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# Methodology Report – SA Biomass Data Set for AREMI

*Prepared for: Renewables SA, Department of  
Premier and Cabinet*

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#### **Document verification**

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# Executive Summary

Renewables SA is preparing a biomass data set (SA Biomass Data Set) for the Australian Renewable Energy Mapping Interface (AREMI).

The data sets included in this first version of the SA Biomass Data set include:

1. Agricultural Biomass Residues
2. Livestock Biomass Residues
3. Municipal Solid Waste Residues
  - Kerbside collection
    - Source separated organics
    - Rubbish organic fraction (currently disposed to landfill)
  - Other Municipal Waste
    - Other (organic) biomass
4. Commercial and Industrial (C&I) Solid Waste Residues
  - Source separated organics
  - Rubbish organic fraction
5. Construction and Demolition (C&D) Solid Waste Residues
  - Source separated organics
  - Rubbish organic fraction

This report provides an overview of the methodology used to prepare the SA Biomass Data Set, including data sources and key assumptions. More detailed information on the methodology has been separately provided to Renewables SA, which may be referred to if further explanation is required.

It is important to recognise that this is the first version of this type of State-wide biomass data set that has been prepared for South Australia. The data set relies on readily available public data and reports that was agreed and confirmed with Renewables SA, so that others would be able to readily access this information to reproduce this data set if necessary. However, this publicly available data is relatively limited. There are potentially other more detailed industry and State Government data sets that could be used to improve the scope and resolution of the SA Biomass Data Set. But it was decided that many of these could not be practically used (for this first version) in the time available to prepare the data set, due to confidentiality restrictions that might apply to their use for this purpose.

Methods and assumptions were also developed on how to convert source data into biomass resource estimates. These were based on a similar previous (biomass mapping) study recently undertaken for the Limestone Coast region of South Australia. These methods and assumptions, too, could be expanded, refined, and improved in future versions of the SA Biomass Data Set.

Consequently, this inaugural State biomass data set should be considered an important starting point for future development of improved knowledge about biomass resources potentially available in South Australia for bioenergy opportunities. We reasonably expect that over time this initial SA Biomass Data Set will continue to evolve and expand in scope and detail, which should improve its utility for potential bioenergy investors.

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# 1 Introduction

Renewables SA is preparing a biomass data set (SA Biomass Data Set) for the Australian Renewable Energy Mapping Interface (AREMI). Colby Industries is assisting with preparation of this data set.

The resulting biomass data has already been separately provided to Renewables SA.

This report summarises the methodology, including data sources, that has been used to prepare this SA Biomass Data Set.

This information is presented in the following sections as follows.

- Section 2 – Important Clarification – brief note on the potential limitations of this SA Biomass Data Set, including future opportunity for improvement
- Section 3 – Data Structure and Sources – what information was used and how it is presented in the SA Biomass Data Set.
- Section 4 – Methodology Overview – summary of how the source information was converted into estimated biomass values for the SA Biomass Data Set
- Section 5 – References – which lists the data sources cited in this report

## 2 Important Clarification

It is important to note that this is the first version of this type of State-wide biomass data set that has been prepared for South Australia.

For this initial version, we have relied on readily available public data and reports, which others can access to reproduce this data set if necessary. In some areas, we have had to develop original methods and make assumptions on how to convert source data into biomass resource estimates. These methods and assumptions were informed by the knowledge and expertise of our staff with biomass generating activities in South Australia, including reviewing and preparing similar data sets for other State Government agencies.

Furthermore, our ability to develop independent data sources and to refine methods and assumptions were constrained by time available to prepare this SA Biomass Data Set.

We therefore recognise that the scope and quality of this initial data set is necessarily limited by the scope and quality of the information in the data sources we have used, the time available, types of methods, and assumptions we have used when converting source data into biomass resource estimates. In this report, we note some of these limitations that exist because of this issue.

These limitations should be kept in mind when interpreting the SA Biomass Data Set.

This inaugural data set should be an important starting point for future development of improved knowledge about biomass resources potentially available in South Australia for bioenergy opportunities. We reasonably expect that over time this initial SA Biomass Data Set will continue to evolve to expand its scope, detail, and perceived accuracy or reliability, which may overcome some of these limitations.

### 3 Data Sets and Data Sources

Figure 3-1 overleaf provides a graphical overview of framework for the SA Biomass Data Set that has been prepared:

- Data Set Structure or Framework (i.e. how the data sets are divided into separate categories or classifications)
- Data Set Outputs (i.e. within each classification, what type of biomass data was prepared)

Table 3-1 below lists these data sets and indicates the data sources that were used to prepare them. The table notes actual or potential limitations or clarifications that may apply to the data source used to prepare the relevant data set, and/or to the resulting biomass data set.

**Table 3-1: List of biomass data sets produced, data sources and summary of potential limitations / clarifications related to the data sources or resulting data sets**

Biomass Data Set Produced	Data Sources*	Limitations/clarifications
<b>Agricultural Biomass Residues</b>	<ul style="list-style-type: none"> <li>• ABS Agricultural Commodities data SA4 Region, SA, 2014-15</li> <li>• Waste Biomass Opportunities Map for the South-East report (prepared by Zero Waste SA)</li> </ul>	<ul style="list-style-type: none"> <li>• Geographical areas are ABS SA4 Regions.</li> <li>• Percentages used to calculate crop biomass residues were from a previous study for South Australia's Limestone Coast, which were extrapolated to all other areas of the State.</li> </ul>
<b>Livestock Biomass Residues</b>	<ul style="list-style-type: none"> <li>• ABS Agricultural Commodities data SA4 Region, SA, 2014-15</li> <li>• Waste Biomass Opportunities Map for the South-East report (prepared by Zero Waste SA)</li> </ul>	<ul style="list-style-type: none"> <li>• Geographical areas are ABS SA4 Regions.</li> <li>• Percentages used to calculate livestock biomass residues were from a previous study for South Australia's Limestone Coast, which were extrapolated to all other areas of the State</li> </ul>
<b>Municipal Solid Waste Residues</b> <ul style="list-style-type: none"> <li>• Kerbside collection                             <ul style="list-style-type: none"> <li>○ Source separated organics</li> <li>○ Rubbish organic fraction</li> </ul> </li> <li>• Other Municipal Waste                             <ul style="list-style-type: none"> <li>○ Other (organic) biomass</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• SA LGA kerbside collection data (from Office of Local Government, DPTI)</li> <li>• Zero Waste SA Food Waste Pilot Kerbside Audit 2008-2009 report</li> <li>• South Australia Recycling Activity report 2013-14 (prepared by Zero Waste SA)</li> </ul>	<ul style="list-style-type: none"> <li>• Geographical areas are South Australian LGA regions.</li> <li>• Biomass residues estimated as follows.                             <ul style="list-style-type: none"> <li>○ Source separated organics biomass residue assumed at 95% kerbside collected value (to allow for the presence of some non-organic material that can be found in this waste stream).</li> <li>○ Rubbish biomass fraction set at 45% (based on kerbside audit data for organics content in South Australia)</li> </ul> </li> <li>• Other Municipal Waste Residues estimated from balance of Municipal waste organics in SA Recycle Activity report 2013-14 and split by LGA based on population.</li> </ul>
<b>Commercial and Industrial Solid Waste Residues</b> <ul style="list-style-type: none"> <li>• Source separated organics</li> <li>• Rubbish organic fraction</li> </ul>	<ul style="list-style-type: none"> <li>• South Australia Recycling Activity report 2013-14 (prepared by Zero Waste SA)</li> <li>• Zero Waste SA (landfill) disposal-based survey October/November 2007</li> </ul>	<ul style="list-style-type: none"> <li>• Geographical areas are ABS SA4 Regions.</li> <li>• Estimated from C&amp;I organics and landfill rubbish volumes in SA Recycle Activity report 2013-14</li> <li>• C&amp;I organics volumes adjusted for major industry activity in different regions and/or split by ABS SA4 Regions based on population.</li> <li>• C&amp;I landfill rubbish volumes split by ABS SA4 Regions based on population, biomass fraction assumed at 51% of volume from past landfill survey</li> </ul>
<b>Construction and Demolition Solid Waste Residues</b> <ul style="list-style-type: none"> <li>• Source separated organics</li> <li>• Rubbish organic fraction</li> </ul>	<ul style="list-style-type: none"> <li>• South Australia Recycling Activity report 2013-14 (prepared by Zero Waste SA)</li> </ul>	<ul style="list-style-type: none"> <li>• Geographical areas are ABS SA4 Regions.</li> <li>• Estimated from C&amp;D organics and landfill rubbish volumes in SA Recycle Activity report 2013-14</li> <li>• C&amp;D organics volumes split by ABS SA4 Regions based on population.</li> <li>• C&amp;D landfill rubbish volumes split by ABS SA4 Regions based on population, biomass fraction assumed at 51% of volume from past landfill survey</li> </ul>

\* Refer to [5. References](#) for citations of listed data source documents

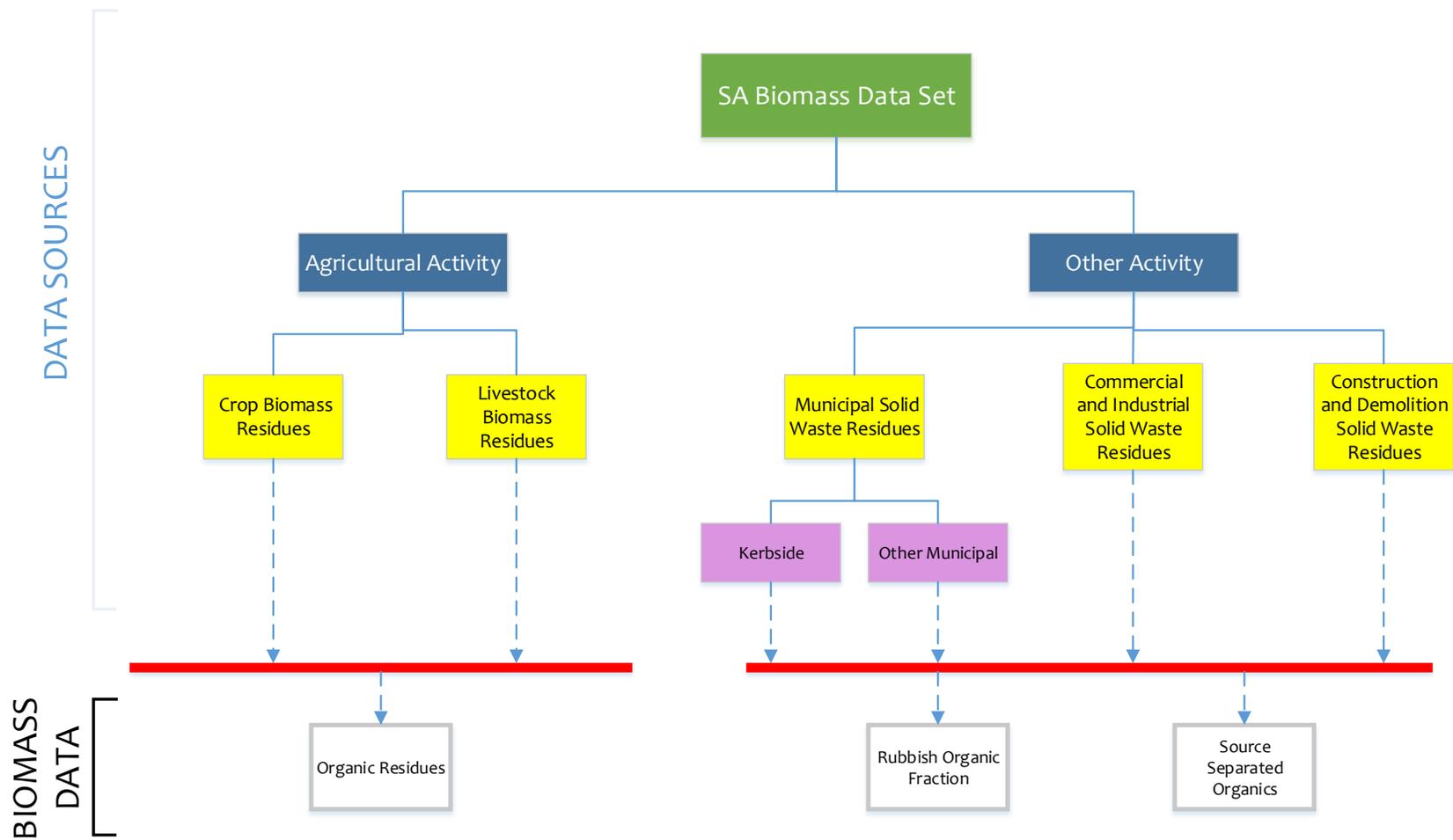


Figure 3-1: SA Biomass Data Set Data Sources and Output Data

## 4 Methodology Overview

### 4.1 Agricultural residues

#### 4.1.1 Crops – Biomass residues

The data for production (in tonnes or kilograms) of crops by ABS SA4 Regions listed in the ABS data set (ABS, 2016) were converted to biomass generated using an assumed conversion factor. The biomass generated value was then split into residues based on percentage assumptions for residues that would be produced from each crop, which had been developed for the Limestone Coast area in separate study (Zero Waste SA, 2014a). (These percentage assumptions in this separate study were informed by advice from an agricultural scientist and independent research.) These assumed conversion factors and residue percentage splits have been provided to Renewables SA in a separate worksheet.

The following provides a basic worked example for Broadacre crops - Cereal crops, Barley for grain, in the Adelaide - Central and Hills region.

1. ABS Crop Production (2014-15) = 153 tonnes (per year)
2. Crop Biomass Conversion Factor (assumed) = 4.0
3. Biomass Generation =  $153 \times 4.0 = 610$  tonnes
4. Potential residue types and % splits and tonnes resulting
  - Chaff – 15% = 92 tonnes
  - Stem/tiller – 35% = 210 tonnes
  - Roots – 25% = 150 tonnes

*Note: This method provides a singular estimate of biomass residues in that year. Crop production, biomass generation, and residue volumes will vary seasonally and in different regions depending on soils, climate and other agricultural conditions. Future agricultural crop biomass data sets could consider providing a range for biomass residue volumes, which may better reflect the uncertainties in annual volumes that may be generated. It is also important to recognise that much of some of the residues may already be resource recovered and reused (e.g. as animal feed, to return carbon and nutrients into the soil). Future data sets could quantify this resource recovery activity. Exploitation of some of these residues could require development of innovative technologies for collection and/or aggregation (e.g. to capture Chaff during wheat harvesting, to recover roots left by crop production).*

#### 4.1.2 Livestock – Biomass residues

The data for production (in numbers) of livestock by ABS SA4 Regions listed in the ABS data set (ABS, 2016) were converted to biomass generated using an assumed conversion factor. The biomass generated value was then split into residues based on percentage assumptions for residues that might be available from each livestock farming activity, which had been developed for the Limestone Coast area in separate study (Zero Waste SA, 2014a). (These percentage assumptions in this separate study were informed by advice from an agricultural scientist and independent research.) These assumed conversion factors and residue percentage split have been provided to Renewables SA in a separate worksheet.

The following provides a basic worked example for Livestock - Dairy Cattle, Cows in milk and dry, Adelaide – South region.

1. ABS Livestock Production (2014-15) = 1,384 animals
2. Livestock Biomass Generation Factor (assumed) = 19.86
3. Biomass Generation =  $1,384 \times 19.86 = 27,500$  tonnes (per year)
4. Potential residue types and % splits and tonnes resulting
  - Manure – Milking Shed – 2.78% = 764 tonnes
  - Manure – Field – 97.22% = 26,700 tonnes

*Note: This method provides a singular estimate of biomass residues in that year. Livestock production or numbers, biomass generation, and residue volumes may vary seasonally and in different regions depending on climate and/or other livestock or farming specific conditions. Future agricultural livestock biomass data sets could consider providing a range for biomass residue volumes, which may better reflect the uncertainties in annual volumes that may be generated. It is also important to recognise that much of some of the residues may already be resource recovered and reused (e.g. to return carbon and nutrients into the soil, anaerobic digestion for biogas production, manufacture of compost products). Future data sets could quantify this resource recovery activity. Exploitation of some of these residues could require development of innovative technologies for collection and/or aggregation (e.g. if field manure was to be collected).*

## **4.2 Other activity**

### **4.2.1 Municipal Solid Waste – Biomass residues**

Biomass residues for Municipal Solid Waste that were included in the biomass data set were:

- Kerbside collected waste:
  - Source separated organics
  - Rubbish (landfill) organics fraction
- Other Municipal Waste

The kerbside collection of waste and recycling in South Australia is surveyed annually by LGA. This data set for 2014-15 was obtained (Office of Local Government, 2016).

For source separated organics, the values from this LGA survey data for kerbside organics collection were used. These values were then multiplied by 95% (assumed value to allow for potential contamination/other materials that might be present) to estimate the potential biomass residue that could be derived from this material.

For the rubbish organics fraction, the value for kerbside rubbish collected from the same LGA survey data were used. These values were then multiplied by 45% (for the assumed organic fraction present) to estimate the potential biomass residue that could be derived from this material. This value of 45% was inferred from recent kerbside audit data collected for South Australia (Zero Waste SA, 2009).

The State-wide volume of other municipal waste collected as a biomass residue was estimated by subtracting the kerbside collected organics from the total municipal derived organics reported in the South Australia Recycle Activity report 2013-14 (Zero Waste SA, 2015). This State-wide value was split between LGA based on population obtained from ABS statistics (ABS, 2017).

*Note: This method provides a singular estimate of biomass residues in that year. Municipal residue volumes may vary from year to year. Future biomass data sets could consider providing a range for these biomass residue volumes, which may better reflect the uncertainties in annual volumes that may be generated. It is also important to recognise that source separated organic residues will already be subject to some type of resource recovery and reuse (e.g. manufacture of mulch and compost products, anaerobic digestion for energy production). Future data sets could quantify this resource recovery activity.*

#### 4.2.2 Commercial and Industrial (C&I) Waste – Biomass Residues

There have been several surveys undertaken in South Australia or specific regions to collect biomass-related data from commercial and industrial sources. However, this data is usually collected on a confidential basis and is only reported and publicly available in anonymised format. This makes it a challenge to disaggregate and to identify specific large or major biomass sources.

In view of this, State-wide data for (source separated) organics resource recovery reported by the South Australia Recycle Activity report 2013-14 (Zero Waste SA 2015) was used to estimate potential biomass residues by ABS SA4 Regions for the following categories.

- Food organics
- Garden organics
- Timber organics
- Other organics

Some of our own experience and knowledge of major C&I activity across the State was used to assign the estimated volumes of biomass residues between different regions that could be attributed to major point sources. The balance of the organics biomass volumes (not allocated in this way) was first split according to reported Metropolitan and Regional splits provided in the South Australia Recycle Activity report 2013-14 and then distributed between the regions according to population.

The State-wide data from this same survey for C&I rubbish (landfill) disposal was also used to estimate potential biomass residue present as landfill organic fraction for each of the ABS SA4 Regions. A value of 51% was assumed as the potential organic fraction in the C&I landfill disposal stream based on most recent landfill survey data (publicly) available (Zero Waste SA, 2007). This estimated organic fraction in the rubbish was first split according to reported Metropolitan and Regional splits provided in the South Australia Recycle Activity report 2013-14 and then distributed between the regions according to population.

*Note: This method provides a singular estimate of biomass residues in that year. Commercial residue volumes are more stable from year to year but future biomass data sets could consider providing a range for these values, which may better reflect the uncertainties in annual volumes that may be generated. It is also important to recognise that source separated organic residues will already be subject to some type of resource recovery and reuse (e.g. manufacture of mulch and compost products, meat rendering, anaerobic digestion for energy production, extraction of biochemical compounds or materials, refuse derived fuel). Future data sets could quantify this resource recovery activity.*

#### 4.2.3 Construction and Demolition (C&D) Waste – Biomass Residues

Like the C&I estimate of biomass residues, the C&D biomass data set was drawn from the South Australia Recycle Activity report 2013-14 (Zero Waste SA 2015). This included data for:

- Source separated organics:
  - Garden organics
  - Timber organics
  - Other organics
- Rubbish -Organics Fraction

The methodology applied was almost identical to that for C&I Waste except that source separated organics the State-wide volumes were only split between Metropolitan and Regional areas and then distributed by population to ABS SA4 Regions; there was no initial or separate assignment needed to reconcile region-based biomass residues for substantive point sources.

*Note: The same notes made for C&I Waste – Biomass residues also apply to C&D Waste – Biomass residues.*

## 5 References

- ABS. (2016). *71201.0 Agricultural Commodities, Australia – 2014-15, Table 5: Agricultural Commodities, State and SA4 Region, South Australia*. Retrieved March 4, 2017, from [www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/7121.02014-15](http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/7121.02014-15).
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