Wimmera Bioenergy Resource Audit

Prepared for Wimmera Development Association

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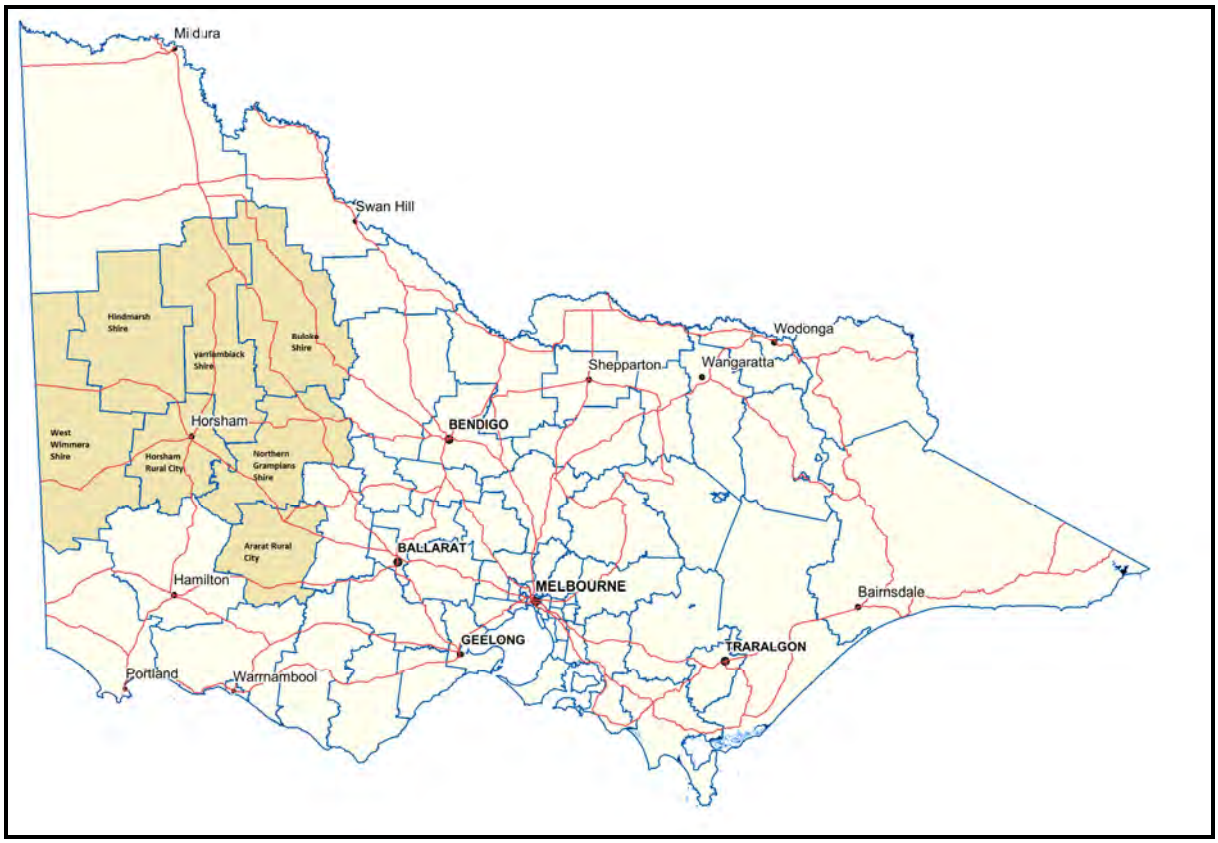
Contents

1. Introduction

This report details the results of the Wimmera Bioenergy Resource Audit undertaken over September and October 2010 for the Wimmera Development Association, with funding from Regional Development Victoria as part of a statewide project. The Bioenergy Resource Audit covers the following municipalities - Horsham Rural City, Ararat Rural City, West Wimmera, Yarriambiack, Northern Grampians, Hindmarsh and Buloke Shires. The area covered by this study can be seen in Figure 1.

Figure 1
Wimmera Bioenergy Resource Audit Study Area



Bioenergy, which is energy resourced from non food agricultural and forestry by-products or residues (known as biomass), offers potential as a viable, low cost and sustainable alternative technology to fossil fuel based energy supply in some parts of regional Victoria.

The project is occurring in conjunction with Regional Development Victoria, the Department of Primary Industries and the Grampians Regional Waste Management Group. Information collected through this audit will be provided to Wimmera Development Association, Regional Development Victoria and other agencies to inform further discussions and work on the potential for bioenergy facilities in this area.

2. Purpose and Background

The purpose of the Wimmera Bioenergy Resource Audit is to accurately determine amount, variety and availability of agricultural, municipal industrial and other relevant resources available in the area which could be used for bioenergy generation.

The audit has considered a diverse range of organic materials from food processing waste, municipal organic waste, material from grain handling and processing, animal industry waste and crop residues. In order to best locate, scale and scope biomass facilities, detailed identification of the scale, type, availability, seasonality of biomass and its point of origin is required.

This project did not consider the feasibility of the establishment of a specific facility or consider a specific bioenergy technology.

3. Methodology

A contact database of businesses was developed through consultation with Wimmera Development Association, Department of Primary Industries, Regional Development Victoria, the Grampians Regional Waste Management Group, economic development staff at the municipalities covered by this study, by referral by other businesses and internet searches. Time constraints associated with the project meant that businesses were contacted by phone in the first instance. Follow up emails were sent if further information was needed to explain the project.

All data was collected over the phone and recorded in the Resource Audit Tool that was provided for the project. The results are summarised in this report. Some businesses knew exact quantities of materials generated and others made estimates – however all results have been recorded and used in this report. Information was collected from over 95 businesses throughout the Wimmera. Appendix 1 has a table indicating the distribution of these businesses.

The approach adopted for data collection and business identification in addition to the time constraints associated with the project means that the list of businesses contacted is not necessarily 100% of the businesses that generate biomass – there may be other businesses that are in the region that generate potential biomass material, affecting the quantity of material available.

Timber processing materials was not part of the scope of this project as this material is being covered by a separate process.

4. Overview of Findings

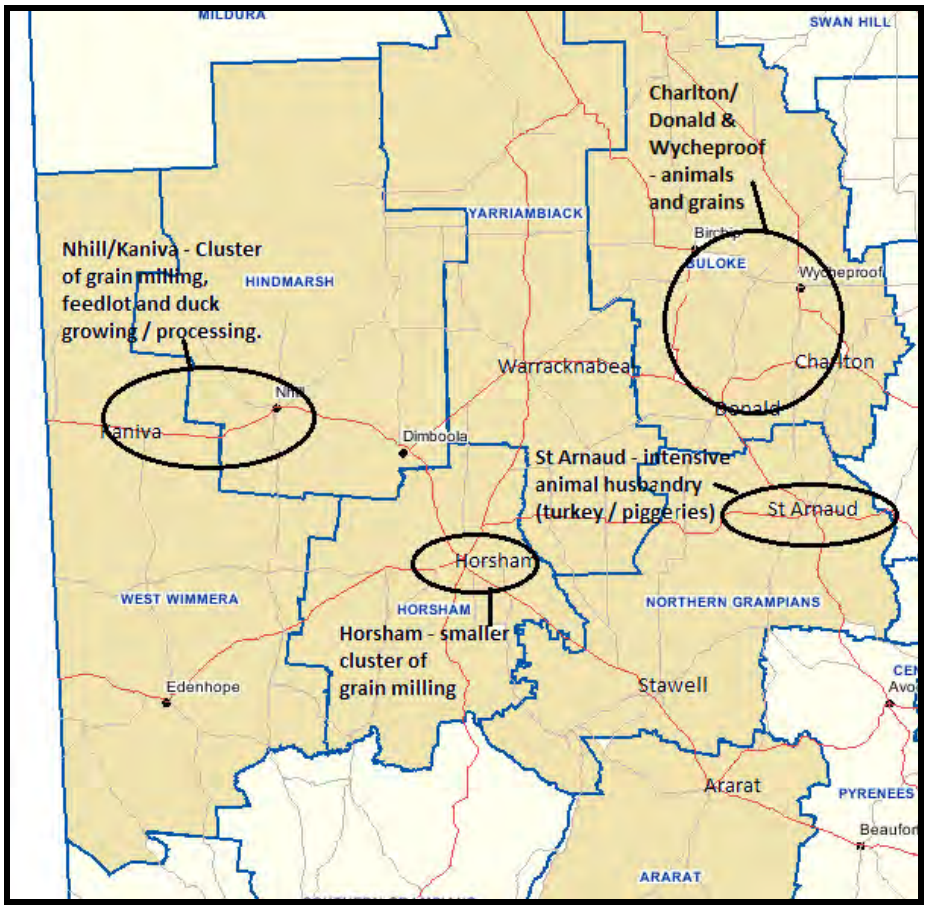
Table 1 is a summary of the results of this audit. It identifies that apart from crop biomass there is on average approximately 155,000 tonnes / annum of biomass material generated and an average 71,500 tyres / annum in the region.

The majority of this material is manure generated from the animal industry (such as poultry producers, piggeries, saleyards and feedlots) and grain from grain processing and handling facilities. Processing waste from the animal industry is also a significant quantity but this material is used in the manufacture of blood and bone and tallow. Similarly much of the grain handling and processing materials is used as stockfeed.

Municipal Green Waste is a significant underutilised resource in terms of both material that is separated at waste transfer stations but also in terms of the potential green waste resource that is not presently captured as part of the kerbside collection process.

The materials are spread throughout the study area; however there are four main clusters (see Figure 2).

Figure 2
Location of Clusters



There is a cluster of businesses in the Charlton / Donald / Wycheproof area with 13 businesses in the animal and grains sectors producing approximately 33,000 tonnes / annum of material (primarily manure). Another cluster can be found around St Arnaud where there are a number of turkey and piggeries producing approximately 25,000 tonne / annum of material. There is a cluster of diverse businesses based around Horsham producing on average 9,227 tonnes of material / annum with some of the grain milling companies located in Horsham producing the bulk of this. Nhill and Kaniva have another cluster of five main businesses in the grain milling, feedlot and duck growing and processing area producing approximately 26,000 tonnes of material which is a mix of manure, animal processing waste and grain processing materials.

Table 1 – Resource Audit Tool Summary

Resource	No of Businesses	Low (tonnes)	High (tonnes)	Average (tonnes)	Other material
Dry Waste Types					
Agricultural residues					
Winter field crop residues					
Grain and pulse-handling facilities	16	19,358	30,804	26,081	
Fruit tree and Grape Pruning					
Olives – prunings, pits and seeds (dry)	7	291	305	298	
Olives - old oil	2				900 litres
Vineyards – prunings	1	111	111	111	
Vineyards – marc (wet) / wine waste streams	2	600	800	700	
Fruit, nut and vegetable	6	-	-	-	
Brush Panel Offcuts	1	260	260	260	
Timber Offcuts	1				
Fruit Processing Residues	1	250	250	250	
Flowers - woody stems, leaves and flowers	5	218	228	223	
Energy Crops					
Dryland energy crops	2	-	-	-	
Municipal Organic Waste					
Kerbside Green Waste Potential (using a figure of 33% of kerbside waste)		*5,550*	*5,550*	*5,550*	
Green Waste from transfer stations and landfill		4,849	4,849	4,849	
Commercial Green Waste	NA				
Sewage Volumes					
Sludge Volumes (from 09/10 year)		9,000	10,000	9,500	
C&D Woodwaste (construction and demolition)		911	911	911	
C&I Woodwaste (above)					
Wet Waste Types					
Animal waste					
Dairies	2				
Piggeries	6	23,450	28,700	26,075	75,000 litres
Feedlots – manure	4	23,800	34,000	28,900	
Saleyards – manure	4	74	85	80	
Poultry - Litter (manure and wood shavings)	23	24,988	25,226	25,107	
Poultry - Processing and hatchery waste (wet)	4	4,986	4,986	4,986	
Poultry - Dead birds / spent hens (some incl in process waste)	2	190	190	190	
Poultry – Feathers	2	515	515	515	
Processing waste					
Food manufacturing / bakeries		182	208	195	
Abattoirs – offal and processing waste (wet)	3	19,468	19,468	19,468	
Abattoirs - manure (wet)	3	1,400	1,400	1,400	
Paper and Cardboard					
COMBINED TONNES		**140,451**	**168,846**	**155,648**	

Other		units	units	units
Tyres – retail	19	63,288	79,648	71,468
Tyres – Transfer stations		340	340	340
Feedlots – dead cattle		30	30	30
Saleyards - dead sheep		300	400	350

In terms of crop biomass this report has identified that cereals are the main crop that is suitable for biomass purposes in the study area. Cereals are the dominant crop in the study area both in terms of hectares planted and production tonnage. Legumes and oilseed biomass residues are less desirable to harvest from a soil conservation perspective. This report notes that there are four methods that have been identified for determining the quantity of biomass that would be available and these methodologies result in considerable variation in the amount of materials available. For instance in the average year (in terms of either area planted or production tonnage) and using the lowest harvest rate application of the four methodologies suggests an amount of 209,847 tonnes to 642,568 tonnes of potential biomass material throughout the study area. There are lower years in terms of area planted for cereals and tonnage and any facility should take into account these lower years.

Table 2 - Cereals for Grain
Potential Biomass Material Available – Average Year

Harvest Rate	Tonnes of potential biomass material		
Methodology	15%	20%	50%
CHBSS	560,293	747,057	1,867,642
UB - Hopetoun Study	642,568	856,757	2,141,892
CP / DPI	472,157	629,542	1,573,856
BG		209,847	

As this is a point in time survey there will be other businesses in the area that have potential biomass material, new businesses will start and some existing businesses may cease to operate or change their operations and products. It is hoped that over time the details generated through this project can be built on to provide an evolving picture of the potential biomass materials that are available in the Wimmera.

5. Resource Profile

An overview of the main resource types is given below.

5.1 Field Crop Residues

The Wimmera and Mallee are the major cereal production regions of Victoria. These areas are predominantly winter cropping areas. Wheat and barley represent the main cereal crops grown in the region. Australian Bureau of Statistics and ABARE data has been analysed to identify the area of land that has been planted to cereal crops and the production tonnage.

The study area for the Wimmera Bioenergy Resource Audit covers the whole of the Wimmera Statistical Division (Hindmarsh Shire, West Wimmera Shire, Yarriambiack Shire, Horsham Rural City and Northern Grampians Shire) as well as Ararat Rural City which is included in the Central Highlands Statistical Division and Buloke Shire which is included in the Mallee Statistical Division. Annual area and production figures for the Wimmera Statistical Division for the last 16 years are listed below.

Table 3
Cereals for Grain – Wimmera Statistical Division[1]

Year Ending (30th June)	Area Planted (Ha)	Production (Tonnes)
1995	441,248	600,106
1996	580,539	1,418,389
1997	613,058	1,561,110
1998	655,855	1,198,020
1999	646,633	1,159,094
2000	692,954	1,583,366
2001	692,779	1,858,631
2002	717,289	1,895,533
2003	769,862	536,423
2004	864,387	2,304,387
2005	777,700	1,212,533
2006	745,784	1,842,679
2007	910,574	511,622
2008	996,483	1,720,851
2009	940,688	1,270,197
2010 Estimates[2]	774,610	1,926,706
Average	738,778	1,412,478

Statistical Local Area data has not been able to be sourced for all these years for Buloke Shire and Ararat Rural City. For these areas data has been sourced for 1997, 1998, 1999, 2001 and 2006 years. The average area planted and production figures for these years can be seen in Tables 4 and 5.

[1] Note the Wimmera Statistical Division covers the municipalities of Hindmarsh, West Wimmera, Yarriambiack, Horsham and Northern Grampians. It does not cover the municipalities of the Ararat (included in the Central Highlands Statistical Division) and Buloke (included in the Mallee Statistical Division). Data at the local government level is usually available only in census years.
[2] Source – Department of Primary Industries Yield Estimates using average rainfall

Table 4 Cereals for Grain - Buloke Shire		
Year Ending (30th June)	Area Planted (Ha)	Production (Tonnes)
1997	269,770	619,805
1998	233,241	345,022
1999	241,339	306,298
2001	321,842	730,429
2006	383,264	786,492
Average	289,891	557,609

Table 5 Cereals for Grain - Ararat Rural City		
Year Ending (30th June)	Area Planted (Ha)	Production (Tonnes)
1997	34,128	91,294
1998	27,717	67,169
1999	37,047	107,151
2001	52,620	177,140
2006	59,873	199,182
Average	42,277	128,387

In determining the potential available biomass material the following factors have been considered:

- Only cereals planted for grain have been considered as providing potential biomass. Appendix 1 shows that cereals are the dominant crop in the Wimmera.
- In the study area oil seeds (predominantly canola) and pulses are not considered an appropriate biomass resource for bioenergy purposes. Lentils leave very little biomass material behind; pea straw doesn't last so long before it is blown away. Pulses have high levels of nitrogen and provide good nutrients for the soil and the cropping residue is an important groundcover. The plant matter left after harvest is difficult to collect and is a very fine material. The area planted to oilseeds in the Wimmera is low (4-8%) in comparison to the area planted for cereals and varies from year to year (see Appendix 1).
- Crops and pastures planted for hay have not been considered as the majority of above-ground biomass is specifically harvested for hay. Appendix 1 shows that on average in the Wimmera Statistical Division 58,000 ha is planted for pasture and hay – around 5% of the area that has been planted.
- Technology used in harvesting can influence the amount of biomass material that is able to be collected and used.

The following factors should also be considered in the use of crop residues for bioenergy:

- In any use of crop residues for bioenergy purposes a minimum level of stubble should be retained (i.e. 10-13 cm) to prevent wind erosion and to contribute to soil health.
- There is annual variation in crops planted depending on the seasonal conditions – i.e. in wetter years more oilseeds and pulses are planted. There is also spatial variation in the crops planted on an annual basis.
- The Department of Primary Industries Cropland Management Transect Survey, an annual survey conducted in April / May and again in Spring, along a set transect in five Wimmera Shires, identifies farm management practices and contains useful information with regard to stubble retention. The 2010 Wimmera Cropland Management Transect Report notes that from 1996-2010 an average of 62.8% of paddocks surveyed had standing and incorporated stubble, with a high of 82% being

observed in 2009[3]. Therefore in any one year not all the maximum potential stubble will be available as burning, chemical and conventional fallow still occurs.

- Future work planned by Department of Primary Industries and the Department of Sustainability and Environment will provide more detailed information on the potential biomass available each year and this will be worth considering in any future bioenergy work.
- By Spring each year a clearer picture of the potential available biomass for that year should be able to be gained.
- Consultation with the Victorian No Till Association (VNTA) and Wimmera Conservation Farming Association (WCFA) raised concern that removal of cereal stubble would have negative effects on soil health, and that retention of soil stubble has led to a decrease in soil erosion. The VNTA want to see 100% of cropping residue material left in the paddock and for that material to be evenly spread throughout the paddock. They indicated that removal of stubble even for one year would have a negative effect on soil health[4].
- The Wimmera Conservation Farming Association (WCFA) made some points worth noting which might effect the suitability and availability of crop biomass:
  - During the recent drought cereal stubble was a prime income source for farmers and was in high demand for use as stock feed and in stock containment areas. In these years there was also minimal hay production.
  - Retention of stubble to beer can height is the bare minimum that is needed for prevention of wind erosion. To improve soil health more will need to be retained.
  - There will be issues associated with the costs of collection of crop biomass – storage and transport
  - Stubble availability will vary from year to year depending on the conditions – for instance this year there will be plenty.
  - Crop residues are a product that farmers have invested in and retention of them contributes to soil health and productivity.
  - Identifying a balanced way to harvest crop stubbles without effecting soil health is the critical factor.

Four methodologies for determining the potential quantity of crop biomass that could be used for bioenergy, have been identified in the research for this project. Each method is different and is outlined below.

A critical consideration in determining the amount of biomass that is available is the notion of a sustainable harvest rate – i.e. how much material can or should be taken compared to how much should be retained on site for soil conservation purposes. The four methodologies apply varying percentages to the amount of materials that can be harvested sustainably and this study applies all three – 15%, 20% and 50%.

[3] Pittock, Antonoff, Robson (2010), Wimmera Cropland Management Transect April 27 2010, Department of Primary Industries, Horsham, Page 8.
[4] Personal communication with Vanessa Greiger – Vic No Till Association, 9 November 2010

Central Highlands Bioenergy Scoping Study (CHBSS)

The Central Highlands Bioenergy Scoping Study conducted by SED Consulting in 2009 considered the available bioenergy materials in the central highlands area of Victoria. Part of what this study considered was crop biomass. This report notes that "to convert both cereal grain and pulse production into stubble availability, the Bioenergy Atlas of Australia recommends applying a multiplication factor of 1.78[5]" – that is Grain Production (tonnes) x 1.78. The report also assumes that only half of the stubble (50%) should be baled so as to leave an adequate cover of mulch on the ground.

Hopetoun Community Sustainable Energy Initiative Pre-Feasibility Study

This study conducted by the University of Ballarat in 2008 considered renewable energy sources for the Hopetoun area including the potential available crop residue biomass that could be available to generate bioenergy. The approach used in this report to determine the total biomass crop yield was to multiply the area of agricultural land by the average crop reside biomass yield. An assumed average biomass yield of 4 tonnes / ha was used (conservative) by this study. 50% of this maybe considered to be crop residue that may be available as feedstock. The report notes that the biomass figures "does not include crop stubble"[6]. This study also applied a figure of 15% as the harvest rate.

Dr Chris Pittock, Department of Primary Industries, Horsham

Another approach that could be used was suggested in discussions with Dr Chris Pittock from DPI in Horsham. A general rule of thumb that can be used to determine the potential quantity of biomass is that with wheat for every tonne of seed you get 1.5 tonne of stubble – i.e. Harvest tonnage x 1.5. (Note - the multiplication factor is different to that used in the Central Highlands Study but these two methodologies produce the most similar results).

Bill Gardner – Peak Power

Peak Power is a group based at Laharum that are looking at the feasibility of generating bioenergy from crop residues. The approach being developed by that group is that half of the cereal grain yield is considered to be the harvestable residue. 20% of this could be harvested sustainably on an annual basis. Assume a sustainable harvest of twice every ten years, removing 50% each time (equals 20% per annum).

Each methodology was applied to the lowest, average and highest years included in Table 2 in terms of either area planted or production based on the respective methodology. Usage rates of 15%, 20% and 50% are applied to each methodology and the results are shown in Table 6.

[5] SED Consulting (2009), Central Highlands Bioenergy Scoping Study, p55
[6] University of Ballarat (February 2008), Hopetoun Community Sustainable Energy Initiative Pre-Feasibility Study, p47.

Table 6 – Cereals for Grain, Wimmera Statistical Division
Potential Biomass Available – Lowest, Average and Highest Years

Lowest Year			
Harvest Rate	Tonnes of potential biomass material		
Methodology	15%	20%	50%
CHBSS	136,603	182,137	455,344
UB – Hopetoun Study	264,749	352,998	882,496
CP / DPI	115,115	153,487	383,717
BG – Peak Power		51,162	
Average Year			
Harvest Rate	Tonnes of potential biomass material		
Methodology	15%	20%	50%
CHBSS	377,132	502,842	1,257,105
UB – Hopetoun Study	443,267	591,022	1,477,556
CP / DPI	317,808	423,743	1,059,359
BG – Peak Power		141,248	
Highest Year			
Harvest Rate	Tonnes of potential biomass material		
Methodology	15%	20%	50%
CHBSS	615,271	820,362	2,050,904
UB – Hopetoun Study	597,890	797,186	1,992,966
CP / DPI	518,487	691,316	1,728,290
BG – Peak Power		230,439	

Table 7 – Cereals for Grain, Buloke Shire
Potential Biomass Available

Average Year			
Harvest Rate	Tonnes of potential biomass material		
Methodology	15%	20%	50%
CHBSS	148,882	198,509	496,272
UB – Hopetoun Study	173,935	231,913	579,782
CP / DPI	125,462	167,283	418,207
BG – Peak Power		55,761	

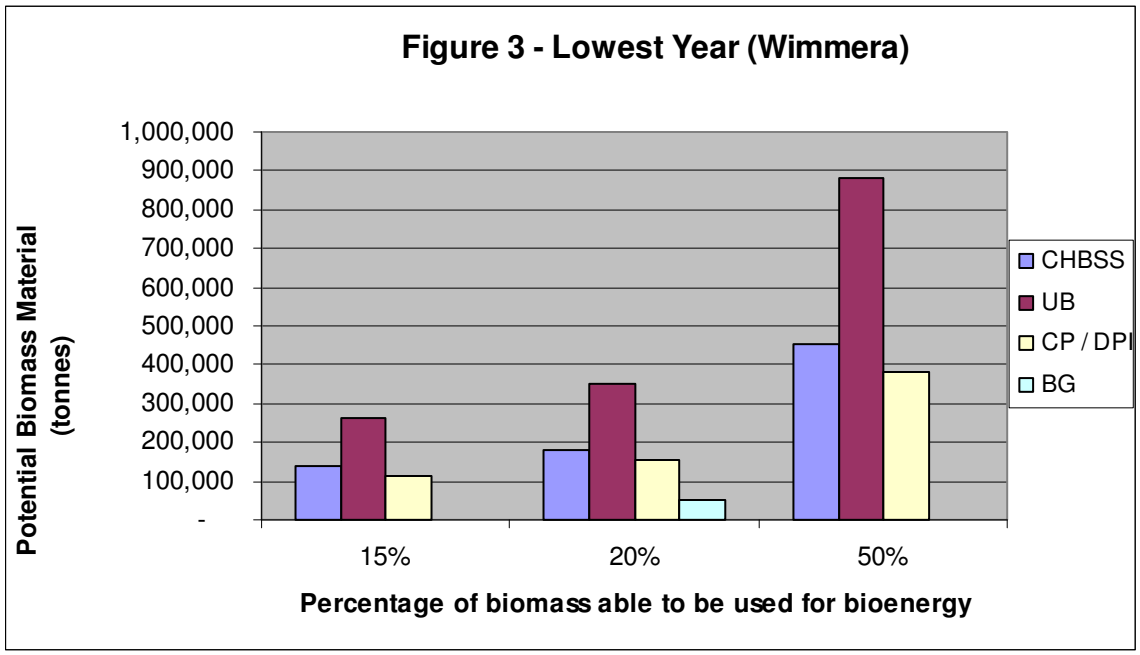
Table 8 – Cereals for Grain, Ararat Rural City
Potential Biomass Available

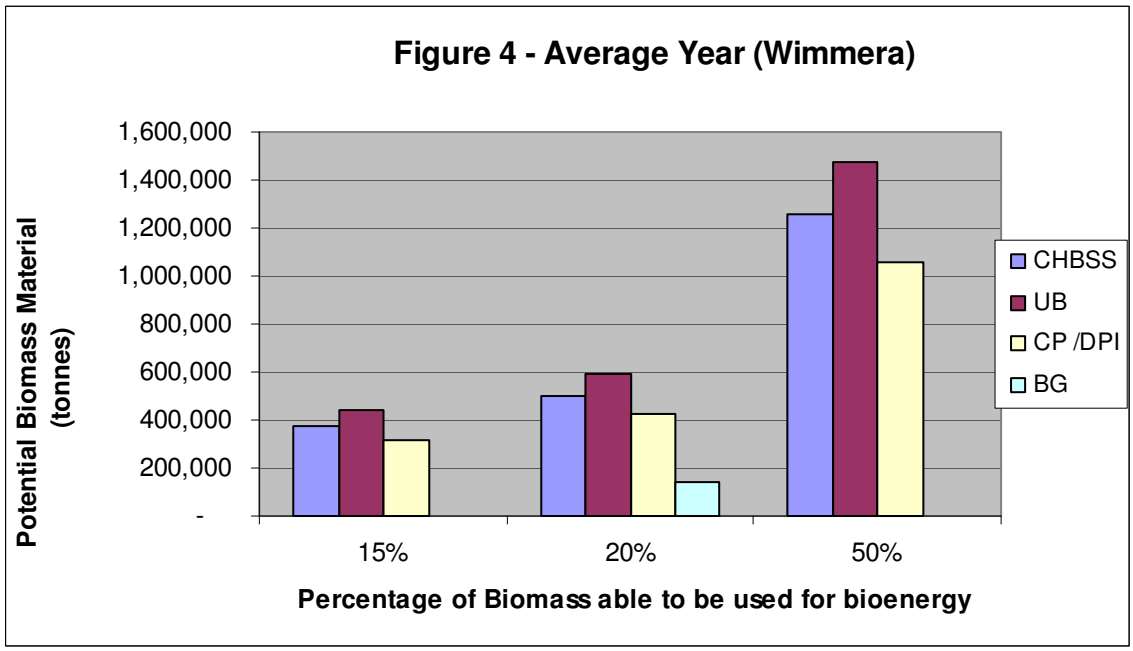
Average Year			
Harvest Rate	Tonnes of potential biomass material		
Methodology	15%	20%	50%
CHBSS	34,279	45,706	114,265
UB – Hopetoun Study	25,366	33,822	84,554
CP / DPI	28,887	38,516	96,290
BG – Peak Power		12,839	

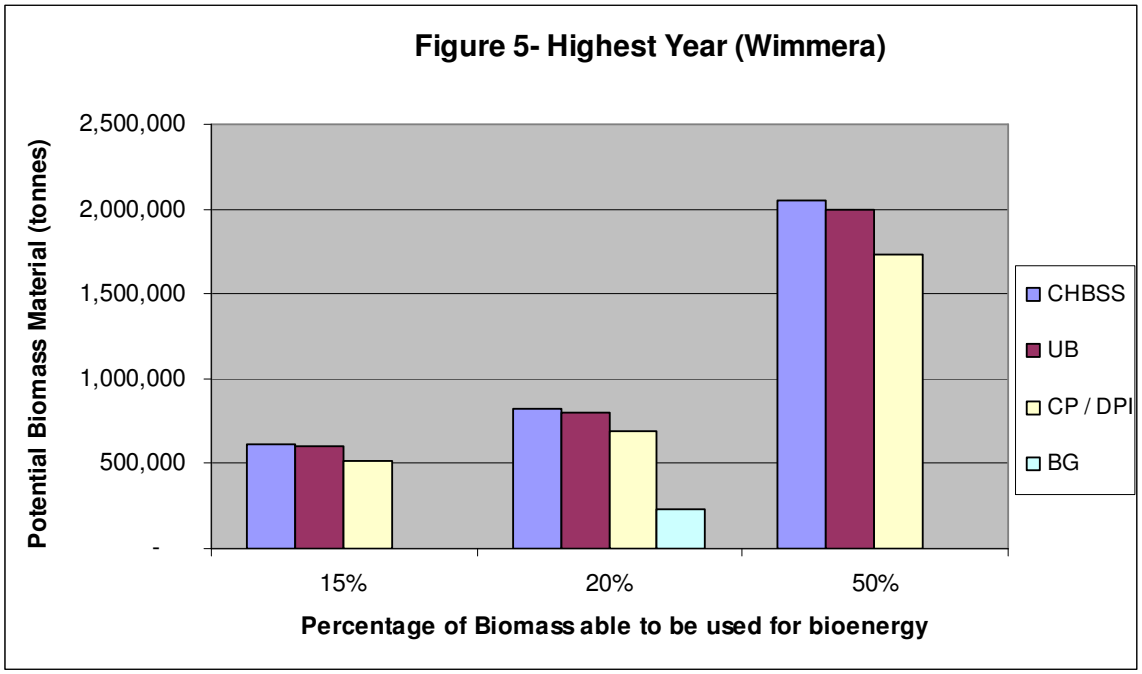
Figures 3, 4 and 5 show the Wimmera results graphically. It is clear that there is considerable variation in the potential amount of biomass depending on the

methodology used. The safest approach in planning any bioenergy facility would be to plan for the lowest – average years, rather than the highest years either in terms of area planted or in terms of production.

As mentioned earlier land management practices adopted by landholders will also affect the amount of material available as 100% of farmers do not retain stubble.







5.2 Grain Handling and Processing

Sixteen grain handling / processing businesses have been contacted, located in or around Horsham, Nhill, Murtoa, Dimboola, and St Arnaud. The main biomass materials identified are grain screenings, fines, husks or waste/spoilt or defective grains.

Within this category there tends to be two main types of businesses – grain processing / milling companies or companies that handle or store grains. Those that process grains have larger quantities of materials.

The combined tonnage ranges from approximately 19,000 tonnes – 30, 000 tonnes with an average of 26,081 tonnes. All biomass material was generally sold as stock feed at variable prices raging from $80 - $290. This material was not seen as a waste product as such but that stockfeed was an important product.

There is considerable variation in quantity of materials available depending on seasonal conditions and the quality of materials - if it is a good season and there is better quality grain, then there is lower seconds etc.

5.3 Vineyards

As a part of this study eight vineyards were contacted. Vineyards tend to be located in the eastern part of the study area around the foothills of the Grampians and the Pyrenees and the township of Great Western, one winery was located in Lower Norton.

Of the eight vineyards surveyed, four make wine and the remainder only grow grapes and have processing done off site. The main biomass materials identified are prunings available from after harvest and marc (seeds and skins) available from March each year.

Two wineries were able to report tonnage of on average 700 tonnes of marc per annum. One winery was able to report the generation of approximately 111 tonnes / annum of prunings. Other wineries report that they are too small to calculate tonnage of marc and prunings. It should be noted that contact was unable to be made with one of the larger wineries located at Great Western therefore the quantity of marc in the study area will be higher then the figure referred to above.

Prunings tend to be mulched / slashed in midrows. Marc tends to be used as mulch for the vines or else spread in paddocks for stock to eat. One winery that generates the bulk of the marc (average 600 tonnes) sells this to a piggery for feed.

There is some interest in creating better quality compost from pruning's and marc. Some wineries reported having to import green mulch in the past for their vines.

Other studies, the Kronos Report looks at use of prunings and marc from the Grampians and Pyrenees regions for material recovery (tartaric acid) and manufacture of compost.

5.4 Olives

Seven olive groves were contacted and are spread throughout the study area located in the Laharum area (3 sites), Dimboola, Stuart Mill and Great Western areas. The main biomass materials identified are from prunings (available from June / July) and the pits / skins from pressings plus some old or waste oil.

Only two businesses in the Wimmera (Toscana and Kalaparee) process olives on site. Most from the region use Toscana and one gets processing done elsewhere outside of the region. 190 tonnes / annum of crushed olive pits and seeds (dry) were reported from the two processing businesses. Approximately 100 tonne of woody pruning's / annum have been identified from all sites. 900 litres / annum of old olive oil were also reported.

The pits and skins were used for compost but one business reported having more than they need. Prunings are either slashed on site where they fall or are burnt.

5.5 Wildflowers

As a part of this study five wildflower businesses were contacted clustered around the Laharum / Northern Grampians area. The main biomass material identified was woody stems (0.5-1.2cm or greater), leaf and flower material trimmed off during the packing process. Approximately 230 tonnes / annum of material were identified.

Material is generally available from April / May through to December. All materials are burnt on site near the packing sheds. Other potential biomass material could be when shrubs are ploughed in and replaced.

There was definite interest from businesses for a better way of using this biomass material and there is scope for growth in industry.

5.6 Poultry, Ducks and Turkeys

As a part of this study six poultry / turkey producing businesses were contacted. These businesses are located at St Arnaud, Dadswells Bridge, Great Western, Wycheproof and around Nhill (Luv a Duck). Luv a Duck based at Nhill are the largest producer in the study area with 18 contract grower sheds in the Hindmarsh, Yarriambiack and West Wimmera areas; two quarantine farms; a hatchery site and processing plant at Nhill.

The main biomass materials that were identified were litter (a mix of manure and wood shavings), processing waste, feathers and dead birds. All businesses operate throughout the year. The following is a summary of the biomass materials available from all businesses:

- Litter (wood / shavings and manure) = 25,000 tonnes / annum
- Offal / processing waste (blood, guts) and hatchery waste (shells, deformed birds) = 4,986 tonnes / annum
- Feathers = 500 tonnes
- Dead birds / spent hens = 190 tonnes

Litter tended to be spread on site as a fertilizer or given / sold to surrounding farmers for free or up to $20 / tonne. This is the case regardless of the scale of the business.

Treatment of offal or processing waste and dead birds varied depending on the scale of the enterprise. With smaller businesses, offal or hatchery waste and dead birds were buried on site or taken to landfill. With the larger companies offal and processing waste was taken to plants that make blood and bone / fertilizer. One egg business based near Ararat sells all spent hens to a company in Melbourne for processing as stock or rolled / pressed chicken meat. One business reported generally selling feathers but when they are occasionally not able to this material also goes to the plant that makes blood and bone / fertilizer.

The Northern Poultry Cluster Ltd[7] based in Bendigo is currently investigating bioenergy options, and there are a number of large scale poultry producers located just outside of the study area boundary around Bendigo. The Northern Poultry Cluster Ltd has established a subsidiary company Biochar Energy Systems Pty Ltd which is looking to commercialise the use of pyrolosis for producing thermal energy and biochar from waste poultry litter and other biological waste streams. Some of the businesses contacted as part of this study are members of the Northern Poultry Cluster.

5.7 Abattoirs

Two large abattoirs (predominantly handling sheep) located at Stawell and Ararat and a smaller enterprise at Hopetoun that slaughters and sells meat at the butchers were contacted. There are two main biomass materials:

- Offal – skin, intestines, fat, bones – 19,462 tonnes / annum
- Manure and liquid effluent/wash down water – 1,400 tonnes / annum

[7] www.northernpoultry.com.au

All three businesses operate throughout the year and are fairly stable in their scale and operations. The businesses reported that they are slightly busier in Spring. The two larger enterprises sell all their offal / processing materials to rendering plants as there is a market for skins, intestine casings, and other materials – for rendering and making blood and bone and tallow. In one instance there is interest in establishing a rendering facility on site.

In all instances manure is spread on farms.

5.8 Saleyards

As part of this study four saleyards (handling sheep) were contacted. The saleyards are spread throughout the study area at Horsham, Nhill, Warracknabeal and Wycheproof. The number of sheep handled by the saleyards varied from 5,000 / annum to 600,000 / annum. The number of sheep through the saleyards has been lower over the past few years, reflecting the general reduction of stock in the area. The main biomass materials identified are solid manure, truck wash water and dead animals.

Some of the saleyards had low levels of usage – this made it difficult to attain reliable data on the volume of manure generated as in these instances the low volumes of manure composted down and the pens were not needed to be cleaned out. In other instances manure was stockpiled and used by Council's parks and gardens sections and in the case of the Horsham Livestock Exchange, the largest saleyard in the study area, a contract has just been entered into for a firm from Ballarat to collect the manure. Liquid effluent was treated on site by waste water treatment systems or connected into town sewer system.

Dead animals were taken to landfill.

5.9 Feedlots

Four feedlot businesses were contacted as part of the project. These businesses are spread through the study area with the largest feedlot being the Charlton feedlot located at Charlton and others in Nhill and Kaniva. The main biomass materials identified were manure, liquid effluent and any dead cattle. All sites operate all year round.

The combined tonnage of manure ranges from 23,000 tonnes – 33,000 tonnes with an average of 28,900 tonnes, with just over 80% of that being from the one site. Manure is predominantly used by landowners as fertilizer which is spread on site, with only one site reporting that the manure is sold at $20 / tonne. Liquid effluent evaporates. Dead cattle tend to be composted / buried or burnt on site.

5.10 Piggeries

Six piggeries were survey as part of this study. These businesses tend to be located in the north eastern part of the study area around Donald and St Arnaud. All businesses are contract growers with animals getting transported off site for processing at a

number of different facilities outside of the Wimmera. Manure and straw bedding is the main biomass material generated from these businesses, which range in size from 170 pigs – 39,000 pigs / annum. The combined quantity of manure/straw material ranges from 23,000 tonnes – 28,000 tonnes with an average of around 26,000 tonnes per annum, plus some liquid effluent. One site generates close to 80% of the waste.

Manure and liquid effluent from the smaller enterprises is re-used on site as fertilizer and spread into land before cropping, or given to surrounding farms for a similar purpose. The larger site sells manure for $10 / tonne and has a contract for a number of years for reuse of this material.

5.11 Tyres

Nineteen tyre retail businesses were contacted as part of this study, and are spread throughout the study area. 63,000 – 79,000 tyres / annum were identified as being available through normal turnover. This is a mixture of car, light truck, truck and tractor tyres.

This volume of tyres is fairly stable and the supply of old tyres is spread throughout the year, although some businesses report an increase of activity in the lead up to and during harvest. Most companies charge a per tyre disposal fee for their clients to cover the cost of disposal. Disposals of tyres occurred with Stawell based firm BTR Pty Ltd or Melbourne based firms.

Smaller businesses in some of the small towns give tyres away for various uses – e.g. to weigh down tarps over silage, for use as fences, tree guards etc. Some businesses in smaller towns also report that it is difficult to get the disposal truck to turn up. Tractor tyres were noted as being problematic and very expensive to dispose of - with many tending to stay on farm rather then get disposed of. Only one business reported an ongoing national contract with a particular disposal company.

An additional 340 tyres per annum were reported as being deposited at waste transfer stations or landfill from waste management agencies. A considerable stockpile of tyres also exists at a former retreading company based in Stawell.

5.12 Municipal Organic Waste

Within the study area there are three Waste Management Groups that work in conjunction with the seven Councils to collect and manage municipal and other wastes. The Desert Fringe Regional Waste Management Group covers the Hindmarsh and West Wimmera Shires. The Grampians Regional Waste Management Group covers the Horsham Rural City Council, Yarriambiack Shire, Northern Grampians Shire and Ararat Rural City Council areas. The Central Murray Regional Waste Management Group covers the Buloke Shire. There are 50 waste transfer stations in the study area and two landfills located at Dooen, just to the north of Horsham, and the Stawell Regional landfill.

The combined average quantity of green waste material separated at waste transfer stations and the landfill sites throughout the study area is 4,849 tonnes / annum[8]. Usage of this material varies with some areas reporting usage by Council parks and gardens, some areas reporting burning and some areas reporting past reuse for green mulch. Regular reuse of this green waste does not occur uniformly throughout the study area.

Within the Wimmera, kerbside collection of green waste does not occur, however approximately 33% of materials[9] in the residential kerbside collection are green waste or organic material such as food waste. Using the figure of 33% of the overall reported waste stream - 5,550 tonnes of green waste material would therefore be going to landfill on an annual basis from the overall kerbside collection.

The 2008 Waste to Landfill Survey conducted by EC Sustainable Environment Consultants for the Grampians Regional Waste Management Group identified that the proportion of food, garden waste and timber organics in the residential waste stream was 43%. The report concluded that there would be 3,228 tonnes of food organics and liquids (predominantly from residential kerbside bins); 2560 tonnes of garden organics (predominantly from residential kerbside bins); and 3678 tonnes of wood and timber[10] (predominantly from landfill sites) that is currently going to landfill. If these results were extrapolated across the study area a higher quantity of green waste material would be available then is stated in the Summary Table.

Figures for timber was not available from all waste management groups however the Desert Fringe Regional Waste Management Group report an average of about 40 tonnes of timber / annum at transfer stations and the 2009/10 Grampians Regional Waste Management Groups' Annual Report indicates that 871 tonnes of timber waste was recycled.

5.13 Sewage and Sludge - Biosolids

GWMWater service the entire study area with 25 wastewater treatment plants servicing towns of different sizes spread throughout the area. Biosolids are the substance that remains after sludge is removed from the waste water treatment lagoons and allowed to dry and stabilise. After desludging sludge sits for a minimum of three years until it meets the regulations for re-use which is generally for pasture improvement or vineyard application. Not all sites are desludged every year and GWMWater's 2008 Biosolids Management Plan recommends a survey of 10 sites within 5 years and a further 10 sites within 10 years to determine when desludging is required. Discussions with GWMWater[11] indicate that it is difficult to predict the complete volume of material that may be generated across all sites.

[8] Personal communication with Regional Waste Management Group Executive Officers
[9] Personal communication – Brian Klemm, Desert Fringe Regional Waste Management Group, 23 September 2010.
[10] This figure is only for Ararat.
[11] Personal Communication – Shu Okai, Sustainability Officer, GWM Water, 29 October 2010

Information used for this study has been sourced from the Corporations 2009/2010 Annual Report and reflects biosolids usage and generation during the 2009/2010 year. The Annual Report notes[12] that at the start of the 2009/10 year there was 11,513 tonnes (dry) of stockpiled biosolids at nine sites. 2,460 tonnes (dry) of this material was reused on farms during the 2009/10 year reducing the stockpile to 9,053 tonnes.

During the 2009/10 year three sites were desludged (Ararat, Kaniva and Birchip) which generated 5,846 tonnes of sludge (4,606 tonnes of this was from the Ararat facility). The material from the Ararat facility was applied directly to farms, leaving 1,240 tonnes of material to be stockpiled. At the end of the 2009/10 year this leaves approximately 10,000 tonnes of biosolids that is in stockpiles.

As biosolids are reused for agricultural purposes the Authority do not consider them a resource that is available for bioenergy[13].

5.14 Other Materials

There are a variety of other businesses listed in the Summary Table that are smaller in their numbers throughout the region. Some of note include:

- Food manufacturing – there is a cluster of three businesses at Donald that are involved in food manufacturing – producing biscuits and soy products. The predominant potential biomass material identified from these businesses is a soy fibre (approx 156 – 170 tonnes / annum on average) which is about to be reused as an input to another product.
- A strawboard manufacturer based at Murtoa generates approximately 260 tonnes / year of brush off-cuts and wheat straw material, which is currently burnt on site.
- Clynes Wholefoods at Warracknabeal generate approximately 250 tonne of waste fruit, cap, stem, stalk which is currently sold as stock feed
- Six fruit, nut and vegetable growers were surveyed – very little waste is generated from these businesses.

There are many retail bakeries, cafes and restaurants spread throughout the Wimmera that may generate food waste but these were not included in the audit.

6. Conclusion and Acknowledgments

This study has shown that apart from crop biomass there is on average approximately 155,000 tonnes / annum of biomass material generated and an average 71,500 tyres / annum in the region. The material is spread throughout the study area but there are four clusters where there is a greater concentration of materials – Nhill / Kaniva, Charlton, Donald and Wycheproof, St Arnaud and Horsham.

In terms of crop biomass this report has identified that cereals are the main crop that is suitable for biomass purposes in the study area. This report notes that there are four methods that have been identified for determining the quantity of biomass that would

[12] GWMWater Annual Report 2009-10, p 15
[13] Personal communication – Jennifer Bartle Smith, GWM Water, 14 October 2010

be available and these methodologies result in considerable variation in the amount of materials available. For instance in the average year (in terms of either area planted or production tonnage) and using the lowest harvest rate application of the four methodologies suggests an amount of 209,847 tonnes to 642,568 tonnes of potential crop biomass material throughout the study area. There are lower years in terms of area planted for cereals and tonnage and any facility should take into account these lower years.

Thanks to the many businesses and groups who provided information for this study, to the staff at the Councils that provided information; to Bill Gardner from Peak Power who shared his research and information on crop stubble biomass potential; to Brian Kearns, Chris Pittock and Mary Raynes from the Department of Primary Industries; and Colin Kemp from Wimmera Development Association.

Appendix 1 – Cereals, Oilseeds, Legumes and Hay Production

Area and Production – Cereals, Oilseeds, Legumes and Crops and Pastures for Hay Wimmera Statistical Division								
	Cereals for Grain		Oilseeds		Legumes		Crops & Pastures for Hay	
Year end (30th June)	Area Planted (Ha)	Production (Tonnes)	Area Planted (Ha)	Production (Tonnes)	Area Planted (Ha)	Production (Tonnes)	Area Planted (Ha)	Production (Tonnes)
1995	441,248	600,106						
1996	580,539	1,418,389						
1997	613,058	1,561,110	64,915	80,963	245,889	341,684	42,186	114,559
1998	655,855	1,198,020	65,262	74,830	275,491	191,433	45,460	113,254
1999	646,633	1,159,094	116,261	131,834	271,830	181,526	60,964	161,992
2000	692,954	1,583,366	164,298	194,866	245,509	315,823	47,301	114,118
2001	692,779	1,858,631	121,830	163,792	233,533	323,049	51,042	143,733
2002	717,289	1,895,533	98,748	133,379	244,979	385,561	42,868	128,637
2003	769,862	536,423	104,614	61,826	252,375	38,779	23,573	76,233
2004	864,387	2,304,387	97,421	144,853	201,259	273,092	61,192	223,710
2005	777,700	1,212,533	106,725	104,112	267,956	145,598	55,186	148,601
2006	745,784	1,842,679	66,330	92,021	236,436	382,930	76,258	239,523
2007	910,574	511,622	71,331	10,859	292,891	20,796	75,632	133,886
2008	996,483	1,720,851	59,471	51,483	N/A	N/A	N/A	N/A
2009	940,688	1,270,197	79,775	55,493	201,256	89,765	122,603	363,495
2010 Estimates	774,610	1,926,706	87,280	87,280	223,655	326,664	N/A	N/A

Appendix 2 - Overview of businesses that provided information as part of Wimmera Bioenergy Resource Audit

Business Name		
Edenhope and surrounds (2)	**Horsham, Laharum and surrounds (22)**	**Kaniva and surrounds (8)**
Edenhope Fuel and Tyres	JK Milling	Carrots - Lamattina Kaniva
Amber Ridge Fresh Produce	Australian Milling Group	R and J Smith Sheep Dairy
Ararat and Great Western (11)	Deutschers Turkeys	West Wimmera Beef, Nhill
Seppelts Great Western	Mt Zero Olives	Emu Park Feedlots
The Fountains Olives	Bill Gardner Onions	Auslot Feeders / Austin Lot Feeders
Green Eggs	Rosemount	Lockhart Almonds
Langhi Ghiran Winery	Mt Talbot Wildflowers	Bow Hill Bulk Storage
Montara	Wimmera Wildflowers	Bow Bakery
Kimbarra Wines	Big Spring Mount	**St Arnaud and surrounds (7)**
Ararat Meat Exports	Grampians Wildflowers	Ridley Agriproducts Pty Ltd
Ararat Tyre Power	Johnsons Asahi	Kara Kara Vineyards
Dunlop Super Dealer	Horsham Regional Livestock Exchange	Kalaparre Olives
Grampians Estate	Bently Tyre Service (Bridgestone)	RivaLea Australia
Grenvale Meats	Beaurepaires	Goldfields Turkeys
Stawell and surrounds (6)	Goodyear Horsham	Rainbow Valley Turkeys
Bellellen Grampians Organics	Horsham Tyre and Battery	St Arnaud Tyre Service
Frewstal Pty Ltd	KMART Tyre Service	**Donald (10)**
Tyrepower - Farrers	PB Seeds	Pea Co
Bentleys Tyre Centre (Bridgestone)	Horsham Stock Feeds	Robert Adams
The Gap Vineyard	Nortons Estate Winery	Warrego
Red Rock Olives	Laharum Grove	Des Wood
Rupanyup / Murtoa & Minyip (5)	Toscana Olives	Country Kookas
Wimmera Grain Company	**Dimboola and surrounds (4)**	Australian Eat Well
Blue Lake Milling	Blue Lake Milling	Warratah Bakeries
Wimmera Health Grain	Nicolas Estate Olives	Donald Mechanical and Tyre Service
Solomit Strawboard	Dimboola Woodworks	Beaurepairs Donald
Wim Pak	Paul Schilling	LP & SM Noonan
Warracknabeal and Hopetoun (6)	**Nhill (7)**	**Charlton and surrounds (7)**
Clynes Foods	Midwest Milling	Charlton Feedlots
Warracknabeal Saleyards	ABA Nhill / Emerald Grain	Grainflow Charlton
Bently Tyre Service-Warracknabeal	Vision Farms	Donaldson's Tyre Service Charlton
Warracknabeal Tyrepower	Nhill Saleyards	Wycheproof Saleyards
Hopetoun Bulk Storage P/L	Luv a Duck	Access Grain
Wellington Butchers	Beaurepaires	Rick Sheahan
		Glenloth Game / Australian Game
	Meeky's Tyre Clinic	Processors (poultry and game birds)

Note – these businesses vary in nature and scale of operations and biomass materials. An additional seventeen businesses were called but contact was not made with them.

Glossary

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
C&D	Construction and Domestic
C&I	Commercial and Industrial
CHBSS	Central Highlands Bioenergy Scoping Study
DPI	Department of Primary Industries
UB	University of Ballarat
VNTA	Victorian No Till Association
WCFA	Wimmera Conservation Farming Association

ABS Data Sources

Production and area of agricultural commodities - Victorian SDs, year ended 31 March 1995
Production and area of agricultural commodities - Victorian SLAs, year ended 31 March 1995
Production and area of agricultural commodities - Victorian SDs, year ended 31 March 1996
Production and area of agricultural commodities - Victorian SLAs, year ended 31 March 1996
Production and area of agricultural commodities - Victorian SDs, SSDs and SLAs, year ended 31st March 1997
Production and area of all agricultural commodities - Victorian SDs, SSDs and SLAs, year ending 31st March 1998
Production and area of all agricultural commodities - Victorian SDs, SSDs and SLAs, year ending 31st March 1999
Production and area of agricultural commodities - Australia, all States/Territories and their SDs and SSDs, year ending 30 June 2000
Production and area of agricultural commodities - Victorian SLAs, year ended June 30 2000
Production and area of all agricultural commodities - Victorian SLA's, year ended 30 June 2001
Production and area of all agricultural commodities - Victorian Statistical Subdivisions, year ended 30 June 2001
Production and area of all agricultural commodities - Victorian Statistical Divisions (SDs), year ended 30 June 2001
Production and area of all agricultural commodities - Victoria and its Statistical Divisions (SDs), year ending 30 June 2002
Production and area of all agricultural commodities - Victoria and its Statistical Divisions (SDs), year ending 30 June 2003
Production & area of all agricultural commodities - Australia, State and Victorian Statistical Divisions (SDs), year ending 30 June 2004
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Agricultural Commodities: Small Area Data, Australia, 2005-06. Cat No 71250 (Reissue), June 2009
Agricultural Commodities: Small Area Data, Australia, 2006-07. Cat No 71250, June 2008
Agricultural Commodities, Australia, 2007-08. Cat No 71210, May 2009
2010 Estimate - Figures provided from DPI