A guide to handling wood by-products for use in bioenergy

wood-to-bioenergy: renewable energy from sawdust and other residues created in sawmilling and wood processing

Developed for use by sawmills and wood processing facilities that produce quantities of sawdust, wood shavings and chip fines, that could be used as bioenergy feedstock.

Wood by-products for renewable energy?

Emerging bioenergy markets provide opportunity for the use of sawmill wood residues and by-products as feedstock into wood-to-bioenergy facilities.

There are ambitions for expanding Australia’s wood-to-bioenergy sector, including it’s linkage with the forest products processing industry. With this will be opportunities for sawmills and other wood processing businesses to access renewable energy markets for the wood by-products they produce.

The use of wood for bioenergy generation reduces our energy carbon footprint.
A guide to handling wood by-products for use in bioenergy

wood-to-bioenergy: renewable energy from sawdust and other residues created in sawmilling and wood processing

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Project background

This guide was developed from findings of a study conducted with the sawmilling and solid wood product processing industry in South East NSW and North East Victoria.

This project was possible through a joint initiative between the Australian Government Department of Agriculture, Fisheries and Forestry and South East Fiber Exports.

The Australian Forest Products Association (AFPA) also contributed to the project.
Typical sawmilling and primary wood production process

incorporating wood by-products for biomass

A typical sawmill and primary wood processing system flow chart incorporating handling of wood by-products for use as biomass
Sawdust, wood shavings and chip fines

*ready-to-use feedstock for most wood-to-bioenergy generation facilities*

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**Considerations for handling**

Sawdust, wood shavings and chip fines have generally a desirable calorific value, dimension and moisture content for immediate use as feedstock for bioenergy generation.

Managing hygiene and moisture at the mill are important for maximising biomass value.

Use this manual to develop a system to handle wood by-products.

**Sawdust, wood shavings and chip fines**

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**Ready to use feedstock**

Fine particle size wood by-products are ready for use as feedstock into a wood-to-bioenergy facility. They tend to fall into three broad categories:

**Sawdust** wood by-product can be generated in large quantities through the log sawmilling process.

**Chip fines** are created in sawmills where off-cuts and the round sides of logs are diverted to a chipper. Wood by-products from this process includes chip fines that are too small to be sold as wood chip for paper production.

**Shavings** are created when sawn timber is moulded to specific section size. Shavings tend to be quite dry as timber is often seasoned before moulding.
Bark, oversize chip and large section woody pieces

*Potentially useful feedstock for most wood-to-bioenergy generation facilities although needs grinding to reduce particle size*

**Considerations for handling**

Further grinding and processing is required before large section size wood by-products like bark and oversize chip are ready as a feedstock for a wood-to-bioenergy facility.

Either at the wood processing facility (point of wood by-product generation) or at the wood-to-bioenergy facility itself, large wood pieces will require re-processing to reduce section size suitable for bioenergy generation.

**Extra processing to reduce section size**

Wood-to-bioenergy facilities will generally source wood biomass in a section size suitable for feedstock. This means wood pieces mostly finer, but no greater than 40mm diameter.

Depending on cost and equipment requirements it may not be economically justifiable to mechanically reduce section size of large wood pieces for use as biomass fuel.
Maintaining biomass hygiene

*rock, steel and other non-woody debris must not contaminate biomass for use in bioenergy generation*

**Considerations**

Hygiene directly relates to quality control.

Rocks and steel cause excessive wear and tear to wood-to-bioenergy facilities.

Contaminants in biomass will reduce the value of the product.

Good hygiene will be imperative to accessing biomass markets.

**Strategies to manage contamination**

Good hygiene practices are imperative to protecting wood biomass from contamination.

Concrete floors in biomass storage areas can be effective in protecting against rock and soil contaminants.

Conveyor systems require careful design to maintain biomass hygiene.

Outdoor storage and earthen floored areas expose biomass to contamination.
Managing biomass moisture

*moisture management and protection from rain is important for biomass calorific value*

**Considerations**

Generally it will not be feasible to mechanically dry wood biomass.

Passive moisture management techniques, such as air drying and protection from moisture are all that will be necessary for preparing wood by-products into the biomass market.

Common practice for storing wood by-products on-site is in open spaces on earthen floors.

Incineration of sawdust, chip fines and shavings is also common practice.

**Strategies for moisture management**

Protection against moisture ingress through rain is important for maintaining a consistent quality of biomass product.

Storing biomass to protect against moisture ingress will be best achieved through sealed containerisation, such as overhead hoppers.

Bunker storage systems, at the very least, need to be roofed to protect against rain.
Handling Wood By-Products for Bioenergy

Sorting and segregating biomass

Screening and conveyor systems

Considerations
Screen shakers to segregate particle size is an important feature in sorting biomass.

Screening and separating different residue types will be important in maintaining consistency and reliability in supply.

An effective screening and conveying system will transport biomass to storage points efficiently whilst protecting biomass from contamination.

The system will need to be integrated into the biomass storage system, as well as to the existing sawmill or wood processing operation.

Systems and technologies
An effective system for handling wood by-products will include segregation of wood by-products and good hygiene management (protecting against contamination from rocks, steel or other non-wood debris).

Various low friction techniques for moving conveyor belts are available, from the typical roller system to more modern air cushioning systems.

Conveyor systems are already common practice for handling wood chips.
Closed air flow systems move by-products directly from the point of generation to storage points.

Closed air flow systems are often used in moulding operations.

Closed air flow systems require specific complementary biomass storage systems. Rather than bunker systems, direct biomass injection into bins or containers is required.

Design will also need to consider loading into haulage vehicle systems, and should aid efficient loading systems, such as bin emptying directly to haulage vehicle.

A number of wood moulding facilities in Australia already use closed air flow systems as part of producing various products including parquetry, decking and structural decking.

Excellent hygiene standards can be expected from these systems.

There is some potential to incorporate closed air flow systems into collection and deposition of sawdust and chip fines.

They are best suited to collecting and on-site transporting of small particle size wood by-products.
Storing biomass on-site

**bunker systems**

**Considerations**

It is important that bunker systems for storing biomass provide protection from rain and contaminants.

Moisture ingress can make the biomass too wet as well as initiate decomposition. Both will reduce calorific value and therefore energy generation potential.

Bunker systems that include roofs and at least three walls can be adapted to screening and conveyor handling systems.

Design will also need to consider loading to haulage vehicle which will generally be done by front end loader.

**Basic bunker systems**

Overhead conveyors directly feed bunker systems.

Concrete based bunkers provide good hygiene standards, protecting against rock and soil contamination.

Bunkers are best applied where biomass is stored for only short periods.

For best efficiency, haulage vehicles must have clear and manoeuvrable access to bunkers.
Overhead hopper systems

Good hygiene standards can be maintained using overhead hopper systems, especially protection from moisture ingress.

Overhead hopper systems aids very efficient loading of haulage vehicles. Transport systems are already equipped for loading from overhead hopper systems.
Loading haulage vehicles

Front end loader practices

Ramps to aid loading to haulage vehicles can be incorporated to improve loading efficiency.

Caution needs to be taken to avoid contamination when loading, through soil and stones collected by the loader bucket.

Considerations

Most suitable for modest operations with relatively small volumes of generated wood by-products.

Front end loading is common practice for loading wood chips into haulage vehicles.
Loading haulage vehicles

**overhead hoppers**

**Considerations**

Efficient system for loading haulage vehicles.

Sliding door systems on conveyors and overhead hoppers also assist in maintaining hygiene.

**Hopper systems**

Overhead hoppers, which include mechanical slide doors, work by gravity, and are positioned to enable a haulage vehicle to park underneath.
Adapting existing operations

industry considerations in renewable energy production from wood by-products from biomass

Policy considerations

The value of wood by-products as biomass feedstock will depend heavily on Australian and State Government policies, that could either advantage or disadvantage wood based bioenergy generation.

The future recognition of wood-to-bioenergy in Government schemes, such as renewable energy credits is still very much an unknown.

Critical mass resource to supply a wood-to-biomass facility

It takes about 10,000 tonnes of wood by-products like sawdust, chip fines and shavings each year, to provide enough biomass to generate 1 megawatt of electricity. Heat will also be generated from a wood-to-bioenergy facility, which can also be used productively.

Biomass feedstock will generally involve blends of different wood-products to obtain the most suitable fuel moisture content, which is conducted just prior to feeding into the boiler. Most technologies work efficiently at biomass moisture ranges from 25% to 45%.
Market readiness considerations

wood by-product to feedstock for bioenergy generation

**Investment considerations**

Uniformity of biomass supply is important.

Predictability of biomass supply is also important.

Haulage distance from the timber mill (source of wood by-product generation) to the wood-to-bioenergy facility will be a critical economic consideration in supply.

Critical volume of biomass is also important. At least enough to load a semi trailer (i.e. 40 tonnes)

**Value of biomas = mill door price less handling costs**

<table>
<thead>
<tr>
<th>Mill door biomass price</th>
<th>Sawdust</th>
<th>Chip fines</th>
<th>Shavings</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value ($ per tonne)</td>
<td>$</td>
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<table>
<thead>
<tr>
<th>On-site handling costs</th>
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<tr>
<td>Labour cost ($ per tonne)</td>
</tr>
<tr>
<td>Energy costs ($ per tonne)</td>
</tr>
<tr>
<td>Other costs ($ per tonne)</td>
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<tr>
<td>Volume of consignment (t)</td>
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</tbody>
</table>

**Total handling cost**

$  

**Economic feasibility**

Mill gate prices for sawdust, chip fines and shavings will be influenced by haulage distance and biomass quality (hygiene and calorific value).

Moisture may also be influence mill door price, but as long as major water ingress has not occurred, green wood by-products will still be valuable as a biomass source.
Further reading

*use and benefits of wood by-products and climate friendly renewable energy production*

**The Australian Forest Products Association** say that there is enough wood by-products available from the existing forest and wood products industry activities in Australia (without harvesting a single extra tree) to produce around 3 million megawatt hours of electricity per annum.

### Benefits of wood-to-bioenergy

Using wood to create energy is renewable.

Wood biomass for energy generation is greenhouse gas neutral because it contains carbon that circulates through the environment.

Wood biomass replaces dependence on fossil fuels to generate energy thus lowering energy related emissions.

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**Information**


