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THE POTENTIAL FOR USING TALLOW AS A FUEL FOR THE PRODUCTION OF ENERGY

Prepared for

SUSTAINABLE ENERGY

AUTHORITY OF VICTORIA

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1.1 Background

Recent discussion between SEAV and the Tasman Group has highlighted the opportunities to use tallow as a fuel either in distributed power or cogeneration applications. Although the price of tallow is currently $500/tonne (~$13/GJ) making its use generally not viable, a number of drivers may change these economics on a limited number of projects.

1.2 Summary of Findings

The main findings of the study are:

1 The supply of renderable animal material is a function of the status of the livestock industry. Consequently, it is subject to the corresponding short term seasonal fluctuations but more significantly, has been drastically affected by the recent drought.. However it is estimated that Victoria produces approximately 110,000 tonnes/year of tallow.

2 Tallow is processed (rendered) at abattoirs and by independent small companies. Rationalisation of abattoir industry means that those plants that are rendering their own material and are expanding as smaller plants close are facing capacity problems. This in turn is creating opportunities for service renderers to step in to take the waste off their hands. Without renderers the meat industry would have a massive amount of putrid waste to dispose.

3 The price received in many cases is different to that stated in official documents and by the renderers themselves. It was mentioned that one of the reasons why renderers are reluctant to provide figures is related to the cash nature of the business.

4 Waste management companies also process dilute grease trap waste and transport it to Melbourne for recycling. The processed grease trap waste is known as **yellow grease**.

5 The total amount of grease trap waste produced in Victoria is not able to be determined accurately but can be estimated. The first estimate from a survey carried out in Sydney the data can be interpolated, based on population, which gives a figure of 8000 tonnes/year. The second estimate comes from the Victorian EPA published data that gives a figure of 3000 tonnes/year.

6 Grease trap material varies in quality and consequently has implications for the consistency of the oil recovered from it. In the case of caustic contamination it affects the viability of recovering oil at all. Grease trap waste can become contaminated with hydrocarbons and domestic sewerage where transporters use the same vehicle when pumping out grease traps, triple interceptor traps and septic tanks.

7 Collectors pick up low grade waste oils and take them to the rural renderers for processing. Collectors also send high quality waste vegetable oil to Melbourne. There is approximately 15,000-20,000 tonnes of waste cooking oil recycled per year in Victoria with about 10,000-15000 tones being produced in Melbourne and surrounds.

8 No published data appears to be available on the chemical composition and calorific value of the different rendered products produced in Victoria.

9 An outbreak of BSE or something similar would radically change the way tallow and meals could be used. Without a market for such products renderers would be reluctant to accept the waste. Similarly, without grease trap oil recovery and oil recycling, operations cooking food would have to dispose of such material by other means. This could open up the market for use of tallow as a fuel for co-generation.

10 The differing regulations across the industry could affect resource availability and its utilisation for energy.

11 Estimates of the volume of tallow/ yellow grease from rendering are available as these operators have to be licensed; part of any such licence is a reporting function. Those involved in re-processing vegetable oil do not have to be licensed; this means that no estimate of production is available for yellow grease derived from recycled vegetable oil. Theft was cited as a major problem in oil recycling by many of the smaller operators.

12 Transporters of grease trap waste have to be licensed with the EPA but those who carry tallow do not. This is because grease trap waste is a proscribed waste as it is deemed to be not reusable, but the tallow that is recovered from it through rendering, is reusable and therefore not proscribed.

13 There appears to be considerable opportunity to set up small power plants with operators who are receiving $200/tonne or less for their refined yellow grease. Many of these operators produce approximately 200 tonnes of yellow grease a year and would benefit from becoming self sufficient in power production. (Refer case study).

14 There also appears to be the potential to utilise both tallow and grease trap waste at abattoirs located in the North East and Coliban areas. The main driving force for a combined heat and power plant is the high cost that abattoirs have for processing their water.

To determine the viability of generating combined heat and power at a specific abattoir, a site visit needs to be carried out and detailed analysis of the wastes undertaken.

1.3 Case Study Summary

As can be seen from the case study later in this report, it is not profitable for a typical (200 TPA) yellow grease producer to only make electricity for the grid, it is much more profitable to make sufficient electricity and heat for their own needs and sell the remaining 2/3 of the Tallow or grease on the open market. This allows the producer to ride the markets up to a price of $425 per tonne where it would be better to sell ALL the yellow grease and buy their energy their needs.

It is also noteworthy that for the base case of $200 per tonne the producer is loosing $19,000 pa, obviously the producer must be getting paid to take the renderable material.

1.4 Recommendations

1) Site visits to potential project collaborators should be undertaken to determine the viability of utilising tallow and yellow grease as a fuel. Detailed resource assessments, heat and power requirements and waste water issues should be determined.

2) Detailed analysis of the rendered material should be undertaken to determine chemical composition and calorific value

3) Engine tests using rendered material and additives (Micronized ethanol/ water) should be carried out before proceeding with a project

4) Detailed estimate of a capital cost of an installation.

5) Financial analysis of potential project sites, each site will have its own specific cost inputs and economic solutions.

   Note that due to perceived industry sensitivity, none of the operators interviewed wished to be included in this report. However some have indicated that they would be willing to be involved in informal discussions with SEAV, BEST will pass on the details of these possible respondents verbally.

i. Author's Disclaimer

This report has been prepared by Biomass Energy Services & Technology Pty Ltd to examine the potential for using Tallow as a fuel for the production of energy. While care has been taken in its preparation, no responsibility will be taken by the authors for omissions or inaccuracies, or for the use of this information by any other party, on which commercial decisions may be based. It is recommended that any interested party undertake its own specific investigations.

2. BACKGROUND

Recent discussion between SEAV and the Tasman Group has highlighted the opportunities to use tallow as a fuel either in distributed power or cogeneration applications. Although the price of tallow is currently $500/tonne (~$13/GJ) making its use generally not viable, a number of drivers may change these economics on a limited number of projects.

These favourable drivers may include:

- Remote power applications where the price of electricity in considerably more than brown coal sourced electricity.
- Electricity grid infrastructure upgrade (or similar capital offset) required making distributed power/cogeneration viable.
- Natural gas isn't locally available with diesel fuel the most likely alternative fuel.
- Distribution and transmission losses affect indirectly the price of electricity purchased from the grid.
- The tallow source is remote from its market making its gate-price cheaper
- Public percept of tallow may lead to market oversupply and a corresponding price decrease
- Contaminated or poor quality tallow may be more affordable or have a disposal cost

SEAV has approach BEST to provide a proposal to carry out the following tasks

1. Complete a resource assessment (animal/vegetable oils/fats), identifying potentially viable opportunities. This assessment will initially be carried out in rural areas as there are a number of companies in the planning stages of building biodiesel plants in the main urban areas in Victoria
2. Provide a technology discussion including fuel processing/preparation and energy conversion technology.
3. Provide the current market price of the fuel resource ($/GJ) and the estimated cost of fuel processing/preparation ($/GJ)
4. Predict the future price of the fuel resource and the reason for this price movement
5. Complete a report covering the above.

3. TECHNICAL OBJECTIVES AND METHODOLOGY

SEAV has stated that at the completion of this work, BEST shall have:

- completed a preliminary Victorian resource assessment, focusing on the rural areas,
- provided comment on the present and future resource market,
- identified potentially viable sites, and
- provided commentary of the applicable technologies to convert the fuel to energy.

The resources should be limited to renewable oils and fats that can be used in reciprocating generators.

To meet the outputs specified BEST carried out the resource assessment in the following manner.

1) Information readily available on the producers, and waste carriers of tallow and used vegetable oils from the internet was downloaded.

2) BEST utilized the services of people in the waste management industry to gain information on the companies and individuals who are collecting, disposing and/or processing the waste.

3) Interviews of key personnel from the tallow/oil producers and waste management companies were undertaken to determine the price paid at the gate, the cost of transporting the waste and any cost in disposal of all or part of the waste stream.

4) Key members (figure 1) in the industry that use tallow were interviewed to gain their perceptions of how the price of tallow and other waste oils will vary in the future.

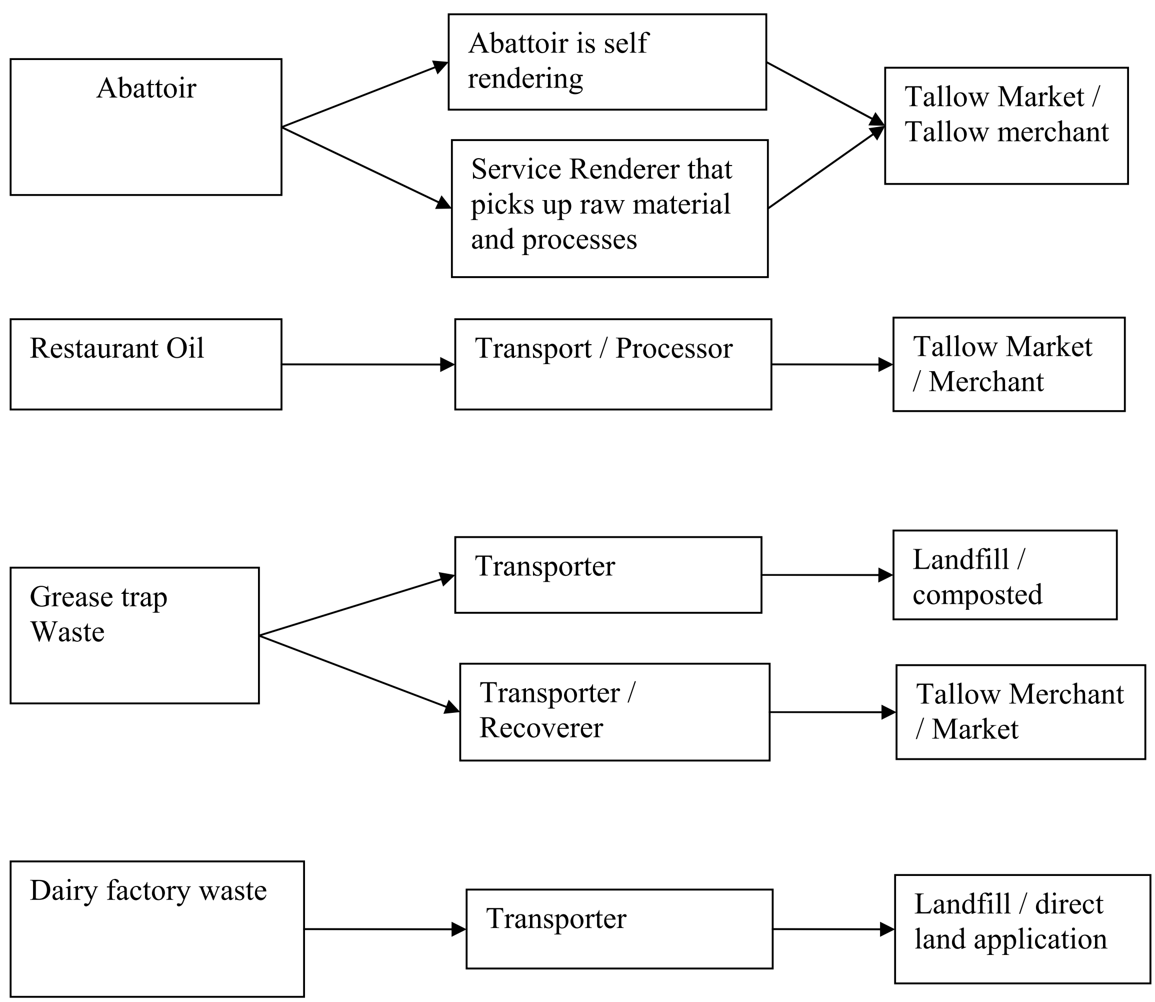
Figure 1: A Typical Small Scale Rendering Processor

4. RESOURCE SURVEY

4.1 A Description of the Industry

Figure 2 provides an outline of the producers, collectors, processors and wholesalers of the different types of fates and oils in rural areas

Figure 2; Block diagram of the Industry



Establishing a definitive list of collectors, transporters, processors and traders of tallow is not as easy as one would expect. This is a function of the variations in licensing. Lists have been collated from a variety of sources and included in Appendices 1 to 2. It should be noted that not all renderers are members of the Australian Renderers Association and matching company names across lists from Prime Safe, Yellow Pages, and EPA registered businesses is problematic to say the least. There are both large and small operators who are in competition.

Any company that collects and processes renderable material (Service renderer) has to be registered with Prime Safe. Abattoirs that render their own are not covered by the same licensing regime but may be members of the Australian Rendering Association.

Those involved in processing vegetable oil do not have to be licensed. Consequently, estimates of the volume of tallow from rendering are available but not so for yellow grease derived from recycled vegetable oil. This part of the industry is considered unstructured with many people carrying out the refining in backyard operations. Theft was cited by a number of smaller operators as a major problem in the oil recycling business.

Transporters of grease trap waste have to be licensed with the EPA but those who carry tallow do not. This is because grease trap waste is a prescribed waste as it is deemed to be not reusable but the tallow that is recovered from it through rendering is reusable and therefore not prescribed

An interview with a small scale collector and processor of waste oils and grease trap waste in a rural town reveals the following.

- Previously he collected grease trap waste and disposed it at the local landfill site for $20/tonne.
- The site has now been closed and one alternative is to dump material at a town approximately 90 kilometres away where the disposal fee is $60 per tonne
- The processor now offers a service that collects and renders the material instead of collecting and taking to the distant landfill site. He charges approximately $140 for a 2000 litre grease trap for this service. He would have to charge approximately $340 if it went to the remote landfill site.
- The material being picked up varies and consequently the tallow produced varies in its quality in terms of Free Fatty Acid content and pH. Some grease traps have a lot of caustic material which breaks down fats and results in a product that does not have a market.
- Option of composting grease trap waste is seen as being too difficult due to EPA regulations and limited opportunities to fetch a good price for product in an already overcrowded market.
- The operator cooks up about 4,000 litres of de-watered grease trap material a month from which he derives about 1,200 litres (14.4 tonne per year) of yellow grease for which he gets between $0-$250 per tonne from a broker who has his business near Melbourne. The latest price he obtained was $200/tonne
- The other fractions include about a 1000 litres of grey sludge that he transports to a landfill site and disposes of at a cost of $60 per tonne, and dirty water which goes to sewer via a grease trap once it is cold.

- o A local butcher renders prime fat for which he receives about $350/tonne from a broker. This broker in turn will receive >$500/tonne.
- o He operates in competition with large collectors such as Collex, who take the grease trap waste, waste oil etc to Melbourne for processing.
- o He felt it was viable for him to generate power if he could receive an income stream that was equivalent to selling his oils and fats for $250/tonne
- o He felt that he could collect sufficient used oils and grease trap waste to produce 200 tonnes of rendered material.

Another much larger operator produced quite different figures. This company received 450-600 tonnes of raw material a day and recovered approximately 13% of tallow. He paid $30-100/tonne for his raw material depending on the amount of silica in the material. His processing costs (electricity, labour, gas, waste water disposal) where $70-80/tonne. He estimated that gas requirements were 1.6 – 2.5 GJ/tonne of input material and electricity 66-110kW/tonne of input material. This equates to about $32-40/tonne of processed material of about $0.9-1.1/GJ (of tallow produced). He received much higher prices from a merchant in Melbourne than the previous renderer. For prime tallows with FFA of less than 1% he has stated that he receives >$600/tonne, for bleach grades he receives $500/tonne (FFA 4-5%) and for medium gut (FFA 10-12%) he receives >$420.

It should be noted that the price received in many cases is different to that stated in official documents and by the renderers themselves. It was mentioned that one of the reasons why renderers are reluctant to provide figures is related the cash nature of the business. It was also suggested that getting a good price for tallow can make the difference between a successful and not so successful abattoir. It was estimated that the price they would receive would be around $400 a tonne for prime tallow and that they would be reluctant to use it for energy as they like to maintain trade in this commodity in order to keep others out of the market.

4.2 Tallow Resource in Victoria

The supply of renderable animal material is not surprisingly a function of the status of the livestock industry. Consequently, it is subject to the corresponding short term seasonal fluctuations but more significantly, has been drastically affected by the recent drought. Prior to the full onset of the drought farmers were keen to reduce stock numbers so there was a large increase in supply, then during the drought there was a general down turn, and as farmers seek to re-stock there is a further decline in activity. This has obvious consequences on the amount of tallow that is produced.

An outbreak of BSE or something similar would radically change the way tallow and meals could be used. Without a market for such products renderers would be reluctant to accept the waste. This could open up the market for use of tallow as a fuel for co-generation.

Table 1: Summary of Distribution of Tallow Resources

Water Authority	Volume of Tallow tonnes 2000/1
South West Water	9,472
Barwon	4,000
Westernport	2,000
Coliban	10,000
Goulburn Valley	5,500
North East	7,000
Gippsland	150
Melbourne City West	63,000
Melbourne South East	10,000

Estimates based on individual surveys of members of the Australian Renders Association suggest that the volume of Tallow (not including Yellow Grease) produced in Victoria in 2000/1 is 111,000 tonnes. As the data used to establish this figure came from individual operators in confidence, the geographical source of this material has to be aggregated to a level that does not allow individual operator figures to be determined. The level of geography chosen is “water authority catchment” as it is small enough to get a feel for the spread. It may also be appropriate if water authorities choose to use tallow as a source of energy to treat waste water in the area as it gives an indication of the energy potential. The figures are summaries in table 1.

Any company that collects and processes renderable material (Service renderer) has to be registered with Prime Safe. Abattoirs that render their own are not covered by the same licensing regime but may be members of the Australian Rendering Association.

4.3 Grease Trap Waste and Waste Vegetable Oil.

Grease trap material comes from a number of sources and in varies in quality. It is collected from food businesses with grease traps such as restaurants; take away outlets, supermarkets, hospitals, and prisons. This variation in source results in variable composition of the waste and thus on the consistency of the oil recovered from it. Caustic contamination from cleaning chemicals affects the viability of recovering oil at all. Grease trap waste can become contaminated with hydrocarbons and domestic sewerage where transporters use the same vehicle when pumping out grease traps, triple interceptor traps and septic tanks.

No information on the chemical composition and calorific value of the different rendered products (and how this varies) was located.

The EPA, in their Publication 890 Draft Classification for Grease Interceptor Trap Waste, estimated that in 2001 Victoria produced 47,000 cubic meters of this material. By extrapolating data from previous years it can be estimated that for 2003 that figure would be approximately 60,000 cubic meters. If the fat/ oil content are approximately 5% then total yellow grease production in Victoria is approximately 3,000 tonnes/year. This is confirmed by estimates from Bernard Stansfield from Argus Tallow. The EPA estimates that 90 percent of this material is currently being reused or recycled through either fats/oils rendering or composting. However this figure is much lower than that found from surveys carried out by private companies in NSW (about 10,000 tonnes). On a population basis there should be 8000 tonnes produced a year in Victoria.

The volume of vegetable oil that is used for cooking and subsequently recycled is much harder to estimate due to the limited regulation. One method of estimating the amount of oil recycled is to use figures derived from the interviews with the processors. On the basis of the ratio of grease trap derived tallow to used oil the figure is likely to be 15,000 tonne.

The other is to use figures derived from similar resource assessments in NSW. Australian Biodiesel Consultancy (Adrian Lake Pers com) has estimated that about 8000 tonnes of grease trap waste is produced in Sydney and approximately 20,000 tonnes of waste vegetable oil. Given these two pieces of information it probable that there is approximately 15,000-20,000 tonnes of waste cooking oil recycled per year in Victoria with about 10,000-15000 tones being produced in Melbourne and surrounds.

There are considerable quantities of dissolved fats (3-5%) in the water treatment plants of the diary processing factories. It is estimated that 52 tonnes a year is produced at the Maffra plant and 86tonnes/year at the Warrnambool Cheese and Butter Factory

4.4 Prices of Rendered Material

The price received for finished product varies according to quality and the type of operator producing and selling the rendered material. A summary of the range of prices that may be received by renderers is given in Table 2: Summary of Prices .

Table 2: Summary of Prices

Tallow Grade	Percentage fatty acids	Price per tonne
Prime Tallow	<1	$400-600+
Bleachable	4 - 5	$350-500+
Medium Gut	10 - 12	$250-420+
Yellow Grease (waste vegetable oil and recovered grease trap)	4 - 80 very variable	$0-400

4.5 Opportunities for Combined Heat and Power Generation

Based on the data gathered during the survey there appears to be an opportunity to set up small power plants with operators who are receiving $200/tonne for their refined yellow grease. These operators can probably produce approximately 200 tonnes of yellow grease a year. As can be seen from the case study later in this report it is not profitable for a typical yellow grease producer to make electricity for solely the grid, it is much more profitable to make sufficient electricity and heat for their own needs. This allows the producer to ride the markets up to a price of $425 per tonne (for the grease) where it would be better to sell ALL the yellow grease and buy their energy needs.

They can use waste heat as well as the electricity from the power generation for their processing. The economics of generating heat and power depend on the quality of the refined product and the period over which the power plant is operated. These are discussed more fully in the next section.

There also appears to be the potential to utilise both tallow and grease trap waste at abattoirs located in the North East and Coliban areas. The main driving force for this combined heat and power plant is the high cost that abattoirs have for processing their water. To determine the viability of generating combined heat and power at an abattoir a site visit needs to be carried out and detailed analysis of the wastes undertaken. At present there does not seem to be the drivers for the larger operators that have plant near or in Melbourne as energy costs are low. Most small to medium sized abattoirs have relatively high heat and power requirements. The price paid for the gas is approximately $8/GJ and for electricity about 12c/kWh during the peak period, although long term contracts and various operating options would lower this price.

An abattoir that utilises the lower quality (lower value) tallows and greases for power and heat generation may provide some opportunities. The simple energy equivalent table Table 5: Energy Comparison Table, shows the relationship between tallow market value and the cost of other forms of energy. Where energy costs are higher than the equivalent value of tallow or grease it may be viable to use that low value material to provide some of the power and heat for the plant.

The example highlighted shows that a price of LPG @ $0.45 per litre is equivalent to $687 per tonne for tallow. This is of course a very simplistic comparison that omits the capital and operating cost of making electricity, however for this report it demonstrates that there are possibilities if the price of LPG is higher than the price of tallow.

5. FUEL, TECHNOLGY AND FINANCIAL ASSESSMENT

5.1 Tallow and Waste Vegetable Oils as a Boiler Fuel

Tallow and waste vegetable oil have been used as a fuel for boilers for well over 100 years. A bibliography of information is attached. Recently the University of Georgia has carried out extensive trials on using a mixture of tallow, yellow grease and chicken fat (33%) with No2 fuel oil. The University found that the efficiency and the combustion characteristics were slightly improved when running with this mixture as compared with fuel oil alone.

5.1.1 Tallow burning (extract from 44179_Eco Efficiency)

Tallow burning may be an option for plants that operate oil, gas or LPG-fired boilers. It would be viable when the selling price of tallow is lower than the cost of oil or gas. The market value of tallow has trended downwards since 1998, such that it is now significantly lower than the cost of fuel oil (See Figure 3.1). Currently tallow competes favorably with fuel oil and LPG, but not with coal or gas.
Tallow as a fuel falls into the heavy fuel oil category (grade 5 or 6) because of its high density (0.9 kg/L) and pour point (30ºC). The levels of impurities are quite low for a heavy fuel oil, and it has a calorific value slightly lower than that of fuel oils.
Oil-fired boilers can quite easily be converted to operate on tallow. The main modification needed is the provision for the boiler to start up and shut down on fuel oil or diesel to preheat the fuel lines to prevent solidification of the tallow. Alternatively diesel could be mixed with the tallow at about 10% to lower the melting point.
Gas-fired boilers would require the additional expense of an atomising oil burner as well as the pre-heating provisions mentioned above.
Tallow does not contain sulphur, therefore the problem of formation of corrosive acids from condensation in the stack does not exist. Flue temperature can be less than the 150ºC normally required for fuel oils, therefore there would be a net increase in boiler efficiency. The slightly lower calorific value results in a slightly higher combustion air requirement. Tallow also has a higher flash point, meaning that the minimum furnace temperature would be around 300ºC. This would not normally be a problem for burners that have a refractory lined combustion chamber (Downey and McDonald, 1984).

5.1.2 Under what circumstances is cogeneration viable?

Cogeneration may be viable for plants that meet the following criteria:
- *a steady demand for steam and power throughout the year;*
- *a higher demand for thermal energy than for electrical energy;*
- *a thermal fuel consumption of more than 2,000 GJ/yr;*
- *a maximum electricity demand of more than 100 kW;*
- *long annual operating hours (more than 3,000 h/yr);*
- *operations taking place during peak electricity charging periods; and*
- *a high price paid for electricity.*

5.1.3 Case Study1

1MW cogeneration plant at Rockdale Beef, Yanco, NSW
Rockdale Beef installed a reciprocating natural gas engine that drives a 920 kW generator to produce electricity and
hot water. The system initially supplied 90% of the plant's power demand, but this has been reduced to 50%
due to plant expansions. Heat from the engine supplies about 80% of the plant's hot water requirements. The
average annual energy outputs are 4,335 MWh of thermal and 4,488 MWh of electrical energy.
Total capital cost: $1,000,000
Total Savings: $300,000/yr
Payback: 3-4 years
Source: http://www.caddet.org/

5.1.4 Case Study2

0.1 MW cogeneration plant at Westside Meat Works, Vic,
and Normanville Meat Works, SA.
At both of these sites, two 50 kW reciprocating gas engines were installed to generate power and heat for hot water.
The units produce 100 kW of electricity and 150 kW of heat and are run on LPG.
Total capital cost: $150,000
Total Savings: not reported
Payback: not reported
Source: Who's Who in Australian Cogeneration, http://www.ecogeneration.com.au
For more information:
Australian Eco-Generation Association. www.ecogeneration.com.au.
This website includes downloadable Cogeneration Ready Reckoner software.
Sinclair Knight Merz, 1997.

5.2 Tallow, Grease Trap Waste and Waste Vegetable Oils to Produce Biodiesel

Tallow and other vegetable based waste oils can be converted to biodiesel. At present there are three biodiesel plants in Australia. The experience to date is that conforming biodiesel is difficult to produce unless the waste vegetable oils are of consistent high quality. The production cost of the biodiesel depends on the cost of the inputs and the amount of contamination that is associated with the waste oils and tallow, especially the amount of Free Fatty Acids, water and particulates. At present tallow is not used as an input into biodiesel as it is expensive and more difficult to convert than used cooking oil.

Research work has been carried out by NREL in the USA and BEST/ SEDA in Australia to convert refined grease trap waste to biodiesel at the bench top plant scale. The author is not aware of any operational plant producing biodiesel from grease trap waste.

5.3 Tallow, Grease Trap Waste and Waste Vegetable Oils Directly Injected into Diesel Engines.

In 1900, Rudolf Diesel demonstrated his new compression ignition engine at the World Exhibition in Paris running on peanut oil. In 1911 he wrote "The engine can be fed with vegetable oils and would help considerably in the development of agriculture in the countries that use it." [1].

Adrian Lake and George Muirhead from Australia Biodiesel Consultancy have stated (pers. com) that there is a power plant in Vanuatu that is running with tallow injected into a 600kW slow speed marine diesel engine. This plant has been operating for over 5 years.

Work has been conducted to examine these oils as fuel replacements or additives. For example in the late 1970's and early 1980's, research was undertaken at Murdoch University (Perth, Australia) into the use of eucalyptus and other plant oils as a fuel component. [6] In New Zealand, there are considerable problems with the disposal of surplus tallow from the processed meat industry and a large amount of work was conducted in the early 1980's on the use of tallow as a fuel.

Phillip Calais (http://www.shortcircuit.com.au/warfa/paper/paper.htm) reports the following.

"Experience has shown that the use of unsaturated triglyceride oils as a fuel may cause significant problems that can affect the viability of their fuel use. But this is not always the case and in many circumstances these problems can either be dealt with or are acceptable to the user.

The viscosity of plant and animal fats and oils varies from hard crystalline solids to light oils at room temperature. In most cases, these 'oils' or 'fats' are actually a complex mixture of various fatty acids triglycerides, often with the various components having widely varying melting points. This may give the oil or fat a temperature range over which solidification occurs, with the oil gradually thickening from a thin liquid, through to a thick liquid, then a semi-solid and finally to a solid.

Many vegetable oils and some animal oils are 'drying' or 'semi-drying' and it is this which makes many oils such as linseed, tung and some fish oils suitable as the base of paints and other coatings. But it is also this property that further restricts their use as fuels.

Drying results from the double bonds (and sometimes triple bonds) in the unsaturated oil molecules being broken by atmospheric oxygen and being converted to peroxides. Cross-linking at this site can then occur and the oil irreversibly polymerizes into a plastic-like solid. [9]

In the high temperatures commonly found in internal combustion engines, the process is accelerated and the engine can quickly become gummed-up with the polymerized oil. With some oils, engine failure can occur in as little as 20 hours. [10]

All of these problems can be at least partially alleviated by dissolving the oil or hydrogenated oil in petroleum diesel. 'Drying oils' such as linseed oil for example, could be mixed with petroleum diesel at a ratio of up to about 8:1 to give an equivalent IV in the mid-twenties. Likewise coconut oil can be thinned with diesel or kerosene to render it less viscous in cooler climates. Obviously the solubility of the oil in petroleum also needs to be taken into account. [7]

Another method is to emulsify the oil or fat with ethanol. Goering [12] found that eight parts of soybean oil, when emulsified with two part ethanol and five parts of 1-butanol as stabiliser, performed as well as diesel fuel and was able to start a cold engine".

The University of Idaho has also carried out extensive literature review of the use of raw vegetable oil as a fuel in automotive engines (refer references section) they concluded that straight vegetable oil could be problematic in for use in a modern automotive diesel engine. They did not look at its use in slow speed marine diesel engines.

An internet site developed by Darren Hill (www.vegburner.co.uk) sites the need to use fuel pumps that create an emulsion with additives such as diesel, ethanol, and demineralised water to ensure clean combustion of straight vegetable oils. The site also notes the Elsbett Family in Germany who will sell direct injection engines that run on straight vegetable oil.

Recent research work has been carried out by Biomass Energy Services and Technology Pty, in partnership with Australian Biodiesel Consultancy, at its engine and fuels test facility on the Central Coast on the use of low grade vegetables oil and fats in marine diesel engines. This work is funded by the New South Wales Government. The following are preliminary conclusions from this work.

1. Using any unrefined waste oil in an engine will produce high emissions of unburnt hydrocarbon, other volatile high odour organic compounds, and carbon monoxide.
2. Some oils and fats could lead to high emission levels of NOx
3. For long trouble free operation all fuels should have any water and particulates removed and bio-ethanol added especially for grease trap waste and acid oils.
4. Fuels with high salt content should be demineralised using a bleaching agent.
5. The exhaust gas needs after burning to ensure emissions meet worlds best practice

After burning can be achieved by putting the engine exhaust into a gas or oil fired boiler or a purpose built device. Figure 2 illustrates a purpose designed porous burner developed by BEST to significantly reduce emissions from the exhaust of a slow speed diesel engine running on vegetable oils and refined grease trap waste. Natural gas is added to this burner to reduce the emissions of carbon monoxide and unburnt hydrocarbons from around 5000 parts per million to 30 parts per million.

Figure 2: Purpose Built Porous Burner

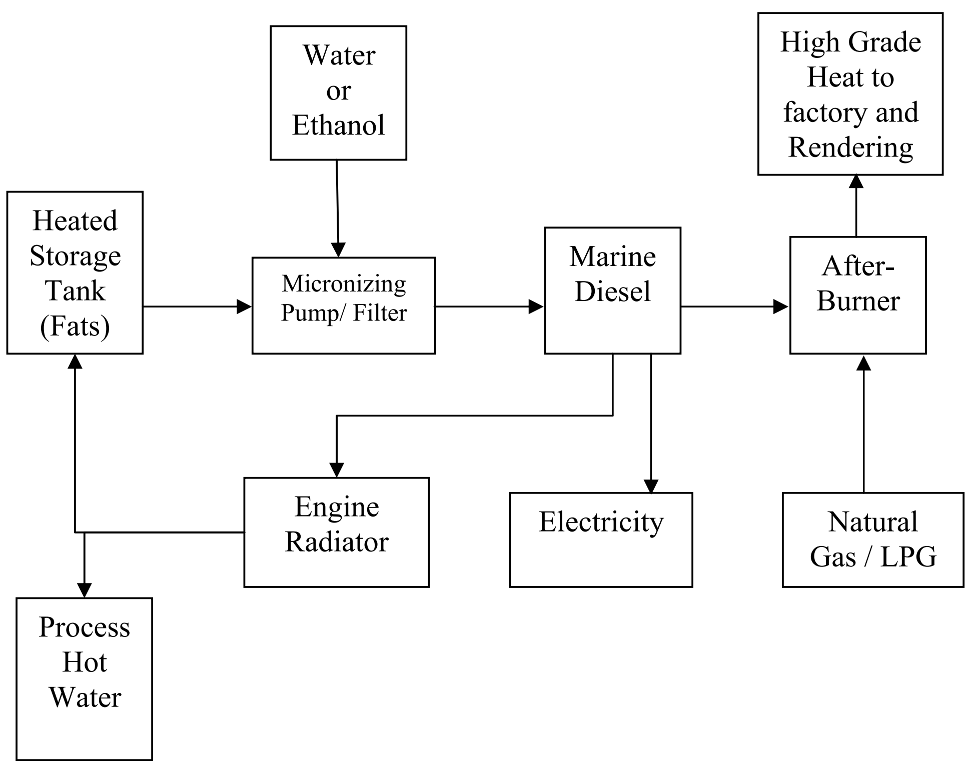
5.4 Combined Heat and Power Plant Outline to Utilise Tallow and Waste Oils and Fats

Given the need to reburn the emissions from the exhaust of an engine fuelled with tallow or other waste oils it will be probable that this waste heat will need to be utilised to ensure that cost competitive electricity can be produced. This waste heat can be used to render grease trap waste and tallow and to treat waste water. Without carry out specific on site energy audits it is not possible to determine how much of the waste heat can be utilised.

The following is an outline of a possible plant configuration. It should be noted that before an energy plant can be specified for a particular location fuel/engine tests will need to be carried out. The cost of processing the waste before it is injected into an engine depends on its composition.

Figure 3 illustrates the components of a combined heat and power plant to produce energy from tallow. A heated storage tank, a small unit to filter the waste and or tallow to remove salts and particulates, a micronizing pump to mix either ethanol and the oil or distilled water and the oil are placed before the engine. LPG or natural gas is added to the engine exhaust and the emissions are burnt in a reburner. The waste heat is then directed to either the rendering plant or for use in an abattoir. The water from the engine radiator is used to heat the processed oils.

Figure 3; Tallow and/or Yellow Grease Fueled Combined Heat and Power Plant



5.5 Input Data and Assumptions for Determining Financial Viability

The following table summarizes the data used to determine the viability of converting waste fats and oils to energy

Table 3: Assumptions for Energy Production

Input	Value
Calorific Value (MJ/kg or GJ/tonne.) Tallow (Dry Basis)	38.0-39.7
Calorific Value (MJ/kg or GJ/tonne.) Yellow grease	36.0- 39.0
Diesel engine Efficiency on Oils	33-35%
Approximate fuel required for engine output of 100kWe	25-30kg/hr
Waste heat available for rendering from 100kWe engine	0.54GJ/hr
Electricity required to process tallow and yellow grease (Pumps, lights etc)	66-110kWh/tonne
Heat required for rendering tallow (estimate)	1.6 -2.5GJ/tonne of processed tallow
Heat required for rendering yellow grease (estimate)	2.0-3.0GJ/tonne of processed grease

5.6 Economics of Power and Heat Production from Rendered Waste

There are two potential power plant options to be considered. A small plant that could be operated by an independent renderer and a larger plant that could be operated by an abattoir that has large heat and power requirements.

a) Small Scale Plant with Output of 200 tonnes/ annum of Yellow Grease

Due to the small nature of the business it is unlikely that the processor of the yellow grease would supply electricity solely to the grid. To supply his own electricity and heat requirements the renderer would need to install an engine genset with an output of approximately 100kW electrical.

The renderer requires about 1.6-2.5 GJ of heat to render 1tonne of tallow, probably more for grease trap waste, and also requires 66-110kWh of electricity.

Thus to refine 1 tonne of material the renderer will need to use approximately 35kg/ hr of processed fats in an engine to generate the 100kWh of electricity.

A quick case study has been completed that involves the renderer installing a grease fired engine genset to provide power and heat for rendering. This study assumes that the engine exhaust will be dirty and therefore needs a reburner. The reburner needs some fuel like LPG or Natural gas to assist in the reburning to produce a clean exhaust. The now very hot exhaust can be used to render the product and the engine cooling water can be used to make the normal warm (65ºC) water needed for various uses around the plant.

The following Graph shows three options:-

Option 1 - Business as usual, buying energy and selling yellow grease. The operators are subject to fluctuation income streams for their product. This is the best option if the price for yellow grease exceeds $425 per tonne.

Option 2 - Installing and engine to provide self sufficiency in power and heat using approximately 1/3 of the available grease and selling the rest. **This is the most flexible and profitable option when the price of yellow grease is greater than $250 per tonne but less than $425 per tonne.**

Option 3 - Installing a bigger engine that uses all the grease to make power and heat for the process and exporting the surplus electricity. This is the least flexible (most stable) option and is profitable only when the price of yellow grease is less than $250 per tonne. There may be additional environmental benefits in allowing more waste water to be economically evaporated, using waste heat, rather than being disposed of in the normal way.

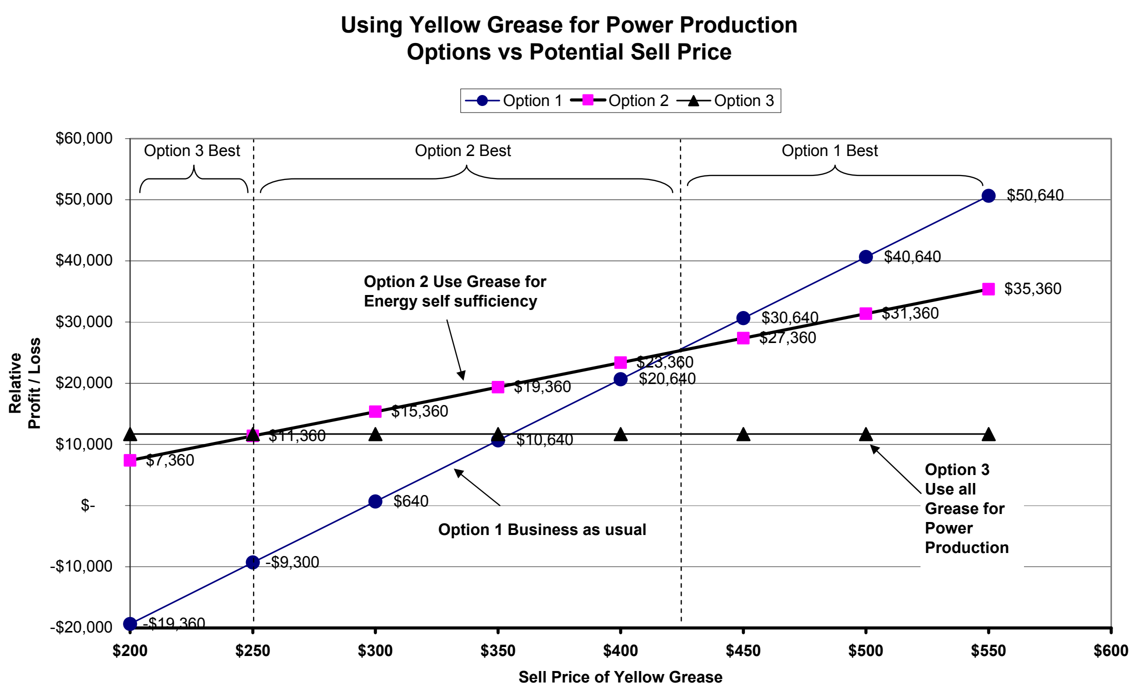


Table 4: Case Study Small Scale Render, below, details the assumptions and calculations used in the case study.

Table 4: Case Study Small Scale Render

Small Scale Renderer

Producing 200 TPA Yellow Grease 200

Assumptions

Calorific Value of Tallow	39	MJ/kg		
Calorific Value of Yellow Grease	37	MJ/kg		
Sale Price of Yellow Grease	200	$/t		
Diesel Engine efficiency	34%			
Approx Fuel required for engine output of 100kWe	30	kg/h		
Waste Heat available from 100kWe engine	560	MJ		
Electricity to process tallow or yellow grease	88	kWh/t		
Electricity Cost	0.11	$/kWh		
Heat for Rendering Tallow (est.)	2.5	MJ/kg		
Heat for rendering Yellow Grease (est.)	3	MJ/kg		
Energy Cost (LPG or Natural Gas)	8	$/GJ		
Top up Energy Required to reburn MJ/Kg tallow	18	MJ/kg		
Operating days	200	PA		
Operating Hours	2000	PA	10	per day
Daily Tallow / Grease production	1	PD	100	kg per hour

Inputs / Outputs	Per Tonne	Per Hour	Per Day	Per Annum		Value
Revenue						
Tallow Production Tonnes (Sold)		0.1	1	200	T	+ $ 40,000
Expenses						
Heat to render GJ/T (LPG displaced)	2.5	2.5	25	5000	GJ	- $ 40,000
Electricity Required kW/t (Power Displaced)	88	88	880	176000	kWe	- $ 19,360
				Subtotal Energy Cost		- $ 59,360
					Profit Loss	**-$ 19,360**

Obviously the renderer must be getting paid to take the renderable material in the first place.

So if energy production makes a positive contribution it would be worthwhile

It is not profitable for a typical (200 TPA) yellow grease producer to only make electricity for the grid, it is much more profitable to make sufficient electricity and heat for their own needs. This allows the producer to ride the markets up to about a price of grease to $425 per tonne where it would be better to sell ALL the yellow grease made and buy their energy needs. This study has only taken into account the savings based on displacing energy costs, obviously there will be capital and operating costs associated with installing and running a generator setup. Due to the need for using second hand engines (price guestimates only) and the different configurations/ situations for each producer it is not possible to make any cost estimates.

It is also noteworthy that for the base case of $200 per tonne the producer is losing $19,000 pa, obviously the producer must be getting paid to take the renderable material.

b) A Larger Power Plant to supply some of the Power and heat needs for an Abattoir.

From the information provided from interviews it is probable that small electricity plants with an electrical output of 600kW and heat output of 1000kW will use approximately 165kg/hr of tallow or yellow grease (assuming a calorific value of approximately 39,000kJ/kg). Total installed cost of a second hand reconditioned marine diesel engine with after burner and heated fuel is estimated to be $150,000 to $200,000.

The simple energy equivalent table below shows the relationship between tallow market value and the cost of other forms of energy. Where energy costs are higher than the equivalent value of tallow or grease it will be viable to use that low value material to provide some of the power and heat for the plant.

The example highlighted shows that a price of LPG @ $0.45 per litre is equivalent to $687 per tonne for tallow. This is of course a very simplistic comparison that omits the capital and operating cost of making electricity, however for this report it demonstrates that there are possibilities.

Table 5: Energy Comparison Table

Price of LPG			Equivalent Energy Value of Tallow	
$ Per Litre	$ Per Tonne	$/GJ	$per tonne	$per GJ
$ 0.10	$ 196.00	$ 3.92	$ 152.88	$ 3.06
$ 0.15	$ 294.00	$ 5.88	$ 229.32	$ 4.59
$ 0.20	$ 392.00	$ 7.84	$ 305.76	$ 6.12
$ 0.25	$ 490.00	$ 9.80	$ 382.20	$ 7.64
$ 0.30	$ 588.00	$ 11.76	$ 458.64	$ 9.17
$ 0.35	$ 686.00	$ 13.72	$ 535.08	$ 10.70
$ 0.40	$ 784.00	$ 15.68	$ 611.52	$ 12.23
$ 0.45	**$ 882.00**	**$ 17.64**	**$ 687.96**	**$ 13.76**
$ 0.50	$ 980.00	$ 19.60	$ 764.40	$ 15.29
$ 0.55	$ 1,078.00	$ 21.56	$ 840.84	$ 16.82
$ 0.60	$ 1,176.00	$ 23.52	$ 917.28	$ 18.35
$ 0.65	$ 1,274.00	$ 25.48	$ 993.72	$ 19.87
$ 0.70	$ 1,372.00	$ 27.44	$ 1,070.16	$ 21.40

6. ARTICLES OF INTEREST

Extracts from the Australian Renderers Association magazine that have a direct bearing on the future of Tallow and similar products.

Klemens Rethmann of SARIA Bio Industries also made comment about feed bans in Europe. Although the new animal by-products regulation makes allowance for category 3 material in feeds, Klemens commented that the feed bans would be in place at the European and national levels until at least 2005.
With no access to traditional markets for protein meals and fats,

Klemens explained how SARIA has turned its attention to energy production. The options are to use fat as a substitute fuel in steam boilers, use meat meal as a substitute combustible in coal-fired power stations or cement plants and to produce biodiesel from animal fats.

Klemens explained that animal fats are efficient boiler fuels but must be carefully purified by centrifugation to ensure clean burning and to avoid residues. With the oleo-chemical industry in Europe looking to use only animal fats from category 3 material (i.e. material suitable for human consumption) the use of tallow as boiler fuel could become the major use of tallow. Converting animal fats to biodiesel is also an option but there are added processing costs and biodiesel production is not feasible unless there are subsidies or tax breaks. Meat meal makes an effective combustible when mixed with coal and it reduces emissions of sulphur dioxide. The cement industry also finds meat meal attractive as a combustible in high-temperature cement kilns. Although new uses have to be found for animal by-products, Klemens pointed out that rendering will remain an important part of the process because the raw materials have to be stabilised in the form of tallow and dry meat meal before by-products can be used as energy sources. An alternative to rendering could be to ferment raw material to produce biogas. This approach can only compete with rendering if the dried residue of biogas production can be used as fertiliser and if subsidies are available.

SARIA is well down the track of producing energy from by-products. It has invested 10 million euros in biodiesel production. It produces 13,000 tonnes per year to fuel 1000 trucks. SARIA also produces a sterilised slurry from 80,000 tonnes of raw material per year and incinerates it to produce electricity in a fluidised bed power plant. This investment cost 20 million euros. The other major investment is in biogas production. For a 4 million euro investment SARIA produces biogas from 40,000 tonnes of food waste.

WRO Discussions

In the WRO session at the symposium Trevor Arnold from New Zealand explained the new animal processing act. He said that all renderers had to control their operations through an auditable risk management plan i.e. they need a HACCP-based quality assurance program.
Klemens Rethmann gave a rundown of the situation in Poland. He said that animal protein is permitted in feeds but other European countries do not want to import food from animals that have been fed animal material. Renderers want the government to introduce a feed ban so that they can charge for processing raw material.
Niels Nielsen talked about Denmark and Sweden. In Denmark rendering plants have been divided into category 1, 2, and 3 plants. Product from Category 3 plants is mostly sold for pet food but prices are low. Niels illustrated the effect of changing regulations and restricted markets with an example of a $15 million blood processing plant that was put out of business in 5 months. He said that in Sweden, meat meal is burned in fluidised bed wood incinerators to produce energy. Because of this use, Sweden has not separated category 1, 2 and 3 processing.

Exports of Tallow

Exports of tallow and meat and bone meal to the major destinations in the last three years are shown in the accompanying figures.
Exports of meat and bone meal to Japan and the Philippines have disappeared due to feed bans. Exports to Indonesia and China have also declined due to strong competition from the USA. However exports of Australian MBM to Vietnam have more than doubled in the last year. Exports to Malaysia, Taiwan and Bangladesh have also been firm. Exports of ovine meal to the USA, which were very strong in 2001/2002, have dropped back in 2002/2003. Sheep and lamb production in 2003/2003 was about 12% below production in 2001/2002 and this reduced the availability of ovine meal for export.
Tallow exports to the major destinations of China, Pakistan and Taiwan have been falling over the last three years. By contrast exports to South Africa have increased and a good market for certified edible tallow to Japan has been developed.


Exports of tallow to major destinations
'000 Tonnes exported
180
160
140
120
100
80
60
40
20
0
China
Pakistan
Taiwan
Iran
Bangladesh
South Africa
Mauritius
Nigeria
Kenya
Sri Lanka
Korea
Mozambique
Japan
2000/01
2001/02
2002/03

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18 Rendering Circles

No. 16 – November, 2003 A Quarterly newsletter produced by the Australian Renderers' Association IncPO Box 390, BAULKHAM HILLS NSW 1755 Web-address: www.ausrenderers.com.au

8. APPENDICIES

8.1 Licenced Inedible and Prime Tallow Rendering Facilities (PRIMESAFE)

Licensed Abattoirs

Australian Food Group
8 - 14 Hume Road LAVERTON NORTH tel: 93696777

Benalla Abattoir
Firth's Road BENALLA tel: 57626897

Eastern Abattoirs
David Street ORBOST tel: 51542222

Frew (Kyneton) Pty Ltd
Edgecombe Road KYNETON tel: 54226222

Frewstal Pty Ltd
Abattoir Road STAWELL tel: 53582844

G & G McGillivray Pty Ltd
Island Road GUNBOWER tel: 54871304

G.A.Gathercole Pty Ltd
Learmonth Road CARRUM tel: 97727011

Garfield Abattoirs
Lovers Lane GARFIELD tel: 56292605

Gippsland Meats
113-117 Holloway Street BAIRNSDALE tel: 97829772

Gordyn Abattoirs
Fosterton Road COBAINS tel: 51498202

Licensed Inedible Rendering Facilities

Fatbusters Pty Ltd
Lot 42 Gravel Pits Road GEELONG SOUTH tel: 52290976

Hazeldenes Chicken Farm Pty Ltd
Hazeldene's Road LOCKWOOD tel: 54311300

KR Castlemaine Foods
Langdon Street CASTLEMAINE tel: 5479 2222

Oztek Holdings Pty Ltd
Plemings Road BARNAWARTHA tel: 0260267206

Pridham

12-16 Merino Street	LAVERTON NORTH	tel: 93692844

Riverside Meats

10-40 Goulburn Road	ECHUCA	tel: 54821566

Warrnambool Stockfeed

Levy's Point	WARRNAMBOOL	tel: 55627775

Wodonga Rendering Pty Ltd

Kelly Street	WODONGA	tel: 0260550276

Licensed Prime Tallow Processing Facilities

Australian Natural Essentials Pty Ltd,

Lot 2 Hitchcock Street	CASTLEMAINE	tel: 542955508

Australian Tallow Producers Pty Ltd

690 Geelong Road	BROOKLYN VIA ALTONA NORTH	tel: 9318 0369

Mirirol Pty Ltd t/a Heathfort Oils

21 Aylward Avenue	THOMASTOWN	tel: 9462 2155

Pridham

21 Evans Street	BRAYBROOK	tel: 92147777

8.2 Tallow Merchants in Victoria (Yellow Pages)

Argus Recycling Pty Ltd
ph: 1300 732 925 Tallow Merchants

Argus Tallow Merchants Pty Ltd
ph: 1300 732 925 Tallow Merchants

Austmate Trading
537 Malvern Rd Toorak VIC 3142

ph: (03) 9823 1466 Tallow Merchants

Australian Tallow Exporters
28 Rathdowne St Carlton VIC 3053

ph: (03) 8310 6084 Tallow Merchants

Australian Tallow Producers Pty Ltd

690 Geelong Rd Brooklyn VIC 3025
ph: (03) 9318 0369 Tallow Merchants

Bob & Heather Sluys
20 Maude St Bairnsdale VIC 3875
ph: 1800 801 004 Tallow Merchants

Bonebusters
49 Chifley Drv Preston VIC 3072
ph: (03) 9480 5444 Tallow Merchants

Brooklite Pty Ltd
6 Lincoln St Laverton North VIC 3026
ph: (03) 9369 0344 Tallow Merchants

Fidelity Agrik Pty Ltd
Level 50 101 Collins St Melbourne VIC 3000

ph: (03) 9653 9314 Tallow Merchants

Gardner Smith Pty Ltd
84 MacKenzie Rd West Melbourne VIC 3003

ph: (03) 9396 1243 Tallow Merchants

Kotra Tallow Pty Ltd
76- 84 Knight Ave Sunshine North VIC 3020

ph: (03) 9366 7700 Tallow Merchants

Kotra Tallow Pty Ltd

ph: (03) 9366 7939 Tallow Merchants

Murray Valley Protein
11 Holcourt Rd Laverton VIC 3028

ph: (03) 9369 4444 Tallow Merchants

Oil Master Recycling
ph: (03) 9931 1014 Tallow Merchants

Pridham (Organic Recyclers)
21 Evans St Braybrook VIC 3019
ph: (03) 9214 7777 Tallow Merchants

Tallowtec Pty Ltd
Lot 8 Westgate Drv Laverton North VIC 3026

ph: (03) 9369 8209 Tallow Merchants

Trade-Tex Blue
7 Rings Rd Moorabbin VIC 3189
ph: (03) 9532 0225 Tallow Merchants

8.3 Waste Treater and Disposers (EPA)

Waste Treaters/Disposers	Locality
MADDINGLEY BROWN COAL P/L	BACCHUS MARSH
VANDERSLUYS, ROBERT THOMAS	BAIRNSDALE
KLEEN PARTS P/L	BALLAN
ILEOWL P/L	BARANDUDA
CRG CHEMICAL REFINING GROUP P/L	BAYSWATER
SEETAL SPRAY BOOTH P/L	BAYSWATER
COOPER BROS HOLDINGS P/L	BENDIGO
WANGARATTA RURAL CITY COUNCIL	BOWSER
NATIONWIDE OIL P/L	BRAYBROOK
ORGANIC RECYCLERS P/L	BROOKLYN
WESTERN LAND RECLAMATION P/L	BROOKLYN
COLLEX P/L	BROOKLYN
BROOKLYN LANDFILL & WASTE RECYCLING P/L	BROOKLYN
HI-QUALITY QUARRY PRODUCTS P/L	BULLA
BULLA TIP & QUARRY P/L	BULLA
ENVIROCHEM TECHNOLOGIES P/L	CAMPBELLFIELD
WASTE MANAGEMENT PACIFIC P/L t/a HINES WASTE TECHNOLOGIES	CAMPBELLFIELD
DONALDSON & ASSOCIATES P/L	CAMPBELLFIELD
A T BUTLER P/L	CAMPBELLFIELD
MRI (AUST) P/L	CAMPBELLFIELD
OZWASTE SOLUTIONS P/L	CARRUM DOWNS
MOUNT ALEXANDER SHIRE COUNCIL	CASTLEMAINE
IDEAL DRUM CO P/L	CHELTENHAM
SELARAS KECHIL NOMINEES P/L	COBURG

GREATER GEELONG CITY COUNCIL	CORIO
ERS AUST P/L	CROYDON SOUTH
ERS AUST P/L	DANDENONG
WILSOLVE P/L	DANDENONG
NUPLEX SPECIAL WASTE P/L	DANDENONG
DRUM BROKERS AUST P/L	DANDENONG
NATIONWIDE OIL P/L	DANDENONG
BRAMBLES AUST LTD	DANDENONG
LAU NAY NOMINEES P/L	DANDENONG
COLLEX P/L	DANDENONG
ARGUS TALLOW MERCHANTS P/L	DANDENONG
TERIS (AUST) P/L	DANDENONG
STERICORP CLINICAL WASTE P/L	DANDENONG SOUTH
HORSHAM RURAL CITY COUNCIL	DOOEN
GREATER GEELONG CITY COUNCIL	DRYSDALE
BRAMBLES AUST LTD t/a CLEANAWAY GIPPSLAND	EAGLEHAWK
GREATER BENDIGO CITY COUNCIL	EAGLEHAWK
CAMPASPE SHIRE COUNCIL	ECHUCA
RIDDETT INVESTMENTS P/L	EPPING
BOWTIER P/L	FYANSFORD
GRAMPIANS REGION WATER AUTHORITY	HORSHAM
SILEC P/L	KEON PARK
WELLINGTON SHIRE COUNCIL	KILMANY
TIMMIS, STEVEN JOHN	KOORLONG
CENTRAL RECYCLING P/L	KYNETON
EAST GIPPSLAND SHIRE COUNCIL	LAKES ENTRANCE
DRUM SERVICES (WA) P/L	LAVERTON NORTH
LAVERTON DRUM RECYCLERS P/L	LAVERTON NORTH
PATRICK DISTRIBUTION P/L t/a UNITED TRANSPORT SERVICES	LAVERTON NORTH

STERICORP LTD	LAVERTON NORTH
ENVIRONMENTAL OIL LTD	LAVERTON NORTH
CHEMSAL P/L	LAVERTON NORTH
VISY STEEL PRODUCTS P/L	LAVERTON NORTH
WELLINGTON SHIRE COUNCIL	LONGFORD
CENTRAL GIPPSLAND REGION WATER AUTHORITY t/a GIPPSLAND WATER	LONGFORD
SITA AUST P/L	LYNDHURST
MILDURA RURAL CITY COUNCIL	MILDURA
NATIONWIDE OIL P/L	MOOLAP
ECO-CHEM P/L	MOORABBIN
GROSVENOR LODGE P/L	MORNINGTON
SIEMENS LTD & THIESS CONTRACTORS P/L t/a SILCAR	MORWELL
LATROBE CITY COUNCIL	MORWELL
SWEENEY TODD WASTE DISPOSAL P/L	NORTH SHORE
EAST GIPPSLAND REGION WATER AUTHORITY	ORBOST
ELLIOTT HOLDINGS (AUST) P/L	PATHO
ALPINE SHIRE COUNCIL	POREPUNKAH
WESTVIC PETROLEUM SERVICES P/L	PORTLAND
GLENELG SHIRE COUNCIL	PORTLAND
KALARI P/L	PORTLAND
MOCONNA P/L t/a MEDICO WASTE DISPOSAL	SALE
WALDEN, JOHN ALBERT & JOANNE THERESE t/a CONTAINER SAVE	SEAFORD
NANCARROW, GREG NORMAN	SEAFORD
CITY OF GREATER SHEPPARTON	SHEPPARTON
BALLARAT CITY COUNCIL	SMYTHESDALE
MASINKO P/L	STAWELL
BIALCROW P/L	SUNSHINE
ALLTIPE DRUM CO P/L	SUNSHINE NORTH

SWAN HILL RURAL CITY COUNCIL	SWAN HILL
WASTE MANAGEMENT PACIFIC P/L	THOMASTOWN
COOPER BROS HOLDINGS P/L	TOTTENHAM
MASTER WASTE P/L	TOTTENHAM
BAW BAW SHIRE COUNCIL	TRAFALGAR
BORAL RECYCLING P/L	TRUGANINA
BRAMBLES AUST LTD	TULLAMARINE
PHOTO WASTE MANAGEMENT P/L	WARRAGUL
ACE SCRAP METAL & STEEL CO P/L	WENDOUREE
PAISLEY PETROLEUM P/L	WILLIAMSTOWN
DRUM SERVICES (VIC) P/L	WILLIAMSTOWN
PAGE, GARY ALBERT	WILLIAMSTOWN
PIONEER AUST WASTE MANAGEMENT P/L	WOLLERT
RON J HUNTER & SON P/L	YARRAM

8.4 Victorian Renderers Association Members

Taken from the Renderers Association Websiteb

Company Name: Faymen Pty Ltd			
Rendering Site:	2 Cope St, Preston, Vic, 3072		
Postal Address:	PO Box 165, Preston Vic 3072		
Telephone:	03 9480 6200	**Facsimile:**	03 9480 4542
Contact:	Marvin Fayman, Selwyn Auster.		
Email:	info@fayman.com.au		

PROTEIN MEALS						
Product Name	**Specifications**					**Annual Production capacity (tonnes)**
	Protein	**Fat**	**Moisture**	**Ash**	**Digest-ibility**	
Provine (Ovine Meal)	76 - 80%	7 - 10%	5-6%	4-6%	98%	1000
Pro blend	64 - 68%	7 - 10%	6-8%	7-10%	96%	1000

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Company Name: Australian Tallow Producers Pty Ltd				
690 Geelong Road, Brooklyn Victoria 3012				
Telephone: 03 9318 0369 **Facsimile: 03 9314 7155**				
Email: c.palmer@austal.com.au				
Contact: Craig Palmer				
TALLOWS				
Product Name	**Specifications**			**Annual Production capacity (tonnes)**
	FFA	**FAC colour**	**MIU**	
Edible tallow	0.05%	1	0.01%	10400
Prime tallow	0.5% max	1	0.1 %	7800
Bleachable tallow				10000
50% Meat and Bone Meal, 10,000 tonnes per annual				
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Company Name: Baybrick Pty Ltd
PO Box 36
ALTONA NORTH VIC 3025
Phone: 03 93151299
Fax: 03 93141011

Email: foravec@belandra.com.au
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Company Name: Echuca Abattoir
P O Box 173
ECHUCA VIC 3564
Phone: 03 54821566
Fax: 03 54824331
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Company Name: HW Greenham & Sons Pty Ltd
PO Box 1118
SOUTH MELBOURNE 3205
Phone: 03 96960054
Fax: 03 96960057
Email: hwg@greenham.com.au
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Company Name: Craig Mostyn & Co, Pty Ltd			
Address:	63 Stead Street, South Melbourne, Vic, 3205		
Postal Address:	GPO Box 2199T, Melbourne, Vic, 3001		
Telephone:	(61) 3 9684 7303	**Facsimile:**	(61) 3 9699 5283
Email:	scooke@craigmostyn.com.au		
Web:	www.craigmostyn.com.au		
Contact:	Stephen B. Cooke		
Products:	• Prime grade tallow • Bleachable grade or laundry grade or soap grade tallows • Feedgrade tallow • Meat and bone meal - mixed or pure bovine or pure ovine material • Blood meal • Hydrolysed feather meal • Poultry by-product meal • Chicken mix • Fishmeal and fish blend meal		
WebSite:	www.craigmostyn.com.au		
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Company Name: Fidelity Agrik Pty Ltd
Level 50, 101 Collins St
MELBOURNE 3000
Phone: 03 96539314
Fax: 03 97611765

Email: commercialoils@msn.com.au
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Company Name: Keys Trading International Pty Ltd			
Address:	1038A Dandenong Road (PO Box 84) Carnegie Victoria 3163		
Telephone:	61 3 95711088	Facsimile: 61 3 412 288 810	
Email:	keys@keysgroup.com.au	**Web:**	http://www.keysgroup.com.au
Contact:	Bob Bolton, Kevin Duff		
Products:			
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Company Name: Kotra Tallow Pty Ltd			
Address:	76-84 Knight Avenue, North Sunshine, Melbourne VIC 3020		
Telephone:	(61) 3 9366 7700	**Facsimile:**	(61) 3 9366 7939
Email:	ververis@tallow.com.au		
Contact:	Jae Yoo, Marketing Manager; Tae Il Cha, Operation Manager		
Products:	• Tallow (extra fancy/top white/good/bleach/unbleachable/medium gut/low gut) • Refined Cooking Oil • Refined Yellow Grease		
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