



# Australian Biomass for Bioenergy Assessment 2015-2021

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 **AgriFutures<sup>®</sup>**  
Australia

# Australian Biomass for Bioenergy Assessment 2015-2021 Final report

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## **Project partners**

AgriFutures Australia

Department of Primary Industries and Regional Development, Western Australia

Sustainability Victoria

Department of State Growth, Tasmania

New South Wales Department of Primary Industries

Department for Energy and Mining, South Australia

Queensland Department of Environment and Science

Queensland University of Technology

University of the Sunshine Coast

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The views expressed herein are not necessarily the views of the Australian Government and the Australian Government does not accept responsibility for any information or advice contained herein.

## Glossary of terms and acronyms

ABS	Australian Bureau of Statistics
ArcGIS	A geographic information system for working with maps and geographic information
AREMI	Australian Renewable Energy Mapping Infrastructure
ARENA	Australian Renewable Energy Agency
ASGS	Australian Statistical Geography Standard
Behind the meter	Energy and solar power equipment located on site
Biomass	Plant or animal material used as fuel to produce electricity or heat
Bioenergy	Renewable energy made from biological sources or biomass
CKAN	Comprehensive Knowledge Archive Network
CSV	Comma Separated Values (computer file format)
Data61	CSIRO group contracted to manage the AREMI map
DPIPWE	Department of Primary Industries, Parks, Water and the Environment, Tasmania
DPIRD	Department of Primary Industries and Regional Development, WA
EVAO	estimated value of agricultural operations
GIS	geographic information system
In front of the meter	Energy and solar power equipment located offsite
LGA	Local Government Area
MW	Megawatt (one million watts)
National Map	Online map-based tool for accessing spatial data from Australian Government agencies
NSW DPI	NSW Department of Primary Industries
Python	High-level and general-purpose programming language
Queensland DES	Queensland Department of Environment and Science
QUT	Queensland University of Technology
REACS	Rural Environment and Agricultural Commodities Survey
SAL	Statistical Area Level (SA1-SA4)
SARDI	South Australian Research and Development Institute
USC	University of the Sunshine Coast
SV	Sustainability Victoria
WMS	Web Map Service

## Executive summary

The purpose of the [Australian Biomass for Bioenergy Assessment](https://arena.gov.au/projects/australian-biomass-for-bioenergy-assessment-project/) (ABBA) (<https://arena.gov.au/projects/australian-biomass-for-bioenergy-assessment-project/>) project was to catalyse investment in the renewable energy sector through the provision of detailed information about biomass resources across Australia. The information has been and continues to be used to assist in project development and decision making for new bioenergy projects, and provides links between biomass resources, through the supply chain to the end user.

A consortium of state government departments and two university partners, led and coordinated by AgriFutures Australia, undertook the \$6.5 million project.

The project was funded by the Australian Renewable Energy Agency (ARENA), the New South Wales, Queensland, South Australia, Tasmanian, Victorian and Western Australian state governments, and two university partners, the Queensland University of Technology and the University of the Sunshine Coast.

Prior to the ABBA there was little data publicly available to support the development of bioenergy industries in Australia. Biomass resource mapping had been undertaken at a regional scale, but the mapping was incomplete, with large areas across Australia never having been mapped. The data was stored in locations across state departments and was not easily accessible.

The ABBA project collected and collated new data regarding feedstock location and availability, and amalgamated the data in one place, on the [Australian Renewable Energy Mapping Infrastructure](https://arena.gov.au/projects/aremi-project/) (AREMI) platform (<https://arena.gov.au/projects/aremi-project/>), which has been transitioned to the [National Map](https://nationalmap.gov.au/) website (<https://nationalmap.gov.au/>), allowing efficient access to the data. The information was developed in conjunction with industry input and feedback to ensure data quality.

The geospatial data is available to renewable energy project developers, policy makers, and others, and provides a multi-faceted dataset that complements existing related information, such as energy infrastructure, power utilities, population data and land use data.

To ensure the accuracy, consistency, reliability and quality of outputs, data must be compiled in a uniform way by all participants. To this end, a data schema was developed by the project partners for data collection across all biomass types. The schema includes a baseline of required fields for each dataset, allowing standardised data collection across all regions, and easier comparison and analysis of data from different states.

The development of analytics tools will support users to better extract and analyse information. Users can select or enter a location on the AREMI platform and specify a radius around the source point from which they want information on the biomass availability. The analytics tool reads and collates the information from the state data files and displays the information in a tabular format on the AREMI platform.

The data and project outcomes have been promoted through various channels, including conference presentations, fact sheets, workshops, meetings and forums. These channels provided an opportunity for potential investors, research collaborators and the public more broadly to network and improve their awareness and understanding of Australia's bioenergy resources.

The ABBA data has been the first source of information for state government departments when responding to bio-industry enquiries, and a number of state departments have also accessed and used the ABBA datasets in other projects.

The collaboration and knowledge-sharing activities between the state agencies were instrumental in the project's success. The formation of the Bioenergy Government Network, which has representation from all states, was a key outcome from the project. Collaboration will continue through this network to further explore and grow the bioenergy sector across Australia.

The project has helped raise the profile of bioenergy in state governments, and bioenergy is now well represented in policies. Dedicated roles in the Tasmanian Department of State Growth and the SA Department for Energy and Mining have also been created to support bioenergy growth in their respective states.

All states noted the opportunity to expand on resource mapping and industry development work supported by the ABBA project, with a number able to provide increased grant assistance to advance bioenergy project development.

The achievements of the project have set a strong foundation for continued state-led bioenergy industry development activities in the future. Moving forward, it would be desirable if biomass datasets could be automatically or semi-automatically updated on the AREMI platform, but the variability of the data sources means it is unlikely that a fully automated option will be possible.

The New South Wales Department of Primary Industries is investigating the development of an automated Python code for future calculations of biomass residues. The code for cropping residues has been completed using NSW formulas, and the same design will be applied for livestock and horticultural residues. A separate code for forestry residues will be developed. Other states are developing their own automation systems with the assistance of NSW DPI, based on the NSW model.

The biggest challenges for the bioenergy sector relate to market knowledge of, and familiarity with, bioenergy. A key component of this is the confidence that there is feedstock available in the marketplace. Continued communication to increase awareness of the bioenergy sector and the benefits and opportunities it presents will help address this challenge.

Opportunities exist for bioenergy projects across Australia, particularly in regional areas. Bioenergy projects provide energy and waste solutions for businesses, reduce landfill,

generate local employment opportunities, and have the added value of by-products such as biochar.

Developing initiatives and financing products that support greater investment in bioenergy generation, exploration of opportunities and the development of business cases to support further progress and growth of the bioenergy sector, will stimulate regional development on a national scale.

Key recommendations from the ABBA project are:

1. The data schema that has been developed through the project should be implemented, promoted and shared across state departments and organisations to ensure standardised data collection across states and regions. This will increase awareness and ensure uploaded data is in a useable format.
2. The Australian Government continues to support the emerging bioenergy sector through ARENA to ensure growth and exploration of opportunities in bioenergy nationally.
3. ABBA project partners become active members of the Bioenergy Government Network. It is recommended support for this network continues, ensuring a strong network persists and continues to connect the bioenergy sector across Australia.
4. A focal/contact point for bioenergy enquiries should be established within each state.
5. Communication and promotion of the [National Map](https://nationalmap.gov.au/) website (<https://nationalmap.gov.au/>) should be continued.
6. A simplified visualisation that contains graphical user-driven data should be created to help people get what they need from the data without having to search through individual detailed datasets.

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## 1. Introduction

A consortium made up of state government departments and two university partners, led and coordinated by AgriFutures Australia, undertook a \$6.5 million project, 'Australian Biomass for Bioenergy Assessment (ABBA)'. The project was funded by the Australian Renewable Energy Agency (ARENA) and the NSW, Queensland, SA, Tasmanian, Victorian and WA state governments, and two university partners, the Queensland University of Technology and the University of the Sunshine Coast.

The purpose of the [Australian Biomass for Bioenergy Assessment](https://arena.gov.au/projects/australian-biomass-for-bioenergy-assessment-project/) (ABBA) project (<https://arena.gov.au/projects/australian-biomass-for-bioenergy-assessment-project/>) was to catalyse investment in the renewable energy sector through the provision of detailed information about biomass resources across Australia. The information assists in project development and decision making for bioenergy projects, and provides from biomass resources, through the supply chain to the end user.

Prior to the ABBA project, there was little data publicly available to support the development of bioenergy industries in Australia. Biomass resource mapping had been undertaken at a regional scale, but the mapping was incomplete, with large areas across Australia never having been mapped. Data was stored in various locations across state departments, and the lack of reliable information on biomass feedstocks has been a significant barrier to the development of bioenergy projects across Australia.

The ABBA project collected and collated data, on a state-by-state basis, on the location, volumes and availability of biomass for inclusion on the [Australian Renewable Energy Mapping Infrastructure](https://arena.gov.au/projects/aremi-project/) (AREMI) platform (<https://arena.gov.au/projects/aremi-project/>). The geospatial data is available in the central AREMI database on the [National Map](https://nationalmap.gov.au/) website (<https://nationalmap.gov.au/>) to renewable energy project developers, policy makers and others, and provides a multi-faceted dataset that complements existing related information, such as energy infrastructure, power utilities, population data and land use data.

National Map is an online map-based tool that enables easy access to spatial data from Australian government agencies. It was an initiative of the Department of Communications and the Arts (DCA) and is now managed by the Digital Transformation Agency (DTA). The software was developed by Data61 in collaboration with the DCA, Geoscience Australia and other government agencies.

Data collected from this project is presented on the AREMI platform as customisable layers and includes:

- The types, locations and volumes of existing biomass resources (identifying both total and potentially available resources where possible).
- The types, locations and volumes of existing bioenergy industries.
- Identification of other relevant spatially based information.
- Land capability for future biomass.

AREMI does not hold data, rather it allows users to access information that has been provided by third-party data custodians (state governments and universities). In the case of the ABBA project, data has been provided as spatial layers to Data61 for integration into the AREMI platform. AREMI is a visualisation tool, with the actual data able to be accessed via internet links.

Interactive analytic tools were also developed by the university partners to enable better access to information.

Bioenergy – renewable energy made from biological sources or biomass. Bioenergy can be used for heat, power and liquid fuels. Bioenergy encompasses multiple feedstocks from agriculture, forestry, and urban sources, and uses a variety of technologies.

Bioenergy provides very low or zero net emissions of carbon dioxide, one of the main greenhouse gases. While bioenergy only provides about 1% of Australia’s electricity supplies, and less than 1% of the country’s transport fuels, it is a likely option for future low-emission fuel and energy needs in Australia.

All forms of bioenergy require sufficient, secure and cost-effective supplies of biomass that meet the energy conversion technology specifications for fuel or feedstock. Unlike other forms of renewable energy, bioenergy plants require ongoing fuel or feedstock supplies for the economic life of the project.

The economic life is determined by the payback period of the invested capital and ongoing returns to investors, as well as the condition of the plant and equipment. The economic life of a project would typically be 20-25 years.

If the bioenergy industry in Australia is going to grow and thrive, cost-effective, reliable and long-term feedstock supplies must be identified. This goal is at the core of the ABBA project.

## 2. Project outcomes

The key outputs from the ABBA project were the development of a national database of biomass resources for bioenergy across Australia, a variety of interactive tools to enable better access to information, and the development of a strong bioenergy network across Australia.

### 2.1 Datasets

#### 2.1.1 Multiple layers of biomass resource data uploaded to AREMI

Prior to the ABBA project, there was no central location to make diverse biomass residue datasets available to the public. The development of the AREMI platform has resulted in greater public access to material and tools that inform the plant design of biomass technology and feedstock.

Project partners uploaded the types, locations and volumes of existing bioenergy industries to the AREMI platform. Additional details were also uploaded. These included: potential annual averages of total residue volumes (tonnes), estimates of the potential minimum and maximum tonnes available, identification of other relevant spatially based information to support user interpretation of the datasets, other renewable energy sectors (i.e. solar and wind), infrastructure, land use and population data.

Land use data was also investigated to determine land capability for potential energy crops for future biomass production and its availability. This linked with other bioenergy projects across government departments.

Table 1 shows the biomass resource data uploaded to the AREMI platform for each state during the project. Data was sourced either directly from industry sources (e.g. Australian Pork Limited) or derived from the Australian Bureau of Statistics (ABS) commodities information.

**Table 1. Biomass resource data uploads to the AREMI platform for each state.**

State	Biomass datasets
New South Wales	<ul style="list-style-type: none"> <li>• Cropping</li> <li>• Forestry</li> <li>• Horticulture</li> <li>• Livestock</li> <li>• Organic waste</li> </ul>
Queensland	<ul style="list-style-type: none"> <li>• Agriculture (cotton, sugar, wheat and sorghum)</li> <li>• Forestry (hardwood and softwood)</li> <li>• Livestock (cattle, pigs, chickens)</li> <li>• Urban waste</li> <li>• Biosolids</li> <li>• Food processing</li> <li>• Horticulture</li> </ul>
South Australia	<ul style="list-style-type: none"> <li>• Waste streams (horticulture, processing plants, straw production)</li> <li>• Crop estimates (by district)</li> <li>• Forestry</li> <li>• Intensive animal husbandry and production (feedlots)</li> <li>• Almond residues</li> </ul>
Tasmania	<ul style="list-style-type: none"> <li>• Cropping</li> <li>• Forestry (forest harvest residues, wood processing residues)</li> <li>• Horticulture</li> <li>• Livestock</li> <li>• Organic waste</li> <li>• Processing and manufacturing</li> </ul>
Victoria	<ul style="list-style-type: none"> <li>• Cropping (cereals and oilseeds)</li> <li>• Livestock (poultry, dairy, piggeries)</li> <li>• Construction and demolition waste (timber, garden organics)</li> <li>• Facilities and sites – potential sites for co-location (WWTPs, landfill facilities, bioenergy facilities)</li> <li>• Food processing (dairy product manufacturing, fruit and nut processing, fruit processing facilities, meat processing – beef, pork and poultry, wine manufacturing)</li> <li>• Forestry (forest harvest residues, wood processing residues)</li> <li>• Horticulture (grape marc, fruit and vegetable)</li> <li>• Municipal solid waste (organics, paper and cardboard, biosolids)</li> <li>• Other industry (organics, paper and cardboard)</li> </ul>
Western Australia	<ul style="list-style-type: none"> <li>• Broiler litter production</li> <li>• Cereal straw</li> <li>• Dairy effluent</li> <li>• Feedlot waste</li> <li>• Grape marc</li> <li>• Oil mallee stems</li> <li>• Seaweed wrack</li> <li>• Forestry plantations</li> <li>• Horticulture (avocado, citrus fruit, hand-harvested vegetables, mechanically harvest vegetables, pome fruit and stone fruit residues, olive oil estimates)</li> </ul>

In addition to uploading biomass resource data for their state, each state led and coordinated the national upload of biomass resources. The state leads were selected for their expertise with the biomass resource. The appointment of state leads allowed standardisation of data collection and reporting via the schema (see section below).

State leads for biomass resources were:

- New South Wales – Forestry
- Queensland – Sugarcane
- South Australia – Organic waste and piggery waste
- Tasmania – Fisheries and horticulture waste
- Victoria – Dairy waste
- Western Australia – Cereal straw

Researchers from the Queensland University of Technology (QUT) and the University of the Sunshine Coast (USC) worked together to develop an analytics plan for the project. The USC research team focused on providing the analytics plan for the supply chain management of biomass resources, while the QUT research team developed suitable algorithms and tools to facilitate the transfer of outputs onto the AREMI platform.

The analytics tool allows users to select or enter a location on the AREMI platform and specify a radius around the source point from which they want information on biomass availability. The analytics tool reads and collates the information from the state-based data files and displays it in a tabular format. Users can select areas within NSW, WA and SA. Further developments are needed in other states to enable the analytics tool to successfully read the datasets.

The project supported two PhD projects. The PhD project through QUT developed a geographical information system-based methodology to optimise the use of multiple biomass types for supplying a large-scale energy plant, to maximise environmental and economic efficiency. The PhD project through the University of the Sunshine Coast (USC) determined the potential of forest biomass resources for bioenergy production in Queensland.

### 2.1.2 Data collection and upload

Different methodologies and processes were employed by states to collect biomass resource data, which was influenced by their varied experiences and skills in resource data collection and GIS. The spatial extent and differences in source data also influenced the methodologies used for data collection.

Data can be uploaded in Comma Separated Values (CSV) format or in ArcGIS Web Map Service (WMS) format. In the CSV format, data must be sent to Data61 so they can attach files to spatial layers such as Local Government Area (LGA) boundaries before displaying on the AREMI platform. Using the CSV format means the AREMI platform auto-selects the symbology (legends, colour schemes) on the maps. In comparison, using the ArcGIS WMS format allows more control over the display of data (i.e. symbology and table of contents can be selected.)

Victoria and WA provided their data as CSV files, while Queensland, NSW, Tasmania and SA provided data using the ArcGIS WMS format. This resulted in non-uniform data file formats for inputting data, meaning Data61 had to intervene before the data was uploaded.

A useful feature incorporated into the AREMI platform is the metadata link ('about this data'). This provides users with background information and links to government pages where details, including how the data was collected, nuances relating to the collected data, and what is included and excluded, is explained. This greatly enhances the value of the mapped data by providing transparency on what has been collected.

### 2.1.3 ABBA schema

To ensure the accuracy, consistency, reliability and quality of outputs, it is critical that data is compiled in a uniform way by all participants, in collaboration with experts and stakeholders.

Early in the project, the state partners, led by the SA Department for Energy and Mining, developed a data collection schema to cover all biomass types across all regions. A baseline of required fields for each dataset was determined, along with additional fields (Table 2). The schema can be applied to the identified biomass for bioenergy feedstocks and includes the capability for extra detail to be added if required.

A minimum dataset is essential to publish biomass feedstock data to the AREMI platform. This minimum dataset allows easier comparison and analysis of data from different states.

Data collected prior to the full implementation of the schema was reformatted to align it with the latest requirements.

**Table 2. Minimum data required to publish biomass feedstock data on the AREMI platform.**

<b>Field name</b>	<b>Description</b>
Region name	Local name of the spatial unit for which data is published. This can be a defined boundary like a LGA or it can be a custom spatial unit depending on the data source.
Region type	Defined region for which the data is being published (e.g. LGA, Australian Statistical Geography Standard (ASGS) 2011 – ABS SA4, National Plantation Inventory Boundary).
Residue type	Type of residue mapped (e.g. harvest residues, wood processing residues, grape marc).
Residue unit	Unit the residue has been recorded in (e.g. kilograms, dry tonnes, hectares). This unit applies to the <b>Total Residues, Minimum and Maximum</b> fields.
Biomass description	Detailed description of the type of residue mapped. This may include whether the data is presented as an average or a one-off value, or further detail on the residue or feedstock.
Timeframe	Time period for when the data was sourced, collected or predicted (e.g. 2010-2015, 2015, 2020-2030).
Total residues	Total value of the residue mapped (as described in <b>Residue Type</b> and defined in <b>Residue Unit</b> ).
Minimum	Minimum potential value calculated over the time period outlined in <b>Timeframe</b> . This field may not always be populated, and its value may depend on the data source and/or analysis. The data in this field indicates the potential variation in feedstocks over time. In some cases, it may reflect climatic variations or seasonal availability that will be details in <b>Note</b> .
Maximum	Maximum potential value calculated over the time period outlined in <b>Timeframe</b> . This field may not always be populated, and its value may depend on the data source and/or analysis. The data in this field indicates the potential variation in feedstocks over time. In some cases, it may reflect climatic variations or seasonal availability that will be details in <b>Note</b> .
Note	Any relevant additional information related to the dataset. This field may be left blank.

## 2.1.4 Data displayed spatially

Layers are displayed spatially, with as many details as possible, on the AREMI platform. The data source determines the scale at which data is displayed.

The biomass data layers range from LGA through to Spatial Area Levels (SA2-SA4). Generally, the lower the Spatial Area Level, the finer the detail displayed. Sensitive data is often aggregated to a larger level (e.g. SA4) to hide the origin of the data and protect data suppliers such as piggeries and poultry farms. The downside of this is that the richness of the data is diluted. But the project team made the decision that it is better to show data at a lower resolution than not at all.

The annual ABS source data is available through the Rural Environment and Agricultural Commodities Survey (REACS) at the SA4 scale. Every five years (census year), an agricultural survey is captured at the finer SA2 scale. This information was used to create a derived SA2 residue dataset for the REACS years, creating a five-year annual average dataset at a finer SA2 scale. Many of the datasets using the ABS source data were derived and displayed at the finer SA2 scale.

The NSW biomass residue data is displayed spatially on the AREMI platform in the finest detail possible for each source dataset. ABS datasets that include cropping, horticulture and livestock are displayed at a relatively fine scale, but considerable manipulation and derived calculations were needed to achieve this. Other sources (e.g. forestry data and solid organic waste such as Municipal Solid Waste (MSW), Commercial and Industrial (C&I) waste and Construction and Demolition (C&D) waste) are displayed at a coarser scale due to confidentiality and the sensitivity of the industries and data sources.

Queensland, Victorian and WA data is displayed at the LGA level, obscuring exact locations of where residues were created and protecting the privacy of individual operations.

Similar to NSW, data for Tasmania and SA is displayed at different scales depending on the data source. Further developments in automation of data processing will help provide consistency in the level of spatial resolution and the level of information about feedstock types.

The decision was made early in the project to use multiple years of data and average it. Project partners agreed that if five years of data could be obtained, this would sufficiently remove the variations in yield and provide a more stable annual figure over time.

In the spatial layers on the AREMI platform, multiple timeframes were used to present data, ranging from a five-year average to one year of data.

For ABS agricultural data, five years of data is available but was not used by all states. For waste data, some states presented data that was the average of multiple years and some states presented data from one year.

### What is scale?

Scale represents the relationship of the distance on the map to the actual distance on the ground. Details on the map are determined by the source scale of the data. The finer the scale, the more detail displayed.

Source scale refers to the scale of the data source, aerial photograph or satellite image from which the data is digitised into roads, landcover or boundaries in a geographic information system (GIS). It is important to note that zooming in on a small-scale map does not increase the level of accuracy or detail.

Grain size, pixel size and extent (the size of the study area) determine spatial scale. While more detail may be better, this also requires more computer power. Grain size can be increased but it cannot be made smaller.

### Statistical Area Levels

The ABS collects, analyses and releases data within a series of unique spatial boundaries. The Australian Statistical Geography Standard (ASGS) framework brings together ABS geographies and regions to form an integrated geospatial standard for collection and analysis of data. Using this framework means data is comparable across states and regions.

ABS census data is aggregated and reported for spatial areas across Australia. The different geographies are outlined below.

Local Government Area (LGA) – a spatial unit representing a whole geographical area that is the responsibility of an incorporated Local Government Council, an Aboriginal or Island Council or Community Government Council.

Statistical Area Levels (SA1-SA4) – regions defined by the ASGS. Regions are based on population and represent various community interactions.

## 2.1.5 Data sharing and use

NSW biomass residue data was shared with universities, consultants and industry. This provided high-quality research information on biomass assessments and assisted with decision making, including in policy development.

Statistics regarding the use of the Queensland Biomass Dashboard (<https://www.statedevelopment.qld.gov.au/industry/priority-industries/biofutures/queensland-biomass-mapping-and-data>) from August 2018 to April 2019 showed there were more than 1200 visits to the site. The 'bounce rate' was low (indicating people stayed on the site and clicked on the content), and the average time spent on a page was high (indicating people interacted with the content).

The SA data is in a WMS format, and is therefore only downloadable on a region-by-region basis. The SA Department for Energy and Mining has also made the biomass datasets

available in an Excel format on their website (<https://data.sa.gov.au/>), extending the reach and engagement with the datasets.

The Tasmanian data has been used by academics, state and local governments, and consultants for bioenergy projects in Tasmania. The Tasmanian Government has reported an increase in bioenergy-related enquiries.

Most people (70%) searching for Victorian data found the data via Google, rather than accessing it from the SV website. Analytics detailing the use of the data showed:

- Page views (2018-19) – 540
- Average time spent on page (2018-19) – 2.58 minutes
- Page views (2019-20) – 643
- Average time spent on page (2018-19) – 4.05 minutes

Google analytics showed the Biomass and Bioenergy webpage (<https://www.agric.wa.gov.au/climate-land-water/biomass-and-bioenergy>) on the Department of Primary Industries and Regional Development WA website received dozens of hits each week, with data used to make decisions across industry and state government departments.

## 2.2 Project communications

### 2.2.1 Raising awareness of the bioenergy sector

Presentations and general media communications from project partners, including media releases, conferences presentations, meetings, workshops and forums, helped promote and increase public awareness and understanding of Australia's bioenergy resources.

State departments and other projects have regularly accessed and used ABBA datasets when responding to bio-industry enquiries.

Trade displays and the presentation of research findings and updates by research partners at the Bioenergy Australia Conference (2016-2019) were opportunities for industry stakeholders to network and helped potential collaborators and investors better understand the research happening in the bioenergy sector and its potential applications in Australia.

In 2018, the ABBA project team won the Research Leadership Award at the Bioenergy Australia Conference.

Researchers from QUT also presented at the 11th International Conference on Applied Energy in Sweden (August 2019).

Data is available and publicly accessible through state department portals, including:

- [National Map](https://nationalmap.gov.au/) (<https://nationalmap.gov.au/>)
- [Forest Science in NSW](https://www.dpi.nsw.gov.au/forestry/science) (<https://www.dpi.nsw.gov.au/forestry/science>)

- [Queensland Government Open Data Portal \(https://www.data.qld.gov.au/dataset/australian-biomass-for-bioenergy-assessment\)](https://www.data.qld.gov.au/dataset/australian-biomass-for-bioenergy-assessment)
- Technical methods available through the Queensland Government publications portal (<https://www.publications.qld.gov.au/dataset/abba-tech-methods>)
- [Queensland Biomass Dashboard \(https://www.statedevelopment.qld.gov.au/industry/priority-industries/biofutures/queensland-biomass-mapping-and-data\)](https://www.statedevelopment.qld.gov.au/industry/priority-industries/biofutures/queensland-biomass-mapping-and-data)
- [Queensland Industrial Biotechnology, Bioproducts and Biorefining \(https://research.gut.edu.au/biorefining/projects/\)](https://research.gut.edu.au/biorefining/projects/)
- [Renewables SA \(http://www.renewablesa.sa.gov.au/\)](http://www.renewablesa.sa.gov.au/)
- [Renewables Tasmania \(https://renewablestasmania.tas.gov.au/home\)](https://renewablestasmania.tas.gov.au/home)
- [SA Department of Energy and Mining \(https://data.sa.gov.au/\)](https://data.sa.gov.au/)
- [Sustainability Victoria – Waste data portal \(https://www.sustainability.vic.gov.au/research-data-and-insights/waste-data\)](https://www.sustainability.vic.gov.au/research-data-and-insights/waste-data)
- [WA Department of Primary Industries and Regional Development – Agriculture and Food \(https://www.agric.wa.gov.au/climate-land-water/biomass-and-bioenergy\)](https://www.agric.wa.gov.au/climate-land-water/biomass-and-bioenergy)

National and state fact sheets were published throughout the project to showcase the ABBA project and raise awareness of the project and opportunities for growth of the bioenergy sector across Australia. The national fact sheet is shown in Appendix 1.

States have assisted stakeholder decision making, including on policy, relating to and advancing the bioenergy sector. Initiatives included:

- The Queensland Government released a Biofutures 10-year Roadmap and Action Plan (<https://www.statedevelopment.qld.gov.au/industry/priority-industries/biofutures>) in 2016 to support development and growth of a competitive biofuels and industrial biotechnology sector in Queensland. The ABBA project was included in Strategy 2 of the roadmap, 'Identify and promote the opportunities in Queensland'. There have been several media statements regarding the roadmap since it was released in 2016; [initial statement \(https://statements.qld.gov.au/statements/78019\)](https://statements.qld.gov.au/statements/78019).
- ABBA data is included in 'Investor information' that is available from the Clean Energy Transition Team, Department for Energy and Mining, SA.
- The Tasmanian Government is developing a Tasmanian Bioenergy Vision for release in 2021.
- The WA Government is developing a Bioeconomy Strategy.

Collaboration and strong links have been developed with key stakeholders, including universities, government agencies and industry, and between biomass producers and end users, project consultants and technology providers.

Regional forums, workshops and symposiums were held across Australia throughout the project. These included:

- ‘Biomass for the Riverina’ (Griffith, NSW, August 2018). The forum showcased the ABBA project, with Riverina residue data presented for open discussion and feedback.
- Forums held in hotspot areas (e.g. south-east and northern SA regions).
- Promotion of bioenergy and the AREMI (<https://www.tffpn.com.au/potential-for-bioenergy-in-tasmania/>) in Tasmania with a focus on the forestry sector (April 22, 2020).
- WA Bioenergy Symposium (May 2019).
- Forums held across regional Victoria, including at Ballarat, Churchill and Dandenong (August 2016), Tatura (September 2016), Geelong (October 2018), Hamilton (April 2019) and Benalla (June 2019).
- The Tasmanian Department of State Growth hosted a Tasmanian Bioenergy Future Online Summit (November 2020) (<https://www.bioenergyaustralia.org.au/bioenergy-events/tasmanias-bioenergy-future-online-summit-/>) with national and international attendance to promote the AREMI and bioenergy.

### 2.2.2 Bioenergy Government Network

The collaboration and knowledge-sharing activities between the state agencies were instrumental in the project’s success. As a result of the ABBA project, the Bioenergy Government Network has been established, with representation from all states. This network enables a forum for information sharing and networking across states. The collaboration will continue beyond the ABBA project to further explore and grow the bioenergy sector across Australia.

### 2.2.3 Publications

Ghaffariyan, MR, Acuna, M and Brown, M (2019). Developing general machine productivity predicting model for thinning operations in Australia. *Silva Balcanica*, 20(2): 13-25.

Heeley, B, Srivastava, S and Ghaffariyan, MR (2019). International assessment of bioenergy stakeholders research requirements of GIS based biomass analytics. *Journal of Forest Science*, 65 (6): 234-246.

Jayarathna, L, Hobson, P, O'Hara, I and Kent, G (2019). Bioelectricity generation from sugarcane waste in Queensland: Model for optimal siting and sizes for biomass energy plants. *Proceedings of 11th International Conference on Applied Energy*.

Jayarathna, L, Kent G, O'Hara I and Hobson P (2020). A Geographical Information System-based framework to identify optimal location and size of biomass energy plants using single or multiple biomass types. *Applied Energy*, 275: 115398.

Li, M, Lenzen, M, Yousefzadeh, M and Ximenes, F (2020). The roles of biomass and CSP in a 100% renewable electricity supply in Australia. *Biomass and Bioenergy*, 143, article 105802. <https://doi.org/10.1016/j.biombioe.2020.105802>

Queensland Technical Methods (<https://www.publications.qld.gov.au/dataset/abba-tech-methods>).

Royal Melbourne Institute of Technology (2020). Investigation of Food Manufacturing and Primary Industry Residues for Anaerobic Co-digestion (Gippsland). Eds: Othman, M, Kavanagh, C and Wickham, K. <https://www.sustainability.vic.gov.au/>

Van Holsbeeck, S, Brown, M, Srivastava, SK and Ghaffariyan, MR (2020). A Review on the Potential of Forest Biomass for Bioenergy in Australia. *Energies*, 13(5): 1147.

Van Holsbeeck, S and Srivastava, SK (2020). Feasibility of locating biomass-to-bioenergy conversion facilities using spatial information technologies: A case study on forest biomass in Queensland, Australia. *Biomass and Bioenergy*, 139: 105620.

Van Holsbeeck, S, Ezzati, S, Röser, D and Brown, M (2020). A two-stage DSS to evaluate optimal locations for bioenergy facilities. *Forests*, 11, 968.

### **Papers under review**

Brookbank, K and Goodwin, A (2020). A model of coppice recovery for Mallee-form eucalypts. *New Forests*.

Jayarathna, L, Kent G, O'Hara I and Hobson P (2019). GIS-based Fuzzy multi-criteria analysis for sustainability assessment of biomass energy plant siting: A case study in Queensland, Australia. *Land Use Policy*.

Jayarathna, L, Kent G, O'Hara I and Hobson P (2020). Optimal utilization of multiple biomass types for bioelectricity generation: A case study in Queensland, Australia. *Applied Energy*.

Middelhoff, E, Madden, B, Ximenes, F, Carney, C and Florin, N. Electricity generation potential and prospect siting of hybrid concentrated solar biomass (HCSB) plants in New South Wales, Australia.

## **3. Data continuity**

Continuity of the ABBA project has been a strategic activity. The ABBA has a number of achievements, with the main ones being the creation and implementation of biomass residue datasets that are now publicly available on the AREMI platform, and the development of a strong bioenergy network across Australia.

These achievements alone have set a strong foundation for continued state-led bioenergy industry development activities in the future. For a bioeconomy and for the bioenergy industry to develop strong roots in Australia, it is imperative these networks continue to facilitate bioenergy investment, and that the AREMI datasets continue to be useful by being kept up to date and relevant.

Moving forward, it would be desirable if biomass datasets could be automatically or semi-automatically updated on the AREMI platform, and the schema for data collection implemented and adopted nationally. But the variability of data sources means it is unlikely that a fully automated option will be possible.

Improvements have made it easier for people to access the AREMI platform. Among these is the development of a user guide with instructions on how to access and update data files.

The collaboration and knowledge-sharing activities between the state agencies were also instrumental in the success of the project. As mentioned earlier, a direct result of the ABBA project has been the establishment of the Bioenergy Government Network, with representation from all states. This strong collaboration will continue beyond the ABBA project through this network.

Linking bioenergy to the bio-economy, circular economy and climate change strategies has provided opportunities for close collaboration with other state agencies that are interested in ABBA data as a tool for their work programs in these fields. Consultation, collaboration and knowledge sharing with these agencies is ongoing through the Bioenergy Government Network.

The biomass datasets have been and continue to be accessed and used by state departments, consultants and industry representatives when responding to bioindustry enquiries. The states have committed to continuing to maintain and update datasets beyond the life of the project where resourcing is available.

Table 3 provides a summary of the ABBA project partners' continuity plans.

**Table 3. ABBA project partners' continuity plans.**

Organisation and state	Committed to maintaining and updating datasets?	Confirmed timeframe for continued support?	Comments
Department of Primary Industries, NSW	Yes	Ongoing	<p>Developing an automated Python code for future biomass residue calculations. The code has been completed for agricultural cropping residues and will be applied for livestock and horticultural residues. A separate code will be developed for forestry residues.</p> <p>Full automation is inhibited by changes to dataset formats from year to year.</p> <p>NSW is assisting other states to develop their own automation systems based on what is being developed in NSW.</p>
Department of Environment and Science, Queensland	Yes	Ongoing (where resourcing is available)	<p>Several groups in the Queensland Government are collecting feedstock and material flow information to support circular economy projects. The Queensland DES will continue to support them in publishing the information, but it is likely that updates to data will be on request and dependent on available resourcing.</p>
Department for Energy and Mining, SA	Yes	Ongoing	<p>The SA Department for Energy and Mining will continue to provide resources to update and maintain the ABBA data.</p> <p>Discussions with other SA government agencies to take over custodianship of the data are continuing.</p>
Department of State Growth, Tasmania	Yes	Ongoing	<p>Committed to developing further automation of data upload and maintenance.</p> <p>The Department of Primary Industries, Parks, Water and the Environment will update finer-scale data on organic waste streams in Tasmania during 2021.</p>
Department of Primary Industries and Regional Development, WA	Yes	Two years	<p>Ongoing maintenance of the WA datasets will be done by the Department of Primary Industries and Regional Development. This will be renegotiated after two years</p>
Sustainability Victoria, Victoria	To be determined	Ongoing (need to achieve 'buy in' from new team structure)	<p>Working with a consultant to correct the LGA level data anomalies, provide an update of prioritised biomass datasets and upgrade the Victorian biomass estimates model and manual. This will enable data to be updated biennially.</p> <p>With the current restructure, the data may move to another government department.</p>
Queensland University of Technology, Queensland	Yes	Three years (commitment to maintain operation of the analytics service on the cloud platform)	<p>This commitment does not include any upgrade or improvements to the system or changes/issues resulting from data upgrades</p>
University of the Sunshine Coast, Queensland	Yes	Ongoing	<p>Anticipated minimal refinement will be required</p>

## 4. Key outcomes and highlights

A major highlight of the ABBA project was the strong and engaged project team, which created a positive and collaborative work environment. The collegiate approach, networking and joint efforts by the state and university partners provide a strong basis for continuity beyond the current ARENA-funded project.

The Bioenergy Government Network is another key outcome of the project. This forum for information sharing, collaboration and networking across states will continue beyond the ABBA project to further explore and grow the bioenergy sector across Australia.

### 4.1 Catalyst for advancing the bioenergy sector

A broader awareness of bioenergy opportunities, the potential for bioenergy to help businesses and industries with energy and waste management, the provision of support and networks around bioenergy project development, and assistance with business cases and insight into bioenergy viability in the sector were key highlights from the project.

The Queensland DES reported an increased awareness of:

- The potential contribution that a bioenergy industry could make in lowering greenhouse gas emissions. This was particularly noted across government and the community.
- The size, scope, location and nature of bioenergy development investment opportunities, particularly among potential investors.
- The additional potential opportunities for beneficial use of organic wastes and residues in energy production, particularly among agricultural and waste industries.

Projects in state departments across Australia have used ABBA data to progress or develop circular economy projects. The ABBA datasets have also been used as the primary information source for funding rounds by state government departments.

### 4.2 Bioenergy policy and vision

The project has helped raise the profile of bioenergy in state governments, with bioenergy now well-represented in many state government policies. The Tasmanian Government is developing a Tasmanian Bioenergy Vision for release in 2021. The Queensland Government released a Biofutures 10-year Roadmap and Action Plan (<https://www.statedevelopment.qld.gov.au/industry/priority-industries/biofutures>) in 2016 supporting development and growth of a competitive biofuels and industrial biotechnology sector in Queensland. The WA government is developing a Bioeconomy Strategy.

### 4.3 Dedicated project staff

A dedicated Project Officer in SA drove industry development in the bioenergy sector and provided networks for engagement with other departments and states. A dedicated role in the Department of State Growth to support bioenergy through Renewables Tasmania has also been established to progress bioenergy growth and development across the state.

## 4.4 Data automation

The NSW DPI is instigating an automated python code for future calculations of biomass residues. The code for cropping residues has been completed using NSW formulas, and the same design will be applied for livestock and horticultural residues. A separate code for forestry residues will be developed. NSW DPI is assisting other states to develop their own automation systems based on what it has developed.

## 4.5 PhD research

The USC PhD project '*Determining the potential of forest biomass resources for bioenergy production in Queensland, Australia*' was successfully completed within the project lifetime. The results showed that large quantities of forest biomass could be sustainably retrieved from forests to contribute to regional renewable energy markets. The greatest potential of forest biomass lies in small-scale regional energy conversion to minimise supply chain costs and maximise the use of biomass. Three research papers, and a review paper were published in high-quality journals, with the biomass cost modelling results also published as part of the project. This data will be useful to the bioenergy and forestry industries.

The PhD project through QUT developed a GIS system-based methodology to optimise the use of multiple biomass types for supplying a large-scale energy plant, to maximise environmental and economic efficiency.

## 4.6 Costing model for forest-based biomass supply

The USC developed a simplified costing model for forest-based biomass supply. This included a step-by-step explanation of the required analytics based on an assessment of the quantity of the biomass, identifying suitable work methods and harvesting technology to collect and process the biomass, and evaluating the productivity of the biomass recovery. The data was then implemented through the QUT analytics work. Feedback from industry consultation with the Australian forest industry (representing more than 80% of forest growers) was used in the development of effective cost-prediction models and the biomass analytic tool.

## 5. Challenges faced/lessons learnt

Bioenergy is generally not well-understood in Australia and makes up only a small share of the renewable energy marketplace. There is also a lack of regulatory framework to support the bioenergy sector.

Support for the emerging bioenergy industry, in an already highly competitive renewable energy sector underpinned by wind and solar resources and an emerging hydrogen industry, means securing funding for bioenergy projects can be challenging. This is particularly the case for large-scale 'in front of the meter' projects. Bioenergy projects are often seen as a higher risk, meaning it is more difficult to find pathways to viable (typically 'behind the meter') bioenergy projects without substantial seed funding in the early stages of development.

## 5.1 Data collection and interpretation

Data is often held by industry and not publicly available at a scale suitable to create biomass residue data. Many industry bodies and government agencies, such as the Australian Bureau of Agricultural Resource Economics and Sciences (ABARES), publish tabular data in annual and quarterly reports, but the information is presented as state figures or figures for large, merged regions of states, and lacks detail at a smaller regional scale.

Industry organisations tend to hold most finer-scale raw data, and confidentiality issues can mean they are unwilling to share the data. As a result, much of the data uploaded to the AREMI platform was extrapolated from publicly available information, (e.g. ABS commodities data).

Sourced data was often messy, difficult to interpret and not available in the same format or a singular table. Multiple spreadsheets were often used to make regional predictions based on data in additional spreadsheets, and convoluted calculations were used to extract the appropriate information for uploading to the AREMI platform.

## 5.2 Inconsistencies in reliable accessible data

The ABS REACS and Agricultural Census survey data is the most reliable annual agricultural data publicly available, but issues were encountered when working with the datasets, as labelling and naming conventions changed from year to year, and some commodities were removed in some years.

The biggest change was in the 2015-16 Census year, when ABS changed their collection scope from agricultural businesses with an estimated value of agricultural operations (EVAO) of \$5000 or more to agricultural businesses with an EVAO of \$40,000 or more. Initial cropping and livestock data (2010-15) was produced using the old EVAO. When updating to 2013-18, the years 2013-15 were recalculated to the new EVAO, ensuring the data was consistent for the five-year average. This resulted in outdated datasets, and complete automation by coding for calculating residues was not achievable. The issues were raised with the ABS, which is working to create reliable, unchangeable datasets in the future.

## 5.3 Earlier data planning and schema development

The integration of digital spatial data from diverse sources to present a coherent national picture was a big challenge. The development of a national data schema at the outset of the project to collate and determine data presentation before it was published would have benefited the program.

As mentioned earlier, a national data schema was created 18 months into the project, which allowed datasets containing similar key headings and information to be created and ensured additional state-level information could also be added. A number of datasets have been updated to the new schema and updating will continue as new residue datasets are uploaded.

## 5.4 Data upload options

The data upload options are discussed earlier in the report. The varied experience and skills in data collection and GIS influenced the methodologies used to collect data. This resulted in datasets with non-uniform file formats being uploaded to the AREMI platform. As a minimum, states should meet the baseline minimum requirements of the data schema to provide more uniformity across datasets for uploading to the AREMI platform.

## 5.5 Automation issues

For automation, raw data sources need to be available in the same format each year. Most raw data sources were not suitable for automation options, and needed manual correction and data manipulation to ensure the ABS agricultural datasets were consistent between years, and in a suitable format to calculate biomass residues. Given the complexity of the data and the nature of the various sources, it is likely future automation will be semi-automated.

## 5.6 Complexity of tool development

The development of the analytics tool was more complex than originally anticipated. This was a result of needing to:

1. Develop a method for users to interact with the AREMI platform.
2. Develop a cloud-based service to interrogate multiple state-based datasets.
3. Undertake calculations and redisplay graphical and tabular data back into the AREMI system.

The tool must also undertake the work in a short turnaround period, as would be expected of a real-time web-based service.

The different formats used by state governments to maintain data meant some datasets were not able to be tagged appropriately to enable ready recognition by the analytics tool. The creation of a separate data portal for two states (Queensland and Victoria), which enabled their data to be accessed by the tool, resolved this issue.

## 5.7 Challenges in balancing service speed with accuracy of results

Multiple methods to balance service speed and accuracy were trialled during the project. The calculation methodology for a user-determined radius required calculation of biomass availability across multiple datasets and states. Response speed from the service was slower when larger radii were input.

## 6. Conclusion

Opportunities for bioenergy projects exist, particularly in regional areas. Bioenergy not only supports the competitiveness of key regional employers such as meat processing facilities, grain mills and timber mills with their long-term waste and energy costs but has the potential to stimulate regional development and generate local employment.

Bioenergy projects can also reduce landfill and have the added value of by-products such as biochar. In energy-constrained regions, bioenergy could potentially attract new businesses to that area.

The ABBA project has created new data regarding feedstock location and availability, and amalgamated the data in one place, on the Australian Renewable Energy Mapping Infrastructure (AREMI) platform, which has transitioned to the National Map website (<https://nationalmap.gov.au/>) to enable efficient data access. The information was developed in conjunction with industry input and feedback to ensure data quality. The analytics tools will support future users of the AREMI system to better extract and analyse information.

The data collection schema allowed standardised data collection across states and assisted with consistency, reliability and quality of data, while the analytics tools will support end users to better extract and analyse information.

The project has enabled better links between biomass suppliers and end users. These links help local businesses get more value from organic material destined for landfill, disposal or other low value uses by improving their access to quality information.

The collaboration and knowledge-sharing activities between the state agencies were instrumental in the project's success. The formation of the Bioenergy Government Network with representation from all states was a key outcome from the project. Collaboration will continue through this network to further explore and grow the bioenergy sector across Australia.

The project also helped raise awareness within industries about the opportunities and benefits of engaging in the bioenergy supply chain, which would grow the bioenergy industry across Australia.

The achievements of the project have set a strong foundation for continued state-led bioenergy industry development activities in the future. Moving forward, it would be desirable if biomass datasets could be automatically or semi-automatically updated on the AREMI platform, but the variability of the data sources means it is unlikely that a fully automated option will be possible.

The biggest challenges for the bioenergy sector relate to market knowledge of, and familiarity with bioenergy. A key component of this is the confidence that there is feedstock available in the marketplace. Continued communication to increase awareness of the bioenergy sector and the benefits and opportunities it presents, including promotion of the [National Map](https://nationalmap.gov.au/) (<https://nationalmap.gov.au/>) and AREMI data, will help address this challenge.

Developing initiatives and financing products that support greater investment in bioenergy generation across Australia is important to aid further exploration of opportunities and the development of business cases to support progress and industry growth and development.

## 7. Recommendations

Key recommendations from the ABBA project are:

1. The data schema that has been developed through the project should be implemented, promoted and shared across state departments and organisations to ensure standardised data collection across states and regions. This will increase awareness and ensure uploaded data is in a useable format.
2. The Australian Government continues to support the emerging bioenergy sector through ARENA to ensure growth and exploration of opportunities in bioenergy nationally.
3. ABBA project partners become active members of the Bioenergy Government Network. It is recommended support for this network continues, ensuring a strong network persists and continues to connect the bioenergy sector across Australia.
4. A focal/contact point for bioenergy enquiries should be established within each state.
5. Communication and promotion of the [National Map](https://nationalmap.gov.au/) website (<https://nationalmap.gov.au/>) should be continued.
6. A simplified visualisation that contains graphical user-driven data should be created to help people get what they need from the data without having to search through individual detailed datasets.

## 8. Further information

For further information relating to the [project](https://arena.gov.au/projects/aremi-project/) (<https://arena.gov.au/projects/aremi-project/>), please contact the state departments below or visit the [National Map](https://nationalmap.gov.au/) website (<https://nationalmap.gov.au/>).

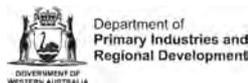
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## Appendices

Appendix 1. Australian Biomass for Bioenergy Assessment fact sheet.



# Australian Biomass for Bioenergy Assessment



# What is the Australian Biomass for Bioenergy Assessment (ABBA)?

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The purpose of the Australian Biomass and Bioenergy Assessment (ABBA) is to catalyse investment in the renewable energy sector through the provision of detailed information about biomass resources across Australia, to assist in project development and decision making for new bioenergy projects, and provide linkages between biomass supply, through the supply chain, to the end user.

In order to achieve this, the project collects, on a state-by-state basis, data on the location, volumes and availability of biomass, for inclusion on the Australian Renewable Energy Mapping Infrastructure (AREMI) platform.

This geospatial data is available to renewable energy project developers, policy makers, and others, providing a multi-faceted dataset that will complement existing related information, such as energy infrastructure, power utilities, population data, and land use data. Data collected from this project is presented on the AREMI platform as customisable layers.

Data collected and uploaded includes:

- The types, locations and volumes of existing biomass resources (where possible identifying both total and potentially available resources)
- The types, locations and volumes of existing bioenergy industries
- Identification of other relevant spatially based information in communication with commercial participants in the renewable energy sector
- Land capability for future biomass.

Strategies (such as data aggregation) are developed to ensure confidentiality of commercially sensitive information.

In addition to these data sets analytical tools are being developed in conjunction with various industry sectors, to enhance the utility of the data in order to contribute to new project development and supporting future industry investment. These analytical tools will include information relating to estimated biomass cost, cumulative availability, and estimates of future biomass potential from alternative cropping scenarios.

This information can be used by potential bioenergy project investors, other biomass purchasers, current and future energy users and electricity providers, and policy makers to guide the early decision making process on biomass resources and availability by location and volume, along with transport logistics and current energy requirements on a spatial basis.

In addition to providing biomass industry relevant data and information for the AREMI platform, the project is assisting in creating market pull for bioenergy through tying bioenergy availability to biomass demand. Both through use of the multiple layers of the AREMI platform, and through state based industry development processes, potential bioenergy users are being linked to bioenergy producers, and regions of high industry potential, for future development activities. Both state and federally based regional development and planning organisations and authorities are able to use the information in future industrial, residential and land use planning.

The ABBA is project managed by AgriFutures Australia and is funded by the Australian Renewable Energy Agency (ARENA).

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## **Australian Biomass for Bioenergy Assessment 2015-2021**

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April 2021

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