Agenda - Session 1  (10am - 12.15pm)

- Welcome and Introduction (Fabiano Ximenes, DPI)
- ABBA project (Cath Carney, DPI)
  - ABBA Project overview
  - National, state and regional residues
  - AREMI platform demonstration
- Biotechnology overview (Klaus Baumgartel, ICN)
- Bioenergy Australia and state examples of biomass use
  (Shahana McKenzie, Bioenergy Australia)
- Piggery with biogas facility (Ian Longfield, Rivalea Australia)
- Hand crafted malts from local grains with biochar facility
  (Brad Woolner, Voyager Craft Malt)
Agenda - Session 2 (1pm - 3pm)

- The MacAnzac Project (Brannan Tempest, AgriWaste Energy)
- Paper mill investigating Albury Biomass to Energy (AB2E) (Michael Machin, Norske Skog)
- Canola oil processing, installing wood waste biomass boiler (Bob Mac Smith, MSM Milling)
- New DPI project – biomass for bioenergy (Fabiano Ximenes, DPI & Nick Florin, UTS)
- General discussion and comments
- Wrap up

ABBA Project overview

- What is ABBA about?
  - Australian Biomass for Bioenergy Assessment
  - ABBA is providing spatial data about the types, locations and volumes of biomass to assist in project development and early decision making for bioenergy projects
  - Across Australia, spatial data is being produced at the national, state and regional level
  - ABBA is helping to develop links between biomass producers and users through forums such as today
  - Funded by Arena and managed by AgriFutures Australia
National, state and regional biomass residues

About the NSW AREMI datasets

- *Cropping straw* and *Livestock manure residues* based on 2010-11 to 2014-15 ABS Agricultural Commodities Data (5 years), annual average mapped
- *Organic waste residues* based on 2012-13 to 2014-15 Renew NSW ROCs datasets from EPA (3 years), annual average mapped
- *Forestry harvest and sawmill residues* based on 2011-2015 FCNSW logging database, annual average mapped
- Future *Almond and Macadamia residues* based on 2010-11 to 2014-15 ABS Agricultural Commodities Data (5 years), annual average mapped
  (Note: large volume increase for *Almonds* in the 2016-17 Ag Census Survey – perhaps map individually as an additional layer)
Cereal straw residues - State & Riverina

- Harvest Index (HI) used to calculate residues for each crop
- Stubble retention (1 tonne/ha) for soil protection for southern NSW

Regional cereal straw residues

- Most cereal straw biomass in Griffith, Wagga Wagga, Deniliquin, Condobolin and West Wyalong
Regional cereal straw residues > 100,000t

Regions with 500,000+ tonnes of residues

- Wheat and Rice
- Wheat
- Wheat and Rice
- Wheat and Barley
- Wheat and Barley

Non-cereal straw residues - State & Riverina

- Harvest Index (HI) used to calculate residues for each crop
- Stubble retention (1 tonne/ha) for soil protection for southern NSW
Regional non-cereal straw residues

- Most non-cereal straw biomass in Griffith, Temora, Wagga Wagga, Albury-Lavington, Corowa and Tocumwal-Finley-Jerilderie

Regional non-cereal straw regions > 50,000t

<table>
<thead>
<tr>
<th>SA2 region</th>
<th>Riverina</th>
<th>Murray</th>
<th>Central West</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Griffith Region (merged)</td>
<td>Junee</td>
<td>Narrandera</td>
</tr>
<tr>
<td>TOTAL Non-cereal Straw (t)</td>
<td>125,222</td>
<td>55,722</td>
<td>68,655</td>
</tr>
<tr>
<td>Cotton (Irrigated)</td>
<td>64,759</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton (Non-Irrigated)</td>
<td>250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canola</td>
<td>50,930</td>
<td>52,833</td>
<td>61,675</td>
</tr>
<tr>
<td>Peanuts</td>
<td>12,637</td>
<td>646</td>
<td>1,463</td>
</tr>
<tr>
<td>Other Oilseeds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Pulses</td>
<td>4,463</td>
<td>2,889</td>
<td>6,333</td>
</tr>
</tbody>
</table>

Regions with **100,000+** tonnes of residues

- Cotton and Canola
- Canola
- Canola
- Canola
- Canola
- Canola
Hay & Silage residues - State & Riverina

- ABS data ‘cut for hay’ and ‘cut for silage’ assumed residue value already
- Possible overlap of cereal cut for hay with cereal straw residues (figures low)

Regional hay & silage residues

- Volumes are much lower than cereal and non-cereal straw biomass
Regional - All straw, hay & silage residues

- Combined layer of cereal straw, non-cereal straw and hay & silage residues for easy regional interpretation of location and total volume of straw residues

Dairy manure residues - State & Riverina

- Daily milk production = 15.5kg/day; average live weight and dry matter intake (DMI) were calculated for each ABS dairy cattle class and time spent in holding yards and feedpads
Regional dairy manure residues

- Most dairy manure biomass in Wagga Wagga, Tumbarumba, Deniliquin-Moama, Corowa and Tocumwal-Finley-Jerilderie

Piggery manure residues - State & Riverina

- Deep litter or conventional system not identified as ABS data not detailed
- Hence bedding not calculated, dataset only represents manure as excreted
Regional piggery manure residues

- Most piggery manure biomass in Corowa, Deniliquin-Moama, Temora and Young

National piggery manure residues

- National piggery residues prepared by Australian Pork Limited (APL)
- Spent Bedding and Conventional Flush Manure mapped for 1 year (2016-17)
ABS data not detailed about whether caged, barn or free range - assumptions
Meat: housed in barns; single-batch litter; 5.5 batches/year; 14 birds/m³
Layers: ~70% of industry caged; manure by conveyor belt, no bedding

Most poultry manure and bedding biomass in Griffith and West Wyalong
Regional - All manure residues

- Combined layer of dairy manure, piggery manure and poultry manure & bedding residues for easy regional interpretation of location of total volume of manure residues

Regional - All manure regions > 2,500t

<table>
<thead>
<tr>
<th>SA4 region</th>
<th>RIVERINA</th>
<th>MURRAY</th>
<th>CENTRAL WEST</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SA2 region</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Griffith Region (merged)</td>
<td>Temora</td>
<td>Tumbarumba</td>
</tr>
<tr>
<td><strong>TOTAL All Manure VS (t)</strong></td>
<td>11,628</td>
<td>3,444</td>
<td>10,519</td>
</tr>
<tr>
<td><strong>Dairy manure VS</strong></td>
<td>145</td>
<td>10</td>
<td>10,491</td>
</tr>
<tr>
<td><strong>Piggery manure VS</strong></td>
<td>563</td>
<td>3,419</td>
<td>11</td>
</tr>
<tr>
<td><strong>Poultry manure &amp; bedding VS</strong></td>
<td>10,920</td>
<td>15</td>
<td>17</td>
</tr>
</tbody>
</table>

Regions with **10,000+** tonnes of residues:

- Poultry
- Dairy
- Dairy
- Dairy and Piggery
- Dairy and Piggery
National winery residues by GI region

- National winery layers put together by SA government
- Winery residues for 1 year (2016-17)

Renew NSW Regional Group regions
All organic waste residues at landfills

- Combined layer of MSW, C&I and C&D organic waste for easy regional interpretation of location and total volume of organic waste residues
- Contains food, paper, cardboard, vegetation, compost, wood, wood products

FCNSW Management Area regions
Forestry - production forests & facilities

- Production Forests and Wood Processing Facilities (sawmills, firewood & fencing suppliers, particleboard and plywood manufacturers)

Sawmill residues - public and private resource

- Combined layer of hardwood & cypress and softwood sawmill residues (also individually mapped)
- Biomass only from sawmills producing green sawdust and green offcuts
**Forest harvest residues - public forests**

- Combined layer of productive native forests, plantation hardwood and plantation softwood harvest residues from known logging operations (also individually mapped)

**Almond residues - preliminary figures**

<table>
<thead>
<tr>
<th>SA4 region</th>
<th>RIVERINA</th>
<th>MURRAY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Businesses</td>
<td>Dry Hull &amp; Shell Residues (t)</td>
</tr>
<tr>
<td>ABS Year</td>
<td>(Kernel (%)</td>
<td>Hull &amp; Shell (%)</td>
</tr>
<tr>
<td>2010-11</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>2011-12</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>2012-13</td>
<td>30</td>
<td>70</td>
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<td>2013-14</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>2014-15</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>2015-16</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>2016-17</td>
<td>30</td>
<td>70</td>
</tr>
</tbody>
</table>

- Average number of businesses haven’t changed over last 7 years
- Dramatic increase in almond production in 2016-17 in the Riverina and Murray ABS SA4 regions
- Still deciding how to map sudden increase – likely prepare a 2010-11 to 2014-15 average layer and an individual 2016-17 single year layer
- Not calculated to SA2 scale yet
AREMI mapped State and Riverina area residues

<table>
<thead>
<tr>
<th>Region Name</th>
<th>Region Type</th>
<th>Cereal Straw, Non-cereal Straw and Hay &amp; Silage Residues (Dry Tonnes)</th>
<th>Poultry, Piggy and Dairy Manures (Dry Tonnes)</th>
<th>MSW, C&amp;W and C&amp;D Organic Waste (Tonne)</th>
<th>Forest Sawmill Residues (Dry Tonnes)</th>
<th>Forest Harvest Residues (Dry Tonnes)</th>
<th>Region Totals</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Murray</td>
<td>ARS SAV Statistical Area</td>
<td>3,665,584</td>
<td>37,649</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>3,683,273</td>
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<tr>
<td>Riverina</td>
<td>ARS SAV Statistical Area</td>
<td>3,765,483</td>
<td>21,682</td>
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<td>n/a</td>
<td>n/a</td>
<td>3,787,166</td>
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<td>Wolgoc (Murray)</td>
<td>Riverina NSW Regional Group</td>
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<td>25,940</td>
<td>n/a</td>
<td>n/a</td>
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<td>Wodgoc (Riverina)</td>
<td>Riverina NSW Regional Group</td>
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<td>n/a</td>
<td>14,045</td>
<td>n/a</td>
<td>n/a</td>
<td>14,045</td>
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<tr>
<td>Wolgoc (Riverina)</td>
<td>Riverina NSW Regional Group</td>
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<td>n/a</td>
<td>9,473</td>
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<tr>
<td>Jago-Bangarli</td>
<td>FINSW Management Area</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>4,585</td>
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<td>Cambodolin</td>
<td>FINSW Management Area</td>
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<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>5,781</td>
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<tr>
<td>Forbes</td>
<td>FINSW Management Area</td>
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<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
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<td>n/a</td>
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<td>n/a</td>
<td>524</td>
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<td>Mildura</td>
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<td>n/a</td>
<td>n/a</td>
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<td>n/a</td>
<td>3,003</td>
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<td>Murray</td>
<td>FINSW Management Area</td>
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<td>2,176</td>
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<td>n/a</td>
<td>14,326</td>
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<td>Barenderra</td>
<td>FINSW Management Area</td>
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<td>n/a</td>
<td>5,901</td>
<td>n/a</td>
<td>n/a</td>
<td>5,901</td>
<td></td>
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<tr>
<td>Tumut</td>
<td>FINSW Management Area</td>
<td>n/a</td>
<td>n/a</td>
<td>293,680</td>
<td>213,673</td>
<td>n/a</td>
<td>403,353</td>
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</table>

**RIVERINA AREA TOTAL** 6,813,072 59,147 50,066 296,239 244,461 7,428,984

**NSW TOTAL** 14,489,745 222,766 2,280,318 709,561 1,545,625 19,238,897

47.0% 26.6% 2.2% 37.1% mostly Tumut 15.8% mostly Tumut 38.6%

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**AREMI live demonstration**

- **Renewable Energy, Bioenergy:** New South Wales layers
- **Renewable Energy, Bioenergy:** Other state layers and National layers – Biomass Projects; Biomass Case Studies; Biomass People; Catchment Scale Land Use
- Other datasets on AREMI
  - **Electricity Infrastructure:** Substations; Transmission Lines
  - **Infrastructure:** Major ports; Transport
  - **Topography:** Aerial/Satellite Imagery – NSW Six Maps (fine scale); Landsat (30m pixel) & Sentinel (10m pixel)
- About This Data tab has metadata & URL link which will take you to the REST Service where Google Earth & ArcMap formats are available
Future and ongoing work

- Almond and Macadamia residues
- Cotton trash residues
- Rice hull residues
- Other horticulture residues
- Analytics team developing tools to enhance the utility of the data
- ABBA2 – What might it look like?
  - More forums to connect producers, users and facilitators
  - Continued development and deployment of biomass data
  - Maybe finer scale biomass data available to develop and deploy as interest grows from biomass producers?

General discussion and comments

- What other biomass is in the Riverina region?
- What have we missed?
- Are there better assumptions that you think we should be using?
- What might you want ABBA2 to deliver?
- General feedback or questions
Thank you from the NSW ABBA team!

Catherine Carney  
Project & GIS Officer  
cath.carney@dpi.nsw.gov.au  
0438 915 269

Fabiano Ximenes  
Senior Research Scientist  
fabiano.ximenes@dpi.nsw.gov.au  
0458 760 812
ICN – Industry Capability Network

- Bioenergy is widely used in Europe and the USA
- Technologies are well developed and work
- Bioenergy is seldom economic on its own and must be considered in a broader context
Bioenergy can provide multiple value streams

- Can provide energy source for power generation or process heat
- Can turn a costly waste into a positive asset
- Can produce by products with market value e.g. biochar, fertilizer, waste that has lower disposal cost etc
- Does require capital investment and plant maintenance so need to consider all these factors in the business case

Technologies Available

- Direct combustion for heat or electricity
- Gasification to produce syngas – substitute for natural gas
- Pyrolysis to give synthetic fuel and biochar
- Biodigestion – produces methane and fertilizer
Direct Combustion

- Technically the simplest and most versatile
- Tolerant to different fuel types
- Need dry materials or pre-drying
- Need emission controls
- Can be used for electricity or process heat
Gasification

- Thermal breakdown of biomass at high temperature in the absence of oxygen
- Produces syngas – mixture of hydrogen, carbon monoxide and hydrocarbons
- Can be used in place of gas for heat or power generation in a genset
Pyrolysis

- Thermal breakdown of biomass at high temperature in the absence of oxygen
- Produces mixture of longer chain hydrocarbons
- Can be condensed to give a syncrude liquid fuel
- Can be used directly or upgraded by hydrotreating to remove oxygen. Results in hydrocarbons only
- Storable
Biodigestion

- Used for low solids content slurries such as sewage
- Produces methane which can be stored
- Can be used to produce heat or electricity
- Fertilizer is a by-product or easier to dispose of waste
- Improves the water quality compared to original
Other Technologies

• Ethanol – can be starch, cellulose or Fischer Tropsch
• Biorefinery – mainly based on lignin
• Bioplastics
• Composting
• Neutraceuticals
• Algae

Klaus Baumgartel
klausb@icnsw.org.au
Mob: 0412 595 897
BIOENERGY IN AUSTRALIA

SHAHANA MCKENZIE
CEO BIOENERGY AUSTRALIA

ABOUT BIOENERGY AUSTRALIA

AUSTRALIA LAGS BEHIND THE WORLD WHEN IT COMES TO BIOENERGY

WE ARE COMMITTED TO ACCELERATING AUSTRALIA'S BIOECONOMY

WE ADVOCATE
WE CAMPAIGN
WE INFORM
WE CONNECT
OUR MEMBERS

• STATE GOVERNMENT DEPARTMENTS
• PRODUCERS OF BIOFUELS
• LARGE CORPORATIONS QANTAS, AGL, VIRGIN
• UNIVERISTIES & RESEARCHERS
• DEVELOPERS OF BIOENERGY PROJECTS
• TECHNOLOGY PROVIDERS
• EXPERT CONSULTANTS
• FINANCE SOLUTION PROVIDERS

CHANGE IS IN THE AIR

AVIATION INDUSTRY MOVING TO A 50% REDUCTION IN EMISSIONS BY 2050
IMO SETTING SIGNIFICANT SULFUR AND EMISSIONS REDUCTIONS
FEDERAL AND STATE ELECTIONS – ENERGY IS TOP OF MIND
INCREASING GAS & ELECTRICITY PRICING
WASTE IS TOP OF MIND AND GATHERING COMMUNITY SUPPORT
PROACTIVE AND VOCAL INDUSTRY BODY ADVOCATING FOR SUPPORT
PROJECT EXAMPLES?

PROJECT SUMMARY

- WORLD FIRST
- SAWMILL RESIDUES
- PRODUCING RENEWABLE DIESEL AND RENEWABLE BITUMEN
- CAN BE CONVERTED TO JET FUEL
- PORT MACQUARIE REGION

Boral could turn sawmill residue into renewable diesel

*Category: News
*Date: 24 August 2023
*Project: Project

PROJECT EXAMPLES?

PROJECT SUMMARY

- ANAEROBIC DIGESTOR
- USING WASTE WATER FROM ABATTOIR
- OWNED AND OPERATED BY EXTERNAL COMPANY
- 50% REDUCTION IN ENERGY COSTS FOR ABATTOIR
- SIGNIFICANT EMISSIONS REDUCTIONS

Goulburn Bioenergy Project

$2.10m

$5.75m
PROJECT EXAMPLES?

PROJECT SUMMARY

- ANAEROBIC DIGESTOR
- USING THREE TYPES OF WASTE
- WASTE WATER TREATMENT PLANT
- DON SMALLGOODS
- DIVERTING ORGANICS FROM LANDFILL
- LOCAL JOBS
- LOCAL ENERGY PRODUCTION AND SECURITY
- SIGNIFICANT EMISSIONS REDUCTIONS

BIOENERGY STRONG

HIGHLIGHTS

- 30 PROJECTS BEING PROFILED
- SESSIONS ON GOVERNMENT SUPPORT
- SESSIONS ON TOOLS TO ASSIST IN ASSESSING THE VIABILITY OF YOUR PROJECT
- CEFC, ARENA, FORESIGHT, NAB, MACQUARIE
- INTERNATIONAL INVESTORS AND DEVELOPERS

TAKE25 – PROMOTIONAL CODE
THANK YOU

SHAHANA MCKENZIE
CEO BIOENERGY AUSTRALIA
Rivalea Energy mix

Energy use by fuel type

- Electricity: 28%
- Natural Gas: 21%
- LPG: 10%
- Liquid Fuels: 41%

Energy use by cost

- Electricity: 53%
- Natural Gas: 6%
- LPG: 6%
- Liquid Fuels: 35%
Corowa operations

How biogas is produced

Water recycled for flushing sheds

CO₂ + H₂O

Biogas captured

Anaerobic lagoon

FACULTATIVE

SETTLER
Construction March 2012
Module 5 Biogas project Key figures

- 40 ML lagoon – 2ML of effluent per day
- 6500m³ of gas per day
- 45,000 pigs
- Reduced emissions of 80,000 tonnes CO₂ since May ’13
- Annual emissions reduction of 20,000 tonnes CO₂
- Cover lifetime of 20 years

Biogas Generator installed April 2017
Electricity Market


Potential Future projects?

- More biogas
- Solar PV
- Solar Thermal
- Bio-char
- Use of biofuels and biomass
Locally grown bio-mass for energy?

- Solid bio-fuel can displace natural gas for industrial uses

<table>
<thead>
<tr>
<th>Table 3-1: Biomass Overview</th>
<th>Woody Biomass</th>
<th>Herbaceous Biomass</th>
<th>Biomass from Fruits and Seeds</th>
<th>Other (Including Mixtures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary (Energy crops)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood fuels</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Agro-fuels</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy forest trees</td>
<td></td>
<td>Energy grass</td>
<td>Energy grain</td>
<td></td>
</tr>
<tr>
<td>Energy plantation trees</td>
<td></td>
<td>Energy whole cereal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary (Byproducts)</td>
<td></td>
<td>Crop production byproducts</td>
<td>Animal byproducts</td>
<td></td>
</tr>
<tr>
<td>Thinning byproducts</td>
<td></td>
<td>Straw</td>
<td>Horticultural byproducts</td>
<td></td>
</tr>
<tr>
<td>Logging byproducts</td>
<td></td>
<td>Stones, shells, husks</td>
<td>Landscape management byproducts</td>
<td></td>
</tr>
<tr>
<td>Wood processing industry byproducts</td>
<td></td>
<td></td>
<td>Bio-sludge</td>
<td></td>
</tr>
<tr>
<td>Black liquor</td>
<td></td>
<td></td>
<td>Slaughter byproducts</td>
<td></td>
</tr>
<tr>
<td>Tertiary (End-use materials)</td>
<td></td>
<td>Wood processing industry byproducts</td>
<td>Food processing industry byproducts</td>
<td></td>
</tr>
<tr>
<td>Used wood</td>
<td></td>
<td>Fiber crop processing byproducts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used fiber products</td>
<td></td>
<td></td>
<td>Used products of fruits and seeds</td>
<td></td>
</tr>
</tbody>
</table>

Source: COPIL

Crop Stubble potential?

- Up to 5 t/ha crop stubble
- CO₂ returns to atmosphere immediately if burned
- Potential to process straw into fuel pellets
- Pellets can be burned in industrial boilers or household/commercial heaters.
- Household will use approx. 1 tonne of pellets per winter
Biomass boiler

Sludge
Composted bedding material
3 MIHG: How it Works

- Injection zone

3 MIHG: In Practice

- Feedstock is directly loaded into reaction cell
- Cell is closed and gasification zone is moved through bed
- Cell is cooled, purged and re-filled
7 Layout

Thank You
THE MALTING PROCESS... WHAT IS IT?

- Malting is the process of converting barley or other cereal grains into malt, primarily for use in the brewing and distilling industry.
- Grain is germinated to change the composition of starches, sugars and proteins inside the kernel.
- After sufficient modification the grain is dried to become shelf stable and give certain malty flavors.
- Grading
- Steeping
- Germination
- Kilning
- Deculming
- Cleaning
- Roasting
- Maturing
- Packaging

**STEEPING**

- 45% Moisture
- 24 – 48 hrs
- Soaking in aerated water
- Air rests
- CO2 removal
GERMINATING

- 5 Days
- Temperature
- Humidity

KILNING

- Energy Intensive – drying from 45% to 3% moisture
- Large volumes of air (70m3/min/ton) up to 120oC
- 32-36 hours (depending on schedule)
PYROCAL'S CONTINUOUS CARBONIZATION TECHNOLOGY (CCT)

- Installed 2016
- 250kg feedstock per hour
- 1,000L char roughly every 4 hours
- 300-500 kW hot water
- 350 days/year
The MacAnzac Project

100MW Agricultural waste to energy power station with Fuel briquetting, livestock feed pellets and cotton gin

Our Feedstock

Barley, Wheat, Canola and Rice straw
Cotton, Corn and Grape stalks
Nut shells and Cotton gin trash
A 35 year proven boiler technology

Stalks and Gin Trash

Cereal Straw

DP CleanTech Group
Combined Heat and Power
Dome Storage

This photo is Drax Biomass Power station (UK)
4 x 82,000 tons = 328,000 tons of wood and straw pellets

Straw Storage Sheds
Briquetting and Pelleting Process

New Cotton Gin

New highly efficient 256 bail an hour cotton gin powered by 100% low emission renewable energy.
Agricultural Fertilizers

The boiler ash is added to fertilizer and rice straw is added as the carrier.

Cattle Feed Pellets

Corn Stalks, Cotton Stalk, Almond Husks can also be added to grain to make a superb cattle feed pellets.

8mm pellets 25kg Bags, 1 Ton Bulka Bags and Bulk truck load’s.

Very cheap production costs due to low cost heat and power.
**Tesla Electric Trucks**

1000km Range (with the 1 M/Wh battery) 10 x 2MW charge points planned (for 30 minuet full charging)

*We believe the addition of Tesla Trucks would be the biggest game changer of all*

---

**Greenhouse Gas Savings**

One million tons of annual greenhouse gas savings

Climate change mitigation is the most important driving force for bioenergy development. Consequently, the environmental
design of bioenergy value chains should address the actual savings of both primary energy
demand and greenhouse gases (GHG)
and no GHG emissions should be
attributed to crop residues (like cereal straws) when they are removed from agricultural land for
the purpose of bioenergy utilisation.
The carbon neutral assumption applied to crop residues.
EPA and News Articles

The EPA have already recognized that the MacAnzac project would significantly help to improve air quality in the region.

Corporate Power Purchase Agreement

Talk to AgriWaste Energy about savings on your power and heat requirements.
This concludes our presentation

Thank you for your time

Author: Brannan Tempest
AgriWaste Energy Pty Ltd

Email: brannan.tempest@tme.com and please CC brannan.tempest@gmail.com
Mobile: 0478 037933  UK +44 7973 112519
Web: https://www.agriwasteenergy.com.au
Albury Biomass to Energy (AB2E)

28 August 2018

Current Mill Energy Position

- Two natural gas fired boilers produce the process steam used for the production of newsprint.
  - One fired on a combination of natural gas and bark fuel
  - One fired on natural gas only
  - Only one boiler operates at any one time
  - 3 MW electricity is generated on site (back pressure steam turbine)
  - Natural gas demand is 1,000,000GJ pa

- Our electricity demand is 630GWh pa supplied from the national electricity market
Future Cost of Electricity Considerations

- Total cost of electricity is currently 32% of operating costs
  - Energy, transmission, regulatory and renewable schemes
- What are the low cost options?
  - NEM price is currently too costly and is forecast to remain high
  - Five years is too late for the mill
- What will be the new pricing models?
  - How will power deals be structured?
  - How will transmission (and distribution) companies recover their previous and future investments?
  - What will be the cost of 5 minute trading in 2021?
- What might a new production model look like for the mill?
  - Production linked to power pricing?
  - Linked to derivative energy deals?
  - Other?

Albury Mill’s Approach

- Energy Efficiency
  - Don’t use it so don’t have to pay for it
  - Decreased annual electricity consumption from 750 GWh pa to 630GWh pa (excluding line loss factors) over past five years
  - For example we bypassed a 500kW motor/pump with alternate pipework
  - Increased the usage of bark fuel decreasing natural gas consumption by 300,000GJ pa (over past three years)

- Step change energy reduction projects
  - Advanced Quality Control implemented and reducing electrical energy by 5%
  - Alternate pulp processing, studied but not economic at present
  - AB2E (Combustion)
AB2E Project Metrics

- CO2 reduction of 23% or 152,400t CO2 per annum\(^1\)
- Main fuel will be biomass residues complying with the renewable energy scheme. Supplemented with natural gas
- 95% (55MW) of the Mill’s steam energy will be from renewable biomass residues
- 15% (11.5MW) of the Mill’s electricity will be from renewable biomass residues\(^2\). Remainder of the Mill’s electricity requirement is from the national electricity market
- Reduce natural gas consumption by 90%\(^3\)
- Capital investment of $75 million, $29 million in Australia, mostly local region
- 120 construction jobs
- 22 external jobs in biomass supply chain, 6 new direct jobs and 8 indirect jobs post construction (36 new jobs)

---

1. Or taking 33,100 cars off the road
2. Equates to supplying electricity to 15,350 households
3. Equates to supplying gas to 33,500 households

---

AB2E Project History

- Project feasibility undertaken in 2009/10
  - Produced the ideal project of a mix of cogeneration and biomass
    (Please refer to Appendix 1)
- Through the main study phases since then, the project has developed into the current AB2E project
- NSW I&I and AlburyCity invested in the main study phases
  - Norske Skog has spent over $1 million
- Third party options examined
  - Build a power station over the fence
  - Build Own Operate at the Mill site
Bankable Project

- Australia’s Energy policy
- Global competition for scarce capital resources
- “ENOVA” and Innovation Norway
  - Regional Growth Fund
- Comission de Regulation de l’Energie (CRE) France
  - Emissions Reduction Fund

AB2E Schematic
Biomass Boiler Fuel Switch Project
Bob Mac Smith
Director
MSM Milling

Based in Manildra in the heart of the NSW canola growing region.

Fully integrated oilseed crushing, oil refining, packaging and stockfeed manufacturing operation.

Operating since 1991. Started on the family farm and expanded to current site 11 years ago.
MSM Milling operates a business model with a strong focus on environmental sustainability.

Vision: to be the best supplier of healthy and sustainable Australian oilseed products domestically and internationally.

Our customers include:
**Bioenergy in Australia**

- Energy is MSM Milling’s 2nd largest expense
- MSM Milling needed a viable renewable alternative
- Australia has had little uptake of bioenergy, currently accounting for approx 0.9% of Australia’s energy mix
- There is large potential for Australian manufacturers to undertake fuel switch projects to bioenergy
- Bioenergy however is a mature technology in Europe
Typical European Biomass Boiler Installations
MSM Milling’s Fuel Switch Project

Replacing LPG Boilers with a 4.88 MW Biomass Boiler.

$5.38 million project. ARENA is providing $2 million

- Greenhouse emissions
- Fossil fuel energy use & depletion
- Costs
- Renewable energy generation in NSW
- Helps secure our future

The boiler will be fuelled by a mixture of sustainably sourced, local wood chips, saw dust, grindings and bark.

Construction is due for completion by mid-October.
**MSM Milling’s Sustainability Journey**

- MSM Milling is constantly investing in efficiency improvements

- The Biomass Boiler project will be MSM Milling’s largest sustainable investment to date

- 80,000 tonnes of CO₂ saved over the project life

- MSM Milling will be sharing knowledge from the project to raise the profile of Bioenergy in Australia
bobmacsmith@msmmilling.com.au

Interested in following the development?
Follow msmmilling on:
Biomass for Electricity: Opportunities for NSW

Fabiano Ximenes, Senior Research Scientist, DPI Forestry, August 2018

Problem and opportunity

- Energy security and reliance on fossil fuels for electricity generation major concerns for NSW

- Need for reliable electricity supply as coal-fired power stations phased out

Opportunity

- Biomass can provide baseload power without need for expensive storage solutions. Allow for gradual transition to wind / solar

- Contribute to GHG emission reductions; regional growth (job multiplier), opportunities to go off-grid

- Opportunity for diversification for farmers: energy crops

- 4 years, NSW Climate Change Fund
Scope and objectives

Use of biomass for medium / large scale electricity generation from biomass in NSW, from existing residues and new energy crops

Objectives

- Identify and test crops to supply biomass for bioenergy
- Conduct a techno-economic assessment of hybrid solar-biomass concepts
- Conduct a techno-economic assessment potential of biomass (white and torrefied pellets) for electricity generation.
- Analyse potential contribution of bioenergy to emissions reduction in NSW
- Analyse social perceptions towards bioenergy (social license)

Outcomes

- Biomass productivity (t/ha) determined for a range of sites
- Hot spots determined for hybrid solar:biomass solutions
- Electricity generation potential from biomass ($/kWh)
- GHG reduction potential from biomass (tCO$_2$-e/kWh)
- Contribution to NSW emission reduction targets determined (Mt CO$_2$-e).

“Adoption of biomass as a dispatchable energy option in NSW for electricity generation in NSW, resulting in lower emissions, greater energy security and promoting socio-economic growth in regional areas”
Energy Crops

Rationale

- As existing biomass is used, additional biomass sources may be needed
- Short-rotation (3-4 y), native wood crops
- Additional source of income: biomass harvest, carbon sequestration – no competition with traditional cropping
- Other benefits for land-holders – wind break; ecosystem services, potential for grazing
- Regional benefits: socio-economic
- Previously: Delta electricity biomass program

Energy Crops

Planned work

- Collaboration with CSIRO (Australian Tree Seed Centre)
- Testing of a number of native, woody crops (e.g. mallee) across a range of NSW regions (inland)
- Belt and block plantings, 3-4 ha trials
- Initial locations (DPI and SCS research stations) – Yanco, Orange, Scone, Tamworth, Glen Innes
- Additional trial areas: farms, mining lands
Hybrid energy systems

- Collaboration with UTS (Institute of Sustainable Futures)
Biomass for bioenergy - New DPI and ISF project overview

Griffith Biomass for Bioenergy Forum - Tuesday 28th August 2018

Overview of ISF:UTS project

- Objective to support policy & industry development for bioenergy projects in NSW
- Provide detailed technical feasibility study and undertake social research for hybrid solar-bioenergy projects in selected regions
- Identify what policy, institutional, social, economic and technical settings are required to enable new projects
- Develop business cases and policy guidance
Small scale bioenergy: hybrid solar-biomass concept

- Hybrid solar-biomass plants present potential cost savings and flexibility
  - by sharing key equipment (turbine, condenser)²
  - by using biomass and waste resources


Identifying feasible locations

- Develop a spatial model to determine feasible locations
- Model outputs will map, e.g.: solar resource, biomass feedstock availability, proximity to grid infrastructure
- Shortlisted locations will be the focus of in-depth cases studies providing technical, techno-economic, and environmental analyses
What combination of factors determines the ‘best’ locations?

Develop framework, e.g: Rural Livelihoods Analysis\(^3\),\(^4\)

Populate framework with data, e.g.: from ABBA, ABS, techno-economic study, expert stakeholder interviews, workshops

Produce NSW assessment tool

---

Stakeholder engagement informing business cases and policy guidance

- Understanding the impacts, constraints, enablers and opportunities of biomass energy in regions
- What are the settings for transforming the energy system?
- How to integrate strategies to address impacts?
Thank you

Contact:
nick.florin@uts.edu.au
### NSW total biomass for Straw Residues

<table>
<thead>
<tr>
<th>REGION NAME (ABS SA4)</th>
<th>TOTAL RESIDUES (dry tonnes)</th>
<th>Cereal Straw</th>
<th>Non-cereal Straw</th>
<th>Hay &amp; Silage</th>
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### NSW total biomass for Manure Residues

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<th>TOTAL RESIDUES (dry tonnes)</th>
<th>Layer Chickens (Mature)</th>
<th>Meat Chickens (Mature Breeding)</th>
<th>Pigpen Manure</th>
<th>Dairy Manure (Total 10%)</th>
<th>REGION TOTAL</th>
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<th>Dairy Manure (Total 100%)</th>
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| NSW TOTAL             | 27,145                      | 81,441                   | 45,620                        |              | 98,360                   |              | 222,706 | 1,094,080                 |
### NSW total biomass for Organic Waste

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<th>REGION NAME (former NSW)</th>
<th>TOTAL RESIDUES [t]</th>
<th>NOTE</th>
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<tbody>
<tr>
<td></td>
<td>MJW organic waste</td>
<td>C&amp;I organic waste</td>
</tr>
<tr>
<td>CEROJO</td>
<td>15.439</td>
<td>14.528</td>
</tr>
<tr>
<td>Hunter</td>
<td>189.866</td>
<td>141.534</td>
</tr>
<tr>
<td>MACROC</td>
<td>62.513</td>
<td>35.210</td>
</tr>
<tr>
<td>MIDWASTE</td>
<td>105.281</td>
<td>77.101</td>
</tr>
<tr>
<td>MurROC</td>
<td>4.262</td>
<td>4.553</td>
</tr>
<tr>
<td>NETWASTE</td>
<td>41.314</td>
<td>35.735</td>
</tr>
<tr>
<td>NEWP</td>
<td>96.037</td>
<td>33.644</td>
</tr>
<tr>
<td>NRW</td>
<td>17.119</td>
<td>17.280</td>
</tr>
<tr>
<td>NSROC</td>
<td>125.747</td>
<td>106.543</td>
</tr>
<tr>
<td>REROC</td>
<td>4.556</td>
<td>4.877</td>
</tr>
<tr>
<td>SSROC</td>
<td>211.583</td>
<td>177.694</td>
</tr>
<tr>
<td>VNRROC</td>
<td>249.313</td>
<td>189.774</td>
</tr>
<tr>
<td><strong>NSW TOTAL</strong></td>
<td><strong>1,178,999</strong></td>
<td><strong>882,066</strong></td>
</tr>
</tbody>
</table>

- \( \text{REROC} + \text{RivRROC} = 24,126 \text{ tonnes} \)

### NSW total biomass for Public and Private Forest Sawmill Residues

<table>
<thead>
<tr>
<th>REGION NAME (FCNSW Management Areas)</th>
<th>Public &amp; Private - TOTAL RESIDUES [dry tonnes]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Native/Plantation HARDWOOD &amp; CYPRESS</td>
</tr>
<tr>
<td></td>
<td>Sawmill Dark</td>
</tr>
<tr>
<td></td>
<td>Plantation SOFTWOOD</td>
</tr>
<tr>
<td></td>
<td>REGION TOTAL</td>
</tr>
<tr>
<td>Alloglana</td>
<td>1</td>
</tr>
<tr>
<td>Batemans Bay</td>
<td>1,634</td>
</tr>
<tr>
<td>Barrenil</td>
<td>851</td>
</tr>
<tr>
<td>Bulahdelah</td>
<td>2,381</td>
</tr>
<tr>
<td>Coffs Harbour</td>
<td>4,359</td>
</tr>
<tr>
<td>Cooma</td>
<td>265</td>
</tr>
<tr>
<td>Goulburn</td>
<td>963</td>
</tr>
<tr>
<td>Glouce</td>
<td>1,129</td>
</tr>
<tr>
<td>Grenfell</td>
<td>1,129</td>
</tr>
<tr>
<td>Hanwood</td>
<td>3,850</td>
</tr>
<tr>
<td>Kempsey</td>
<td>2,985</td>
</tr>
<tr>
<td>Kyack</td>
<td>9,111</td>
</tr>
<tr>
<td>Morong</td>
<td>1,961</td>
</tr>
<tr>
<td>Moss Vale</td>
<td>2,931</td>
</tr>
<tr>
<td>Mulgild</td>
<td>29</td>
</tr>
<tr>
<td>Narooma</td>
<td>1,183</td>
</tr>
<tr>
<td>Narromine</td>
<td>874</td>
</tr>
<tr>
<td>Naroom</td>
<td>4,430</td>
</tr>
</tbody>
</table>

**NSW TOTAL**: 4,430,70,466,191,580,109,040,82,009,240,026,700,551
| REGION NAME | FACEW (Management Area) | Harvest Weekend | Harvest Cover & Branches | Harvest Stump & Logs | Harvest Total | Harvest Weekend | Harvest Cover & Branches | Harvest Stump & Logs | Harvest Total | Harvest Weekend | Harvest Cover & Branches | Harvest Stump & Logs | Harvest Total | Harvest Weekend | Harvest Cover & Branches | Harvest Stump & Logs | Harvest Total | Harvest Weekend | Harvest Cover & Branches | Harvest Stump & Logs | Harvest Total |
|-------------|-------------------------|----------------|-------------------------|---------------------|-------------|----------------|----------------|---------------------|-------------|----------------|----------------|----------------|----------------|-------------|----------------|----------------|----------------|-------------|----------------|----------------|----------------|-------------|
| Phala | 899 | 2,173 | 851 | 2,096 | 3,899 | Tangerine | 2,173 | 851 | 2,096 | 3,899 | Tangerine | 2,173 | 851 | 2,096 | 3,899 | Tangerine | 2,173 | 851 | 2,096 | 3,899 |
| Bemm | 11,002 | 20,000 | 7,400 | 20,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 |
| Macquarie Bay | 120 | 130 | 90 | 0 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 |
| South | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 | 2,9 |
| Daintree | 12,538 | 17,637 | 2,135 | 48,911 | 159,431 | 39,300 | 71,000 | 3,850,408 | 633,784 | 44,135 | 31,900 | 1,545,538 | 1,545,538 | 1,545,538 | 1,545,538 | 1,545,538 | 1,545,538 | 1,545,538 | 1,545,538 | 1,545,538 | 1,545,538 | 1,545,538 | 1,545,538 | 1,545,538 |

**NSW total biomass for Public Forest Harvest Residues**
What is the Australian Biomass for Bioenergy Assessment (ABBA)?

The purpose of the Australian Biomass and Bioenergy Assessment 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 will collect, 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 www.nationalmap.gov.au/renewables.

The NSW Forest Science Unit of the Department of Primary Industries is responsible for the biomass data collection and maintenance for New South Wales.

Data collection and presentation

Data collected from the project will be presented on the AREMI platform as customisable layers. The data collected and uploaded will include:

- 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

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

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

The AREMI platform will be providing relevant data and information to the biomass industry. This will assist in creating market pull for bioenergy through tying bioenergy availability to biomass demand. Potential bioenergy users will be linked to bioenergy producers and regions of high industry potential for future activities.

Photos © NSW Department of Primary Industries
NSW ABBA Factsheet

Table 1: Potential key NSW biomass sources for data collection to be included on the AREMI platform

<table>
<thead>
<tr>
<th>Potential biomass sources</th>
<th>Suggested key areas of interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forestry</td>
<td>Harvest/wood-processing residues</td>
</tr>
<tr>
<td>Agriculture</td>
<td>Crops and livestock</td>
</tr>
<tr>
<td>Horticulture</td>
<td>Crops</td>
</tr>
<tr>
<td>Municipal Waste</td>
<td>Municipal Solid Waste (MSW), Construction and Demolition (C&amp;D) and Commercial and Industrial (C&amp;I) waste</td>
</tr>
</tbody>
</table>

Who can use this data?

This geospatial data will be available on the AREMI platform to be used by potential bioenergy investors, other biomass producers, current and future energy users and electricity providers, renewable energy project developers, policy makers, and the public.

The data can be viewed in conjunction with a multitude of other relevant spatial layers to enhance the visual interpretation and understanding of the data and its location in relation to other biomass sources, towns, transport networks, electricity networks, etc.

Timelines and background support

The initial data collection, maintenance and upload to the AREMI platform is scheduled to run from 2016 to 2020. Data will be published and continually updated throughout this time.

Get Involved

We will be working with biomass producers such as forest growers, farmers and food and fibre processors, industry peak bodies, research and development corporations (RDCs), waste managers, economic development groups such as in local councils, consultants, other state government agencies and sourcing information from within NSW Department of Primary Industries (DPI).

Do you want to help drive the types of biomass datasets being developed and uploaded to AREMI? Do you have tabular or spatial data available that could be incorporated and contribute to building strong reliable biomass location and volume datasets? It would be great to combine our research with existing data to develop strong datasets which potential bioenergy investors can use to develop new business and jobs.

If you would like to know more about the ABBA project or would like to be involved please contact us.

For further information please contact

Project manager

Fabiano Ximenes, NSW Forest Science
T: 0458 760 812
E: fabiano.ximenes@dpi.nsw.gov.au

Project & GIS officer

Catherine Carney, NSW Forest Science
T: 0439 915 269
E: cath.carney@dpi.nsw.gov.au

Acknowledgments

We acknowledge AgriFutures Australia (formerly RIRDC) for their contributions to this document.