow; the technology and value proposition of the additive.

Executive summary

Diesel and biodiesel low temperature properties are determined by their chemical makeup which affects crystal growth. All diesel fuel and biodiesel contains wax molecules, which are dissolved in the fuel at higher temperatures. As the fuel temperature drops, the wax molecules begin to crystallize.

The problems of associated with cold flow are more acute in biodiesel made from animal fats such as tallow than with mineral biodiesel. The cold-flow additives work by interacting with the growing wax crystals to keep them small and thus able to flow[1]. MLA with their technical partners, have developed a process and formula for a B5, B20 and B100 biodiesel additive.

MLA has secured a provisional patent for the additive which lowers the cloud point temperature for biodiesel. The additive lowers the cloud point for animal-fats-based biodiesel from 50 degrees to 21 degrees Fahrenheit (10 degrees to minus 6 degrees Celsius), thereby increasing the potential for using biodiesel made from animal fats in colder climates.

The additive blend comprises 25% raw material (proprietary blend of surfactants and polymers) and 75% diesel oil. The additive blend is then added at approximately 2% to a B5, B20 or B100 biodiesel blend.

This report details:

- the market, feed stocks and manufacture of biodiesel
- the economics of biodiesel production from tallow
- environmental advantages of utilising biodiesel
- government policies and regulatory environment affecting biodiesel
- the technology behind and value proposition of the additive.

[1] http://www.biodieselmagazine.com/article-print.jsp?article_id=1866 last accessed 17/12/09

CONTENTS

1 TECHNOLOGY BACKGROUND[2]

Biodiesel is an alternative to petroleum diesel fuel made from renewable resources such as vegetable oils, animal fats or algae. It has very similar combustion properties to petroleum diesel, and can replace it in current uses. However, it is most often used as an additive to petroleum diesel, improving the otherwise low lubricity of pure, ultra low sulfur petrodiesel fuel. A growing number of fuel stations throughout Australia and around the world are making biodiesel available to consumers, and a growing number of large transportation fleets use some proportion of biodiesel in their fuel.

Tallow is a rendered form of beef or mutton fat, processed from suet and is a solid at room temperature. Unlike suet, tallow can be stored for extended periods without the need for refrigeration to prevent decomposition, provided it is kept in an airtight container to prevent oxidation.
The major uses of tallow are:

- Soap making
- Oleo-chemicals
- Edible applications
- Pet food
- Biodiesel production
- Stock fee

The Australian red meat industry currently produces about 600,000 metric tons of animal fats per year which is primarily used in the manufacturing of soap and synthetic rubber. Tallow is a feedstock for the biodiesel industry, but suffers from poor cold flow properties.

The most common method of producing biodiesel is to react animal fat or vegetable oil with methanol in the presence of sodium hydroxide (a base, known as lye or caustic soda). This reaction is a base-catalysed transesterification that produces methyl esters and glycerine[3]:

Oil or Fat (1000 kg) + Methanol (107.5 kg) = Methyl ester (1004.5 kg) + Glycerol (103 kg)

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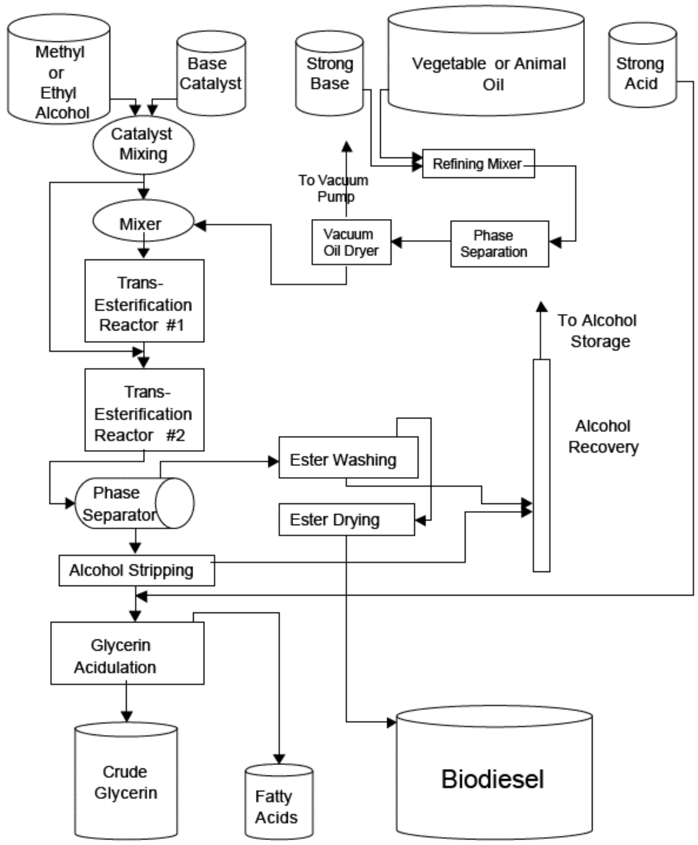
[2] Information taken from the Kate Gunn report, P.PSHP.0340 unless referenced otherwise.
[3] Biodiesel production and economics, May 2006, Government of Western Australia



The fuel properties of biodiesel will greatly depend on the fatty acid chains of the feedstock used for esterification. For example, in biodiesel produced from tallow, a highly saturated fat will solidify at a higher temperature than biodiesel produced from corn oil because the fat it was formed from also solidified at a higher temperature. However an advantage of using tallow is that the biodiesel will have a higher cetane number, a desirable property in diesel fuel (Table 1). Among the vegetable oil crops, palm oil is a reasonably close substitute for tallow since both products have a similar fatty acid profile.

Table 1: properties of biodiesel feedstocks[4]

Fuel specific	**Canola**	**Tallow**	**Palm**
Viscosity (mm^2/s)	5.6	4.8	5.7
Cloud Point (C)	0	16	13
Pour Point (C)	-15	16	8
Cetane number	62	73	62
Iodine number	110	40 (mutton)	37
		-50 (Beef)	
Heating value (MJ/kg)	40.5	39.9	37.8

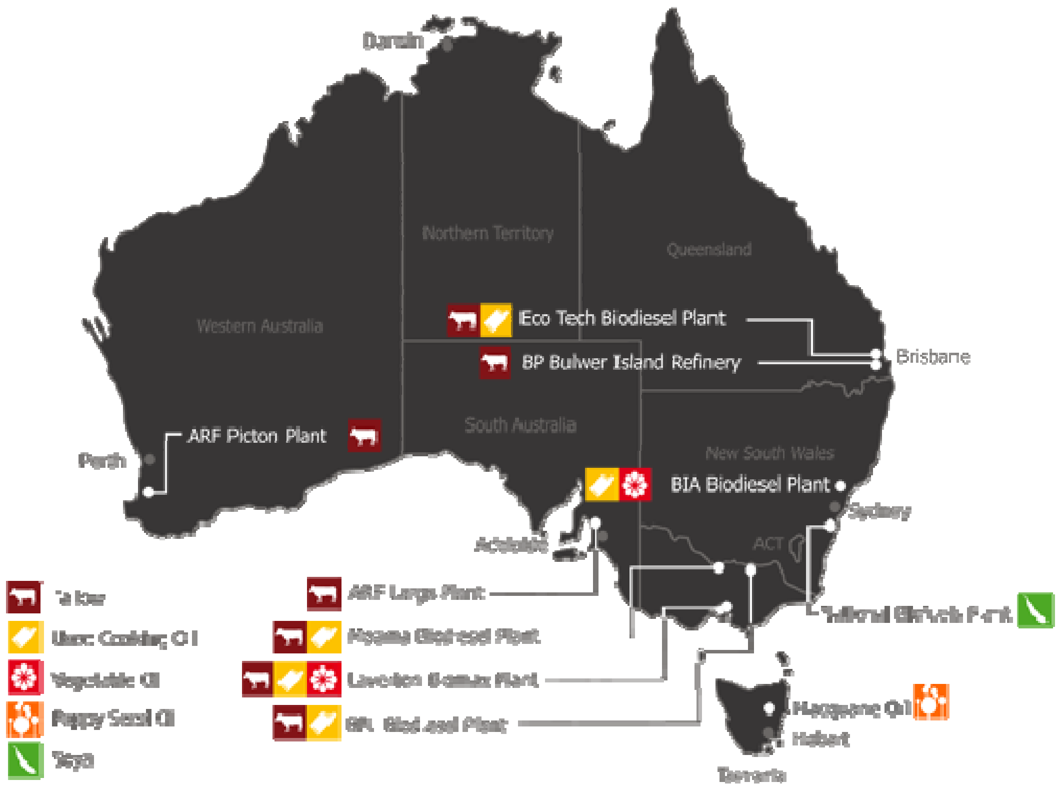
An iodine value of less than 25 is required if the neat oil is to be used for long term applications in unmodified diesel engines.

[4] Biodiesel production and economics, May 2006, Government of Western Australia

1.1 Biodiesel production

In 2003 fifteen proposed Australian biodiesel projects with a production capacity totalling 757 million litres (ML) were costed at approximately $597 million. A typical 40ML plant was costed at approximately $25M, equating to a fixed annual capital cost, including financial costs, of $1.8M/annum or 4c/L (rate of return of 6% and a plant life of 30 years)[5].

As of the 1st of January 2008, there were 10 biodiesel plants with a combined production of just under 560ML, but by January 2009 there were only 7 biodiesel plants with a capacity of 240ML[6]. Four of these plants were estimated to produce 100ML of biodiesel made from tallow and used cooking oil. You will notice that the figures for capacity and production are quite different.



A number of these biodiesel plants were closed down when tallow prices reached $900 per tonne, making production more expensive than sales, combined with tax changes that reduced sales. The companies that were impacted the greatest were Australian Biodiesel Group Narangba and Australian Renewable Fuels[7].

The major expense for biodiesel production is the feedstock (the type, availability and price) as evidenced in the table below[8]:

[5] Biodiesel production and economics, May 2006, Government of Western Australia
[6] Biofuels Association Australia website, last accessed 10th August 2009
[7] Kate Gunn report March 2009
[8] Biodiesel production and economics, May 2006, Government of Western Australia

Table 2 – Production cost of biodiesel (Biodiesel economics, May 2006, Govt Western Australia)

	Input detail	% of production cost
Feedstock	0.992kg/L biodiesel	83.67
Methanol	0.107kg/L biodiesel	6.62
Catalyst	0.001kg/L biodiesel	0.34
Sales and admin	0.009 AU$/L biodiesel	5.77
Maintenance	1.56% (%capital cost/L biodiesel)	2.57
Insurance	0.63% (%capital cost/L biodiesel)	1.03

1.2 Tallow biodiesel

Tallow is a rendered form of beef or mutton fat, processed from suet and is solid at room temperature. Unlike suet, tallow can be stored for extended periods without the need for refrigeration to prevent decomposition, provided it is kept in an airtight container to prevent oxidation. Industrially, tallow is not strictly defined as beef or mutton fat. In this context, tallow is animal fat that conforms to certain technical criteria, including its melting point. It is common for commercial tallow to contain fat derived from other animals, such as pigs.

Example of quantity and value of rendered product from 270 kg steer[9]

Material available for rendering (excludes added water and intestinal contents)	Yield of meat meal	Yield of tallow	Value of tallow and meat meal*
165 kg	48 kg	52 kg	$68.70

** Values based on July 2009 prices reported in MLA Co-products market analysis report*

The main determinant of tallow quality and price is free fatty acid (FFA). Free fatty acid is a measure of the amount of breakdown of the main component of tallow, triglyceride. High levels of free fatty acid result in loss of yield when the tallow is processed to make soap or biodiesel and may incur higher processing costs.

Breakdown of triglyceride in tallow and increases in FFA can occur in the raw material before rendering and after rendering in stored tallow. Free fatty acid levels are not usually affected by the rendering process. Sheep material generally produces tallow with a higher FFA than beef. Steps can be taken at the processor to limit increases in FFA in raw material.

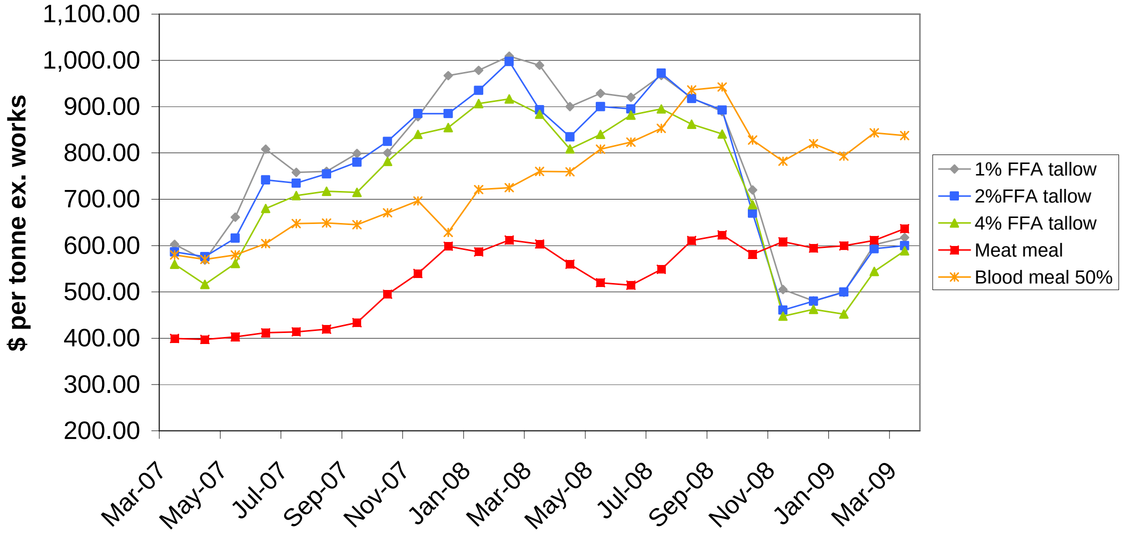
In theory, free fatty acid can be removed from tallow by addition of alkali such as sodium hydroxide. Alkali reacts with free fatty acid to form a soap which is not soluble in the fat and can be separated by settling or centrifugation. Removal of FFA from tallow by neutralization with alkali results in loss of yield. In addition, the effluent from the process may be difficult to dispose of[10].

Animal fats generally have a higher level of free fatty acid (FFA) which makes them harder to process into biodiesel, and makes biodiesel that gels quicker in cold temperatures. But due to their lower value, and depending on the process and local availability, tallow can make a lower cost biodiesel. It was estimated in 2004 that the cost of producing biodiesel from

[9] Coproducts compendium, MLA, 2009
[10] Coproducts compendium, MLA, 2009

tallow was $AU0.66/l versus $AU1.19/l from canola[11]. Obviously feedstock prices are critical in making tallow economically feasible. Tallow prices have fluctuated greatly[12]:

: Historical prices of tallow, meat meal and blood meal



When in 2007 the tallow price reached $900/tonne, making the production of biodiesel from this feedstock unfeasible, as realised by The Australian Biodiesel Group and Australian Renewable Fuels, amongst others.

MLA reported in 2008: 'Tallow prices were lower in July, with 1% free fatty acid (FFA) tallow falling from $972/tonne ex works a year earlier, and $875/tonne in June to average $775/tonne ex works. 4% FFA tallow was also lower, while the price fell to $655/tonne for 2% FFA tallow.

Tallow prices continued to fall due to lower world prices for vegetable oil, for which tallow is a substitute good. Tallow prices continued to fall into August and it is thought that at these prices demand should re-emerge.'[13]

1.3 The additive product

A growing number of fuel stations throughout Australia and around the world are making biodiesel available to consumers, and a increasing number of large transportation fleets use some proportion of biodiesel in their fuel. Tallow is a feedstock for the biodiesel industry, but suffers from poor cold flow properties. The research and development behind this project has sought to develop an additive to solve issues of cloud point.

Diesel and biodiesel low temperature properties are determined by their chemical makeup, which affects crystal growth. All diesel fuel and biodiesel contains wax molecules, which are dissolved in the fuel at higher temperatures. As the fuel temperature drops, the wax molecules begin to crystallize. Cold flow additives work by controlling the crystals. They interact with the growing wax crystals to keep them small and able to flow[14].

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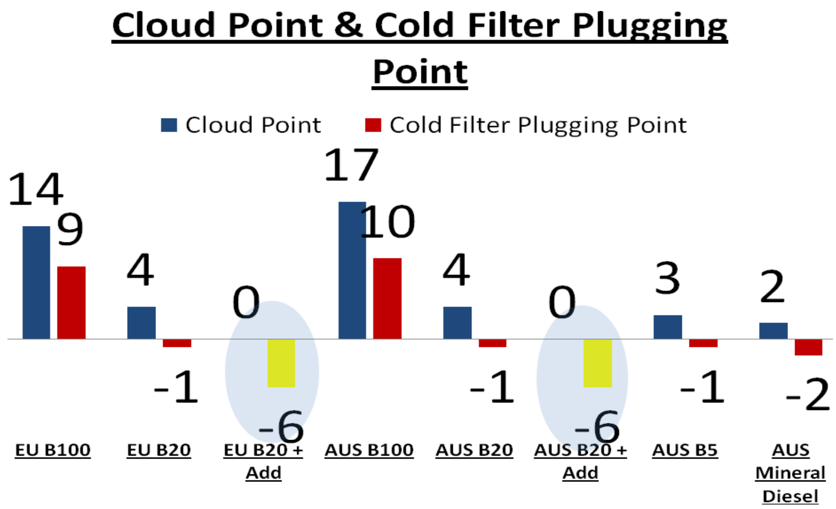
[11] Biodiesel production and economics, May 2006, Government of Western Australia
[12] Coproducts compendium, MLA, 2009
[13] http://www.mla.com.au/NR/rdonlyres/B469B152-EFD4-4311-B247-2CFF65F5CA76/0/Jul08coproductssummary.pdf
[14] http://www.biodieselmagazine.com/article-print.jsp?article_id=1866 last accessed 17/12/09

The research has developed a process and formula for a B5, B20 and B100 biodiesel additive. The researchers overcame past issues with tallow based biodiesel, including issues surrounding crystallisation and cloud point at lower temperatures. B20 was identified as: a) the most effective and b) potentially most suitable from the results on characteristics and also the current trend of the market, particularly in the USA.

MLA has secured a provisional patent for the technology. The additive lowers the cloud point temperature for biodiesel made from animal fats, which are high in saturated fats. The additive lowers the cloud point for animal-fats-based biodiesel from 50 degrees to 21 degrees Fahrenheit (10 degrees to minus 6 degrees Celsius), which increases the potential for using biodiesel made from animal fats in colder climates.

The additive blend comprises 25% raw material (proprietary blend of surfactants and polymers) and 75% diesel oil. The additive blend is then added at approximately 2% to a B5, B20 or B100 biodiesel blend.

The following graph outlines the latest independent results achieved after B100 from two different manufacturers was blended to B20 and the additive was applied. The additive has only been tested in laboratory conditions, and further trials are required. Furthermore, various performance parameters related to commercial biodiesel standards will need to be addressed, probably by further reformulation of the additive.

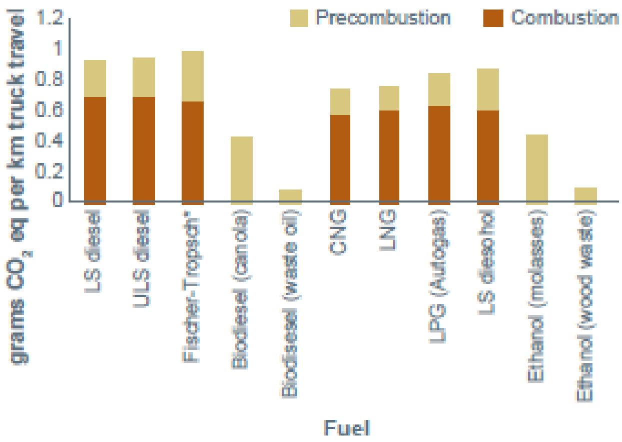


If this technology is successfully commercialised, the biodiesel industry will be able to utilise tallow as a feedstock throughout Australia, and in many other regions of the world, year round.

1.4 Carbon emissions and sustainability

Biofuels, such as biodiesel, can play a role in reducing greenhouse gas and carbon emissions. According to the greenhouse and air quality emissions of biodiesel blends in Australia (CSIRO, August 2007), biodiesel blends produce lower tailpipe emissions of chemicals such as carbon monoxide and fine particle matter. Although, oxides of nitrogen may be increased slightly and contribute to smog.
(http://www.caltex.com.au/biofuels/biodiesel.aspx)

The CO_2 emissions are compared with other common fuel sources[15]:



Policies affecting Biofuels

General Australian policies[16]:

- Assistance currently provided to producers includes (a) a production grant of 38.1 cents per litre (c/L), which fully offsets the excise paid on biofuels; (b) a capital grant for new facilities that effectively provides around 1 c/L in additional assistance over the lifetime of the plant.
- Assistance to biofuels is scheduled to fall to 12.5 c/L for ethanol and 19.1 c/L for biodiesel by 1 July 2015. A banded excise system will impose rates on different fuels, classified into high, medium and low energy groups. This strategy broadly keeps constant the excise payable per kilometre travelled by vehicles using the fuel, with biofuels retaining a 50 % discount on this excise.

State Government Australia policies:

'NSW plans to introduce a 2 per cent biodiesel mandate and double its ethanol mandate for petrol, which was introduced in October, from 2 per cent to 4 per cent next year. Mr Kelly said the NSW mandate would be met from production at the Biodiesel Industries facility near Maitland in the Hunter Valley, north of Sydney. Biodiesel Industries managing director Andrew Hill said the plant produced about 40 per cent of the 50 million litres of biodiesel made each year in Australia'[17].

[15]Biofuels in Australia–an overview of issues and prospects, CSIRO, 2007 https://rirdc.infoservices.com.au/downloads/07-070.pdf
[16]Biofuels in Australia–an overview of issues and prospects, CSIRO, 2007
[17] The Australian, Biodiesel mandate in NSW defies backlash, June 06, 2008

Policies in other countries:

- ✓ Argentina E5 and B5 by 2010
- ✓ Brazil E22 to E25 existing (slight variation over time); B2 by 2008 and B5 by 2013
- ✓ Canada E5 by 2010 and B2 by 2012; E7.5 in Saskatchewan and Manitoba; E5 by 2007 in Ontario
- ✓ China E10 in 9 provinces
- ✓ Germany E2 and B4.4 by 2007; B5.75 by 2010
- ✓ India E10 in 13 states/territories
- ✓ Malaysia B5 by 2008
- ✓ New Zealand 3.4 percent total biofuels by 2012 (ethanol or biodiesel or combination)
- ✓ United Kingdom E2.5/B2.5 by 2008; E5/B5 by 2010
- ✓ United States Nationally, 130 billion liters/year by 2022 (36 billion gallons); E10 in Iowa, Hawaii, Missouri, and
- ✓ Montana; E20 in Minnesota; B5 in New Mexico; E2 and B2 in Louisiana and Washington State;
- ✓ Pennsylvania 3.4 billion liters/year biofuels by 2017 (0.9 billion gallons)

2 NICNAS REGISTRATION

The production, handling, sales, uses and if required, disposal of any industrial chemicals in Australia are governed by legislation under the New Industrial Chemicals Notification and Assessment Scheme (NICNAS) governed by a statutory body of the same name based in Marrickville (Sydney, NSW)To put it simply, a new chemical, either manufactured in or imported into Australia must receive regulatory approval for it to be registered in the Australian Inventory of Chemical Substances (AICS). NICNAS regulates individual chemicals within products, so if a mixture is involved, the assessment and registration will need to be done for its individual constituents.

If a chemical has already been listed on the AICS; for example, since it had been registered by another company or organisation, then only its full production needs to be registered with NICNAS.

The type of permit/certificate required will depend on (a) how much of the substance is intended for use in commercial evaluation and (b) how it will be evaluated for commercial viability.
Commercial Evaluation Permits have (a) a limit of 4 tonnes per annum and (b) cannot be sold to the general public. The reason for this is that the permits require each user to sign an agreement saying they have a copy of the permit and will abide by the conditions on the permit. Therefore, if the chemicals are to be trialled in service stations accessed by the general public then the Commercial Evaluation Permit will not be appropriate.

If only small quantities of the chemicals are required for commercial evaluation (eg. up to 100 kg) then they can be introduced under a < 100 kg Research and Development Exemption. .

The information required for a Commercial Evaluation Permit is limited: chemical identity, proposed use, proposed volume of introduction, potential for exposure, release to the environment plus any physico-chemical properties or toxicological or aquatic toxicological tests conducted on the chemical.

Once the decision has been made during or after commercial evaluation to go into full scale production, then it is to apply for full registration (NICNAS would call this an assessment certificate). Depending on the nature of the chemical/polymer and the quantity required, one could apply for a Standard (STD), Limited (LTD) or Polymer of Low Concern (PLC) assessment certificate. It is advised to discuss this further with NICNAS once the approximate quantities involved are known.

Prima facie, the registration in Australia of the additives mentioned in this document would not be hard, although it may be time-consuming. It appears that at least one of the additives has been on the AICS, thus the work involved may be considerably lighter.

3 MEETING BIODIESEL STANDARDS Worldwide

The attached table summarises the required biodiesel standards in some key geographical regions of the world. In Australia, the applied standards, contained in the Fuel Standard (Biodiesel) Determination 2003, are very much similar to the EU standards in Table 3.

Table 3: Biodiesel standards

Biodiesel Standards		EUROPE	GERMANY	USA	PETROLEUM DIESEL
Specification		EN 14214:2003	DIN V 51606	ASTM D 6751-07b	EN 590:1999
Applies to		FAME	FAME	FAAE	Diesel
Density 15°C	g/cm³	0.86-0.90	0.875-0.90		0.82-0.845
Viscosity 40°C	mm²/s	3.5-5.0	3.5-5.0	1.9-6.0	2.0-4.5
Distillation	% @ °C			90%,360°C	85%,350°C - 95%,360°C
Flashpoint (Fp)	°C	120 min	110 min	93 min	55 min
CFPP	°C	* country specific	summer 0 spr/aut -10 winter -20		* country specific
Cloud point	°C			* report	
Sulphur	mg/kg	10 max	10 max	15 max	350 max
CCR 100%	%mass		0.05 max	0.05 max	
Carbon residue (10%dist.residue)	%mass	0.3 max	0.3 max		0.3 max
Sulphated ash	%mass	0.02 max	0.03 max	0.02 max	
Oxid ash	%mass				0.1 max
Water	mg/kg	500 max	300 max	500 max	200 max
Total contamination	mg/kg	24 max	20 max		24 max
Cu corrosion max	3h/50°C	1	1	3	1
Oxidation stability	hrs;110°C	6 hours min		3 hours min	N/A (25 g/m3)
Cetane number		51 min	49 min	47 min	51 min
Acid value	mgKOH /g	0.5 max	0.5 max	0.5 max	
Methanol	%mass	0.20 max	0.3 max	0.2 max or Fp <130°C	
Ester content	%mass	96.5 min			
Monoglyceride	%mass	0.8 max	0.8 max		
Diglyceride	%mass	0.2 max	0.4 max		
Triglyceride	%mass	0.2 max	0.4 max		

Free glycerol	%mass	0.02 max	0.02 max	0.02 max	
Total glycerol	%mass	0.25 max	0.25 max	0.24 max	
Iodine value		120 max	115 max		
Linolenic acid ME	%mass	12 max			
C(x:4) & greater unsaturated esters	%mass	1 max			
Phosphorus	mg/kg	10 max	10 max	10 max	
Alkalinity	mg/kg		5 max		
Gp I metals (Na,K)	mg/kg	5 max		5 max	
GpII metals (Ca,Mg)	mg/kg	5 max		5 max	
PAHs	%mass				11 max
Lubricity / wear	µm at 60°C				460 max
		EUROPE	**GERMANY**	**USA**	**PETROLEUM DIESEL**

Please note that no rigid specifications are set for CP and CFPP as these are performance-, not regulation-dependent. As mentioned elsewhere in this document, B20s in Europe generally have CP and CFPP values of 4 and -1°C, respectively. These figures limit the uses of B20 in cold climates unless there are other measures such as fuel winterising or fuel-line heat-tracing are used.

The use of the additive mentioned in this document will bring CP and CFPP to 0 and -6 °C respectively.

4 CURRENT STATUS

Further research is required to actually create “the additive” product. There is currently no product. The product recipe has not been optimised and "frozen".

Both B20 and B100 additives have been used in vehicles without obvious issues; one of these vehicles was driven continuously from Victoria to Adelaide. As this use was in December/January temperature was not tested, however, this use proves that the formula works in a vehicle.

While an additive in a bottle is more appealing as a product, the current additive is **25% concentrate of additive transported in diesel** prior to blending to a B20 diesel. The additive cannot currently be transported in a powder form. Discussions with distributors/blenders have mixed reactions to this, however in general the product appears to be acceptable to them.

5 IP STATUS

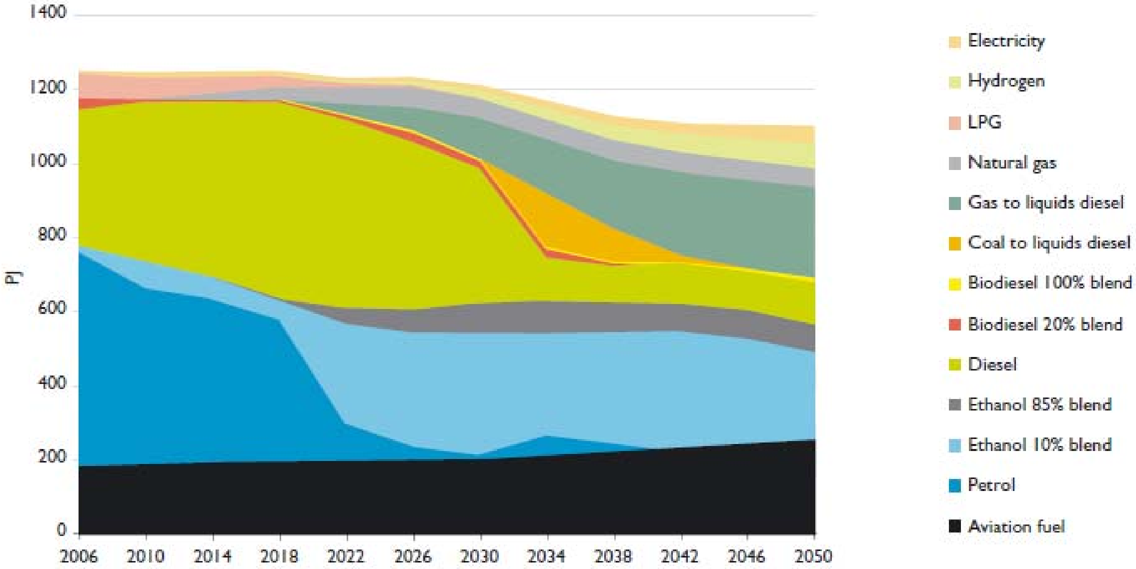
A PCT application PCT/AU2009/000657 was filed with the next critical date being the 26th March 2010. The IP is owned 100% by MLA.

6 VALUE PROPOSITION

6.1 Market size – Australia

At the 31 March 2008 MVC snapshot, 13.0 million vehicles in Australia (85.2% of the total vehicle fleet) were registered with a petrol fuel type[18]. The number of vehicles registered with diesel fuel as of the 31 March 2008 accounted for 12.0% (or 1.8 million vehicles) of the total fleet. A total of 6,206 million litres of diesel was used by articulated and rigid trucks[19]. This was 66.2% of all diesel used. Hence as of end-2007, the total diesel consumption in Australia by vehicles was 9.372Ml. In total, diesel consumption is approximately 14.2billion litres (Kate Gunn report, 2009).

An example of current and potential fuel and technology uptake is presented in the Figure below[20]



Australian production of tallow is ~ 600,000 tonnes, Annual availability of used cooking oil is ~ 50,000 tonnes[21].

If the total Australian tallow production were converted to biodiesel this would represent approximately 4.22% of Australia's current diesel demand. Biodiesel had a 3.94% share of the diesel market based on a biodiesel capacity of 560ML in January 2008. However, given the shut down of biodiesel plants in the past year due to high tallow feedstock prices, the current market size in Australia is:

Diesel ~ 14.2 billion litres
Biodiesel capacity (Jan 2009) ~ 240 ML
Tallow based biodiesel (Jan 2009) ~ 100ML
B20 biodiesel product ~ 500ML (3.5% of diesel market)
Additive blend ~ 10ML (assuming 25% concentrate, 2% added to the biodiesel blend)

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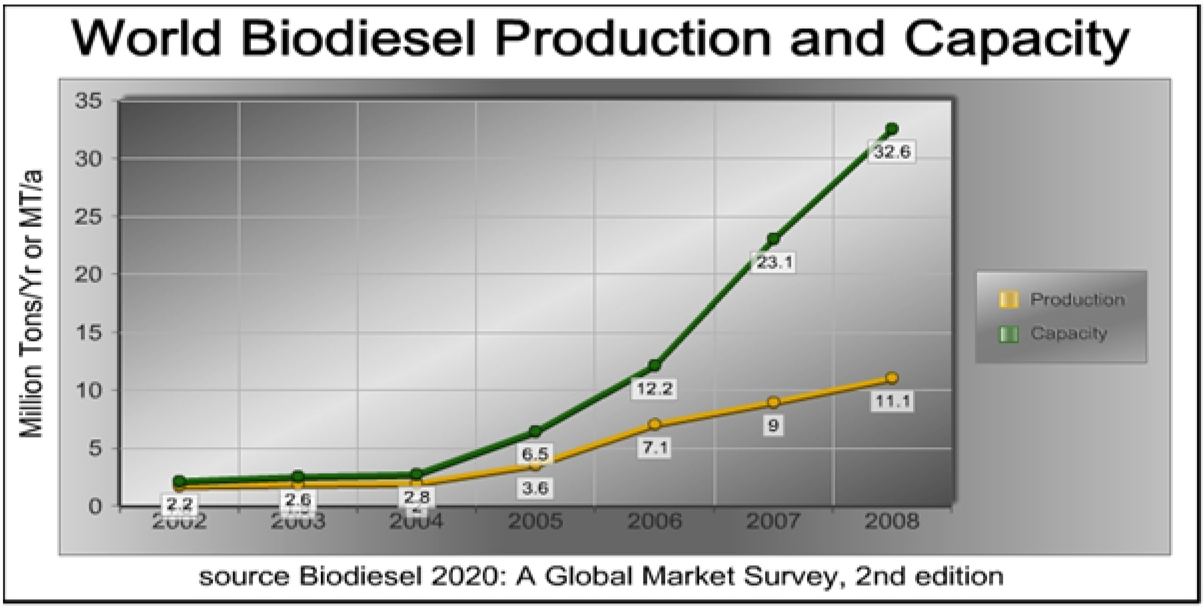
[18] Motor Vehicle Census, 31 March 2008
[19] Survey of Motor Vehicle use, Australia, 12 months ended 31 October 2007
[20] Fuel for Thought, Future Fuels Forum, June 2008
[21] Biodiesel in Victoria, DPI, note AG1313, updated November 2008

If all tallow produced in Australia were converted to biodiesel:

Tallow capacity ~ 600 ML (4.2% of current diesel demand)
B20 biodiesel product ~ 3,000ML
Additive blend ~ 60ML

6.2 Market size – Globally

'Half of world biodiesel production continued to be in Germany. Significant production increases also took place in Italy and the United States (where production more than tripled). In Europe, supported by new policies, biodiesel gained broader acceptance and market share. Malaysia's ambition is to capture 10 percent of the global biodiesel market by 2010 based on its palm oil plantations. Other biodiesel producers are Austria, Belgium, the Czech Republic, Denmark, France, and the United Kingdom'[22].



In 2004, Australia produced about 6% of the world's tallow, while the USA produced approximately 43%. Frost and Sullivan (2006) estimated that the total global tallow production was 9,500kt per annum.

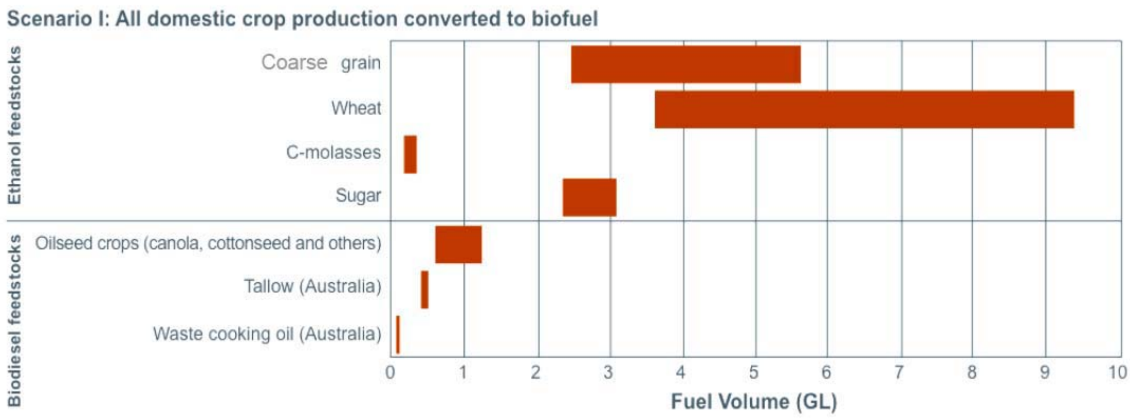
Assuming the global production of tallow of 9,500kT or approximately 9500ML, and assuming only 20% is converted into biodiesel, the market for the additive internationally would be:

Tallow capacity ~ 1900ML
B20 biodiesel product ~ 9500ML
Additive blend ~ 190ML

[22] Renewables 2007 Global Status Report http://www.martinot.info/RE2007_Global_Status_Report.pdf

7 COMPETITORS

The following table shows the volume of biofuel that would be available in Australia if all domestic crop production was converted to biofuel. You will notice that tallow is only a few small proportion of the biodiesel market. While the volume may be lower, the price to production of biodiesel from tallow is certainly competitive, as shown in the next graph[23].



The production costs of different feed stocks are shown in the figure below[24].

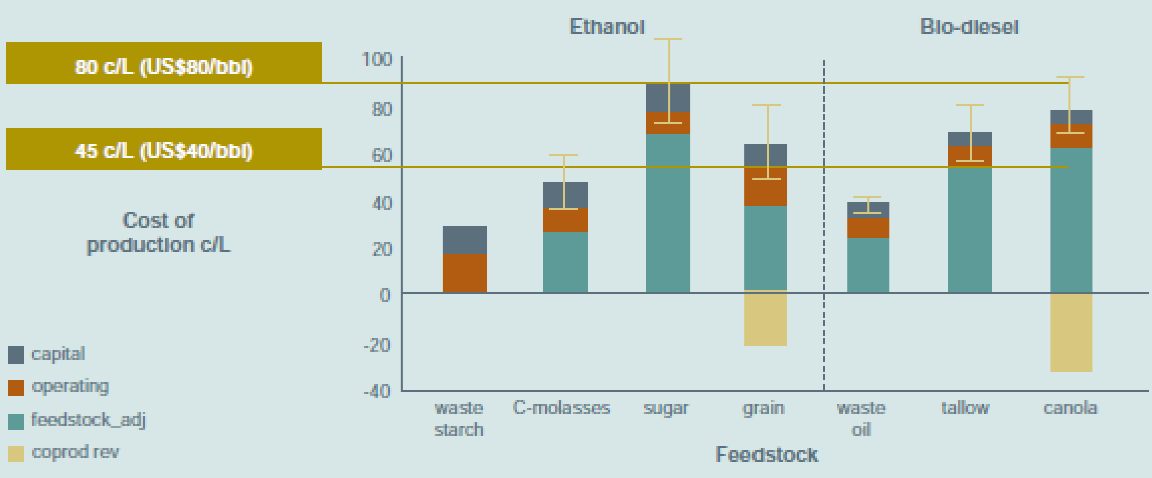


Figure 6 Indicative production costs in Australia, showing capital costs, operating costs, feedstock costs. The co-product revenues are shown as a negative cost.

(Keating, B.; O'Connell, D.; Beer, T.; Dunlop, M.; Batten, D.; O'Connor, M.; Grant, T.; Poole, M.; Miller, T. and Lamb, D. (2006). Biofuels from Australian Agriculture - prospects and implications for R&D. In: *AIAST Biofuels: Paddock to Pump Symposium*, 19 October 2006, Canberra, Australia.)

Many of the current biodiesel producers appear to use some of the following substitute products, or "work around" solutions with regards to tallow-based biodiesel and reducing the Cold Filter Plugging Point (CFPP). While they do not necessarily create the best quality biodiesel, producers argue that petrol, ethanol and diesel can all have quality issues on occasion.

[23] Kate Gunn Report 2009.
[24] Biofuels in Australia – an overview of issues and prospects, CSIRO, 2007

Other alternatives for reducing the Cold Filter Plugging Point (CFPP) include[25]:

- Blends: Many producers have a work around which they call the "blending game". The most common blend with tallow is canola oil biodiesel. This results in an acceptable, yet lower grade B20 biodiesel. Blending like this is common in petroleum diesel as well, where it is blended to suit a variety of regions, season and climates. Both biodiesel and diesel are sometimes blended with kerosene.

- Winterising biodiesel: This involves chilling the biodiesel to drop out the saturated fat component of the fuel, thereby winterising the remaining biodiesel. To do this 100% of the biodiesel has to be chilled and 30-40% of it filtered out as a heavy phase. This heavy phase can then be sold cheaply to fleet operators who spend money on heat tracing their vehicles fuel system. This is a popular solution in Europe where infrastructure has been purpose built for winterising biodiesel. It is, however, an expensive process and an additive replacement may be considered attractive as it will minimise yield loss.

- Ethanol: Can be used as it reduces the CFPP by around 3-5°C. When using ethanol, extra complications arise due to its tendency to form an azeotrope when water is present. This means that extra drying processes are needed to remove all water from the biodiesel in the manufacturing process. Otherwise the biodiesel yield is drastically affected. Ethanol is an example of using different alcohols in the production of biodiesel to obtain different properties. We know that using alcohols other than methanol and ethanol give better CFPP properties again.

- Blend biodiesel with diesel that has been treated with cold weather additives.

- Use block and filter heaters.

- Store vehicle indoors.

- Use B2 or B5

8 SUMMARY OF PRODUCT DEVELOMENT PROJECT

The R&D project mentioned elsewhere in this document has successfully developed a process and formula for a B5, B20 and B100 biodiesel additive. The researchers overcame past issues with tallow based biodiesel, including issues surrounding crystallisation and cloud point at lower temperatures. B20 was identified as: a) the most effective and b) potentially most suitable from the results on characteristics and also the current trend of the market, particularly in the USA

The additive lowers the cloud point for animal-fats-based biodiesel from 50 degrees to 21 degrees Fahrenheit (10 degrees to minus 6 degrees Celsius), which increases the potential for using biodiesel made from animal fats in colder climates. This is critical for the extended applicability of tallow-based biodiesels, and potentially may allow biodiesels made from other feedstock's to be used in colder temperatures.

[25] Kate Gunn report, 2009