Current Utilisation of Timber Waste and Recommendations for Future Uses

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Timber Development Association NSW

&

Australian Plantation Products and Paper Industry Council

Photo courtesy of Laminex Industries
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**Executive Summary**

This study has looked at the current uses for primary and secondary wood processing residues and end-of-life waste timber to gain a broad understanding of the current uses of these residues. The purpose of this is two-fold, to ascertain potential markets for end-of-life waste timber and to ensure that any future uses compliment rather than compete with these existing residue markets.

Management of wood processing residues has been, and continues to be, an essential requirement for anyone processing wood into timber. Management of waste timber after consumption is largely left to the final consumer to deal with. This study has found a number of businesses around Australia that manage this aspect of the timber supply chain.

This study has identified a large number of products made from secondary processing residue and end-of-life post timber in Australia and internationally.

The current major applications for post consumer waste timber and wood products are:

- Recycling of timber salvaged from demolitions
- Repair and reuse of timber pallets and packaging
- Recycling into mulch, compost and other landscaping applications
- Recycling into new reconstituted panel products such as particleboard
- Recycling into animal bedding products, particularly horse and poultry bedding
- Fuel for domestic heating
- Fuel for industrial process heat and/or electricity generation
- Sequestration of carbon

The study estimates that over 60,000 tonnes of timber is salvaged for recycling from demolitions. At least a further 500,000 tonnes is currently processed into mulch, chicken bedding and particleboard or used as energy products.

Use of post-consumer waste timber in some applications such as mulch is high compared to Europe while production of products such as particleboard or fuel is low. This utilisation mix probably higher demand in Australia for mulch products (enhanced by water restrictions), easy access to low priced alternatives sawmill and forest residues for production of particleboard and firewood, greater transport distances as well as lower demand for heating from waste wood.

However, the utilisation mix appears to be changing in some states due to increases in landfill taxes, increased competition for forestry resources in some areas and changes in legislation to encourage alternatives to fossil fuel, mainly for use in electricity production.

A wide variety of applications for pre-consumer timber processing wastes and primary processing residues have also been identified. Besides traditional markets such as boiler fuel, paper production, charcoal, animal bedding and as an ingredient in nursery soil mixes demand for sawmill residues is increasing for use in small markets such as wood/plastic and wood/cement composites.

The areas for greatest potential for growth appear to be:
• Greater recycling of salvaged timber and increased repair and reuse of pallets and packaging
• Increased supply of high value residential mulch and compost products
• Increasing use in reconstituted panel products
• Increased use in animal bedding products
• Increased supply of energy products
• Increased recognition of sequestration as a legitimate use for waste timber products not suitable for the above applications.

A range of markets are needed to maximise the value and maximise the recovery of waste timber. Each major urban centre has its own mix of drivers, infrastructure and markets that need to be understood before the development of a strategy to recycle and recover more waste timber.

Utilisation of post-consumer waste timber in products such as production of liquid fuels or charcoal appears some way off and will probably be applied to sawmill residues before they find any application in diverting end-of-life timber from landfills.

This study recommends at this stage to identify the barriers to increased utilisation for the above identified areas for growth and develop a strategy to work through these barriers in each major urban centre of Australia.
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1 Background to Report

The Timber Development Association and A3P have received funding from the Department of Agriculture, Fisheries and Forestry and the timber industry to develop an Extended Producer Responsibility Strategy for Waste Timber.

An important step in developing a Strategy for waste timber is to examine the current uses for waste timber.

1.1 Report Methodology

A literature review of Australian and international web-based documents.

Interviews were conducted with companies at all parts of the supply chain and those involved in producing the identified products.

A series of site visits were undertaken at key facilities in New South Wales, Victoria, South Australia and Western Australia. Telephone interviews were undertaken with key facility operators in Queensland and Tasmania.

Finally, targeted surveys were sent out to a number of businesses in the softwood and hardwood primary processing sector across Australia.

Due to the sensitive nature of some of the information obtained, TDA is bound by confidentiality agreements operators not to divulge individual data. As a result, all data presented in this report are aggregated.
2 Definitions and Current Utilisation

Some definitions need to be clarified as different industries have different names for the same material. What is waste to one person is another industries raw material. This is more so the case for wood and timber than many other materials. What follows is some clarification of definitions which are summarised in Table 1.

2.1 Forestry Residue

Forest residue makes up approximately 50 – 60% of the total material produced during the forestry harvesting stage.

According to MBAC Consulting in a report prepared for the National Association of Forest Industries in 2004 (NAFI 2004), residues from harvesting operations generated 4.2 million tonnes of dry biomass per annum. Most of this forestry residue is left in-situ to biodegrade or it is burnt on-site as this adds nutrients to the soil.

2.2 Primary Wood Processing Residue

Once wood has been harvested it is generally taken to primary processing facilities such as sawmills, pulpmills or panel plants. If timber is being produced, approximately 30 - 50% is converted into timber products depending on the feedstock, equipment and desired end product. The remainder - bark, sawdust and chip is primary processing sawmill residue.

Softwood primary processors produce chip residues at about 33-40% and sawdust at 8-12% of intake volume. Pulpmills and particleboard plants produce smaller proportions of residues (FAO 1991). MBAC Consulting estimated that residues from processing of wood generate an estimated 2.8 million tonnes of dry biomass per annum. They also found that much of this residue is already utilised. This finding has been confirmed by this research, interviews and surveys.

Most sawmills not only rely on the revenue from the timber they produce, but also from the revenue raised by sale or reduced cost of disposal of residue material generated by the processing operations. End markets for residues such as export woodchip for paper production, charcoal, reconstituted panel products, energy products (on-site and off-site), animal bedding and landscape applications are very important to the profitability of primary processing operations.

The residue generated at this stage of production is considered to be relatively free of contaminants and consistent, making it attractive to end users, many of whom are willing to pay good prices for the residues.

Uses for sawmill residues are diverse, primary uses include fuel for kiln-drying, woodchip for paper production (internal and export), panel production and landscape products (NRPFDC 2000).

2.3 Waste Timber

Waste timber is defined as the timber generated by the production, use and disposal of finished wood products. Sources include frame and truss manufacturers, workstation manufacturers as well as waste timber generated during the building process and the demolition of existing buildings. Large quantities of waste timber come are also derived from the timber packaging used to package manufactured goods imported into
Australia and transported around the country. Other sources are discarded furniture from houses and offices and fencing and vineyard posts from agricultural enterprises. **Figure 1** below illustrates a simplified product and waste flows to show the inter-relationship between products, residues and wastes.

Based on a review of published data and discussions with governments and industry around Australia, the Treated Timber Product Stewardship Group (TTPSG) estimates the current generation of waste timber to be around 1.5 million tonnes per year. It is estimated that at least 474,316 tonnes of this is recycled into other products or used as energy. See Table 1 below for the breakdown by state and territory (except Northern Territory) for recovery in each state and **Figure 2** below for a breakdown of the major products made with waste timber diverted from landfills in Australia.
These figures exclude salvaged timber and animal bedding which is broken down separately in the following pages.

<table>
<thead>
<tr>
<th>State</th>
<th>Data Year</th>
<th>Waste Timber Recovered (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>2005-2006</td>
<td>15,600¹</td>
</tr>
<tr>
<td>NSW</td>
<td>2003-2004</td>
<td>76,089*</td>
</tr>
<tr>
<td>QLD</td>
<td>2005-2006</td>
<td>20,000⁺</td>
</tr>
<tr>
<td>SA</td>
<td>2002-2003</td>
<td>116,000⁺</td>
</tr>
<tr>
<td>TAS</td>
<td>2005-2006</td>
<td>0</td>
</tr>
<tr>
<td>VIC</td>
<td>2004-2005</td>
<td>229,000⁺</td>
</tr>
<tr>
<td>WA (Perth)</td>
<td>2005-2006</td>
<td>17,627⁶</td>
</tr>
<tr>
<td>National</td>
<td></td>
<td>474,316</td>
</tr>
</tbody>
</table>

Table 1: Estimation of total post consumer waste timber recovered for recycling and energy – by state (excludes recycled salvaged timber and animal bedding))

Figure 2: Major products derived from waste timber and wood products diverted from landfills - Australia

³ Based on TDA interviews with Queensland reprocessors.
<table>
<thead>
<tr>
<th>Residue and waste classification</th>
<th>Sector</th>
<th>Source</th>
<th>Output</th>
<th>Current uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest residue</td>
<td>Forest harvesting</td>
<td>Thinning, logging, harvesting operations</td>
<td>Bark, branches, leaves, rejected trees, roots, stumps, thinnings, top wood</td>
<td>Preservation logs, particle board, MDF, landscape products, electricity production, cogeneration</td>
</tr>
<tr>
<td>Primary wood processing residue</td>
<td>Primary processing</td>
<td>Sawmills, board mills, treatment facility, MDF / particleboard / hardboard / plywood manufacture, pulp mills</td>
<td>Bark, edgings, off-cuts, rejects, sawdust, slab wood, shavings, wood chip</td>
<td>Paper production (domestic and export), particle board, MDF, hardboard, animal bedding, pellets, on-site disposal, energy products (on-site and off-site), landscape products, wood/plastic composites, wood/cement composites, wood flour, charcoal</td>
</tr>
<tr>
<td>Waste timber</td>
<td>C&amp;I waste</td>
<td>Secondary processing</td>
<td>Flooring, furniture, joinery, pallet and packaging manufacture, truss and frame manufacturers, kitchen and workstation manufacturers, treatment facilities</td>
<td>End-trim, damaged products, off-cuts, reject material / products, sander dust, sawdust, screening and grinding dust, shavings, veneer clippings / waste, treated timber wastes</td>
</tr>
<tr>
<td>Wood waste</td>
<td>Distribution – Wholesale and Retail</td>
<td>Distributors, importers, merchants</td>
<td>Possible secondary processing residues and rejected / damaged products</td>
<td></td>
</tr>
<tr>
<td>End-of-life timber and wood products</td>
<td>Construction</td>
<td>Builders, landscapers, fencing contractors, flooring contractors, kitchen fitters, shop fitters, scaffolding, concreters</td>
<td>Frame and truss off-cuts, sawdust, reject/damaged products, pallets and packaging, cable drums, plywood formwork</td>
<td>Salvage (reuse), landscape products, particleboard manufacturer, energy products, animal bedding</td>
</tr>
<tr>
<td>Urban wood residue</td>
<td>C&amp;D waste</td>
<td>Demolition</td>
<td>Builders, landscapers, fencing contractors, demolishers, kitchen fitters, shop fitters, rubbish removal, civil contractors, timber salvage operations</td>
<td>Coated timber, cladding, dimension timber, doors and door frames, fences, flooring, framing timber, panels and engineered wood composites using adhesives, piles, poles, solid wood, stakes, window frames, bridge and wharf timbers, telegraph poles</td>
</tr>
<tr>
<td>Salvaged wood residue</td>
<td>C&amp;I waste</td>
<td>Multiple industry and commercial businesses</td>
<td>Manufactured good importers</td>
<td>Pallet, crates and packaging, commercial and industrial end-of-life products such as furniture, scrap timber and panels, garden and landscaping waste</td>
</tr>
<tr>
<td>Post-consumer waste timber</td>
<td>Municipal waste</td>
<td>Municipal waste</td>
<td>Residential products, council public parks</td>
<td>Residential end-of-life products include furniture, scrap timber and panels, garden and park waste</td>
</tr>
<tr>
<td>C&amp;I waste</td>
<td>Agriculture</td>
<td>Viticulture</td>
<td>Fence posts, preservative treated posts</td>
<td>Salvage (reuse), domestic firewood</td>
</tr>
</tbody>
</table>
3 Reuse

Reuse of timber is a common practice throughout the world. In Australia, there are over 400 secondhand building materials businesses, the majority trading in salvaged timber. A number of businesses also specialise in repairing and reselling timber pallets. There are some markets for reuse of vineyard posts and utility poles which are briefly discussed. Also briefly discussed is the trade in second-hand timber furniture.

3.1 Salvaged Building Timber

Many companies specialise in salvaging timber from the deconstruction and demolition of buildings and civil structures. Timbers obtained include large section timber from road and rail bridges, old wool sheds and commercial buildings as well as from homes in the inner and middle ring of capital and regional cities.

Queensland’s Department of State Development, Trade and Innovation (DSDTI 2005) estimates that in Queensland alone, 20,000 m$^3$ of timber is salvaged and resold each year. Extrapolating this on a per capita basis to other states it is estimated that 100,500m$^3$ of structural and flooring timber is salvaged each year in Australia. Most of the salvaged timber is hardwood so, assuming a density of 630kg/m$^3$ (AGO 2005), this is equivalent to approximately 63,000 tonnes per annum. See Table 3 below.

<table>
<thead>
<tr>
<th>State</th>
<th>Estimated salvage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>cubic metres</td>
</tr>
<tr>
<td>ACT</td>
<td>1,500</td>
</tr>
<tr>
<td>NSW</td>
<td>34,000</td>
</tr>
<tr>
<td>QLD</td>
<td>20,000</td>
</tr>
<tr>
<td>SA</td>
<td>7,500</td>
</tr>
<tr>
<td>TAS</td>
<td>2,500</td>
</tr>
<tr>
<td>VIC</td>
<td>25,000</td>
</tr>
<tr>
<td>WA</td>
<td>10,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100,500</td>
</tr>
</tbody>
</table>

Table 3: Estimated quantities of salvaged timber recycled in Australia

Supply of salvaged recycled timber is limited. DSDTI report that larger sized demolition timbers have an estimated supply life of 20 years. Presumably this is because older structures, with large quantities of quality hardwood, are progressively reduced by demolition or protected by heritage listing. DSDTI also estimates that salvaged timber is only supplying 2% of the market for timber in Queensland.

Currently the demand for salvaged timber appears to be growing. It is used in high profile commercial fitouts as well as in high value architect designed homes. Much of the salvaged timber is from old-growth forest that was harvested decades ago and is in sizes and species no longer accessible from newly harvested native timber.
Additionally, salvaged timber has a perceived higher environmental attributes compared to new timber among many conservation groups, designers, architects and builders. The influential Green Building Council of Australia’s Green Star rating scheme heavily promotes the use of reused (recycled) salvaged timbers as do environmental groups such as WWF and the Australian Conservation Foundation.

There is a lot of interstate trade in salvaged timber to places where demand, and prices, are strongest. Large section hardwoods such as jarrah are sent from Perth to Victoria for machining into high value flooring for sale in that state. Salvaged timber is sent from demolished buildings in Sydney to Melbourne, Canberra, South Australia and Queensland and vice versa. Some salvaged hardwood is even sent overseas for processing in lower labour costs countries and imported back into Australia for sale.

In the Sydney area, popular softwoods such as Douglas Fir are much less likely to be salvaged unless in large sections. Within Australia, salvaged structural hardwood is widely available via popular “tip shops” co-located on landfills. These are more common in country areas and areas with small volumes of waste.

A number of landfills visited had formal and informal practices which separated out reusable lengths of timber from material suitable for chipping and recycling. Dial a Product has an arrangement with a local secondhand building materials supplier to supply salvaged timber. Kimbriki Landfill and Recycling Centre in the northern suburbs of Sydney has a second hand building yard in which they sell timber salvaged from the tip face. A load of good quality construction timber observed being dumped at a landfill in Melbourne was quickly surrounded by staff salvaging pulling out the best pieces, presumably for personal reuse.

A company called Resource operates at the only landfill in the ACT and salvages timber at this landfill for resale at a nearby ‘tip shop’. In Tasmania, there are numerous salvage operations as well as ‘tip ships’ located at waste management centres and landfills that salvage material, including reusable timber from the disposed material (DPIW 2007).

In Queensland, there are a large number of timber salvagers and resellers due to the widespread use of Australian hardwoods in buildings and increased demolition of these structures due to infrastructure reaching its end-of-life and urban renewal projects. One such salvage operator, Kennedy’s Timbers, has recently opened a new resource recovery facility to salvage large quantities of timber from mixed construction and demolition waste.
3.2 Pallets & Packaging
Pallet repair and reuse is also a widespread practice around the world. Within Australia, pallet pooling businesses such as Chep and Loscam have many pooling and repair facilities that can extend the life of a single pallet in excess of 10 years (Loscam 2007).

A number of other smaller companies in the major urban centres also repair and resell pallets. Companies such as Enviro Pallets in Sydney, Waste Converters in Melbourne and Adelaide Pallet Recycling in Adelaide, Pallet Repair Co. in Hobart and Pallet Recyclers in Queensland and Activ Industries in Perth repair and resell pallets. Enviro Pallets claim to have recycled over 300,000 pallets in 2006.

Also widespread is the recovery and sale of cable reels for telecommunications and power cables. Companies such as the Australian Cable Reel Company collect empty reels directly from customers, repair any damage there may be and return the reels for re-use.

3.3 Vineyard Posts
The Australian Wine Industry report that large quantities of end-of-life CCA treated vineyard posts are given away to farmers and other people for use in fencing, landscaping and other purposes (Peter Llewellyn, Timber Development Association South Australia pers comm. 2007).

Reuse of CCA treated posts is increasing due to the unavailability of suitable landfills in South Australian for large quantities of CCA treated timber.

3.4 Railway Sleepers
The use of reclaimed hardwood railways sleepers is also very common. The majority are used to build retaining walls with smaller proportions used as driveways, jetty construction and firewood. During normal maintenance, approximately every fourth sleeper is replaced every two years. The recent awarding of a contract too replace all the timber sleepers on the Melbourne to Sydney line by the Australian Railway Track Corporation with concrete sleepers is expected to result in a large increase in supply of used sleepers. Many of the sleepers in good condition will be used to replace timber sleepers in poor condition on branch lines (Russell Ainley, Forest Product Association of NSW pers comm. 2007). Sleeper salvage is usually tendered out to the highest bidder and those who can comply with stringent quick removal and OH&S requirements.

3.5 Utility Poles
Timber utility poles are commonly used in many parts of Australia with approximately 2 million in New South Wales alone (EANSW 1999).
Approximately 1% of these poles are replaced annually, which is equal to the replacement of 20,000 poles per annum. At least 95% of those currently are hardwood eucalyptus species are treated before installation as well as during their service life.

There is some evidence of utility poles being set aside at landfills and either reused on site, or collected by people who reuse them. Dial-A-Product in Inner Sydney had an arrangement with a local second hand building materials supplier to purchase a wide range of timber – including piles and poles.

In Queensland, a local salvage business, Kennedy Timbers has a contract with the major electricity utility, Energex to process and sell used power poles and last year sold a large quantity of timber from this source. About 70-80,000 poles are pulled out each year in Queensland, with a lot being reused or cut up for firewood. Energex also states that wood poles are sometimes reused by property owners for fencing material in remote areas (ENA 2006).

To increase reuse of utility poles, Koppers Wood Products, one of the major suppliers of treated timber poles, has recently released a timber and galvanized steel composite pole product. Composite pole recycling is available for re-using viable portions of reclaimed poles alleviating the current disposal problem faced by utility pole customers in some areas of Australia.

### 3.6 Furniture

The trade in second-hand domestic and office furniture is widespread. No attempt has been made to quantify the trade in these goods as it was viewed as being beyond the scope of this study. However, salvaged timber companies have identified the furniture industry as a major buyer of salvaged timber for production in Australia.

Besides the obvious informal networks, many charities such as the Salvation Army and St Vincent de Paul pick-up and resell furniture in Australia and other developed countries.
4 Recycled and Energy Products

Compared to forestry and primary processing residues, there are a small number of applications that waste timber is currently used for. The main applications are landscaping products such as mulch followed by energy, animal bedding and reconstituted panels.

In the United States, post-consumer waste timber markets are dominated by production of landscaping mulch and fuel products (Falk & McKeever 2004). Chipped and shredded waste timber is also used as a composting bulk agent, sewage sludge bulking medium and animal bedding.

In the United Kingdom the main utilisation of post consumer waste timber is panelboard production followed combustion in small boilers, horticultural surface products, animal bedding and energy recovery (WRAP 2004).

In other parts of Europe panelboard production and energy are the dominant uses (Warnken 2001).

4.1 Manufactured Wood Products

4.1.1 Particleboard

The use of end-of-life waste timber pallets and packaging as well as timber production waste is increasing in Australia.

Three particleboard manufactures are producing particleboard from post-consumer waste timber; Laminex in Western Australia, D&R Henderson in Victoria and small quantities by Carter Holt Harvey in Queensland.

Laminex have entered into using waste timber in a serious way in the last three years. They accept large quantities of softwood / pine packaging and lightly coloured (tan) timbers such as pallets, packaging and crates of light construction at their facility in Welshpool, Perth. They also accept quantities of laminated veneer lumber (LVL) from a local manufacturer. This material was previously burnt. Material accepted at Welshpool is given a primary chip onsite before being back-loaded to the Laminex manufacturing facility at Dardenup south of Perth.

Companies dropping off waste timber (including many large waste companies such as SITA and Cleanaway) at the Welshpool site are charged a reduced rate compared to dropping off timber at transfer stations or landfills. To increase supply of waste timber, Laminex have been negotiating with a number of parties throughout Perth to set up waste timber processing facilities timber to supply Laminex. The Eastern Metropolitan Regional Council is currently building such a waste wood facility on 100 hectares of land next to Perth Airport.
D&R Henderson have a waste timber recycling facility located at their distribution warehouse at Coolaroo in the northern suburbs of Melbourne. The company accepts a range of timber products such as pallets, packaging, fruit crates, offcuts from manufacturing and some demolition timber. The material is shredded on-site and backloaded to their production facility at Benalla north of Melbourne.

D&R Henderson has received grants of $170,000 from the Victorian Government to install the shredding and loading systems at the Coolaroo facility.

In Queensland, Carter Holt Harvey’s Wood Products Australia uses dockings from frame and truss manufacturers north of Brisbane for inclusion in their new particleboard. A small price is paid for the dockings which is much cheaper than disposal costs for the companies involved.

In New South Wales, Carter Holt Harvey uses particleboard offcuts from major customers of output from their Tumut plant. Offcuts are accepted for free and arrive on trucks which deliver new particleboard to their customers. These offcuts are chipped and feed into their boiler to provide process heat.

Total quantities recycled into new particleboard are estimated at 12,000 tonnes in 2003/04. Laminex and D&R Henderson are both working to increase the amount of waste timber they recycle however the infrastructure for recycling material for particleboard is limited to areas of the country reasonably close to particleboard mills capable and needing to use waste timber. Additionally, the ability of waste timber processors to access this market application depends on their ability to supply “clean” material that meets fairly tight industry specs. One processor interviewed with experience supplying the European particleboard markets with recycle product explained that the specification is very tight in Australia compared to Europe. As a result, timber from demolition processes, which is acceptable in Europe, contains too much sand and grit for the Australian manufacturers.

In Europe, 14% of particleboard is made from recycled post-consumer waste timber with recycling particularly prevalent in Germany, Italy and the United Kingdom Janssens (2003).

4.1.2 Flooring product
A number of those interviewed referred to the possibility of using hardwood dockings in the manufacture of other flooring products; only one facility was found to currently do it. Drouin West Timber, based at Morwell in Victoria export high grade dockings to China for use in the manufacture of housing components which are then exported to Japan (VAFI 2005).

Kennedy’s Timber is piloting the production of a flooring product made from hardwoods salvaged from demolitions.

4.1.3 Cement bonded products
Within Australia, TimberCrete® produces bricks made from sawdust, cement, sand and other materials. These bricks are highly durable, fire resistant and have better noise and insulation characteristics than traditional cement and clay bricks. There are 14 manufacturers of Timbercrete® products throughout Australia with another 6 factories in New Zealand and the United States. The Australian manufacturers’ source
their sawdust from local pine sawmills throughout Australia. They mostly use green sawdust however they can also use dry sawdust though they cannot use the very fine and dry sawdust produced by frame and truss manufacturers. The business is currently growing however TimberCrete® say that they may have difficulty sourcing product from sawmills in the future due to competition from companies sourcing material for nurseries. Brokers are also locking sawmills up to long-term supply agreements to buy all their residue products which they cannot offer at this stage.

In the United States, Faswall™ is a timber/cement wall construction system that use clean waste wood that is locally available (e.g., recycled hardwood pallets). The main ingredient is wood (approximately 85%), with cement and fly ash making up the remaining 12% and 3%, respectively. (KX Faswell 2007).

In Canada, Durisol, is a proprietary cement-bonded wood fiber material. It is composed of specially graded recycled waste wood (100% clean, natural softwood lumber), that is neutralized and mineralized, and then bonded together with Portland cement.

4.1.4 Wood Plastic Composite Products

Wood plastic composite products are now common in the United States and in Europe (Clemens 2007). Most use sawmill residue but some now use urban wood residue as their wood fibre source.

Australia’s first (and currently only) manufacturer of wood/plastic composite products is ModWood Technologies. ModWood have a production plant in Melbourne and source pine residue from local sawmills as well as post consumer waste from a frame and truss manufacturers. They prefer wood shavings which they mill into wood flour for incorporation into a range of decking, screening and heavy duty products (James Grandison pers. comm.).

4.2 Landscaping Products

4.2.1 Mulch

Production of mulch to improve the soil, suppress weeds and to reduce water evaporation is a well established industry. Bark removed from logs prior to sawing or pulping is commonly used to produce a range of fine to coarse mulch products. Wood chips not suitable for export for paper production structural timber is also commonly sold to producers of mulch products.

Increasingly, waste timber from pallets, packaging and old fencing is chipped into a range of products for sale to private gardeners and the landscaping industry.

Mulch producers report that mulch made from post-consumer waste timber is long lasting due to its low moisture content.

Markets are good for this product in Victoria, where landscapers use large quantities on many of the freeways around the main urban areas. There is also a commonly accepted specification for waste timber mulches called MR12/20, TG12/20, BK12/20 (standing for Moss Rock, Twigg Group and Bark King respectively). This common terminology for the product seems to help landscapers source recycled material.
In NSW, a large producer of mulch using post-consumer timber is Australian Native Landscapes. They use the registered terms forest blend® and forest fines® to describe their 100% recycled products. Australian Native Landscapes operate stand alone processing facilities but also operate on landfill sites in western and northern Sydney.

Dial-A-Product, operating on a landfill in inner city Sydney, produces two sizes of product as well – woodchips fine and woodchips blend garden mulch for weed control and to aid in water retention.

In South Australia, the market demand for mulch products is very strong. Water restrictions and the demands for reduced water usage are resulting in strong utilisation of mulch products made from forest and sawmill residue as well from waste timber in urban areas.

In Queensland, a number of companies process waste timber into mulch and composted products. The main ones are Phoenix Recyclers and Wood Mulchers and, until recently, Blinks Chop and Chip. The main activity for these companies is the processing of green waste or garden organics for local councils. Processing of waste timber from businesses is only a small proportion of what they do. The main use for the waste timber is as an ingredient in compost products and soil conditioners, not as a mulch product.

Markets in Western Australia appear immature for mulch made from waste timber as they have to compete with mulch produced from garden waste which is often given away for free by local councils (Geraldine Busby, Eastern Metropolitan Regional Council pers comm.) as well as low-priced mulch produced from forest and sawmill residues.

In Tasmania, no mulch producers have been identified using waste timber to produce mulch or compost products. The drivers for reducing water usage are not as great and there appears ample sawmill and forest residue available close to urban markets.
This study also found one company that is shredding waste timber on-site for use by builders and landscapers. Force 5 operates an on-site recycling service in Queensland, Victoria and New South Wales. At lock-up stage timber and plasterboard “carpet” mulch is laid around the base of the house to reduce the potential of workers slipping over in wet conditions. This also helps controls erosion and provides the added benefit of nutrients to the soil. The mulch is left for builders or landscapers to spread through garden beds.

Using the mulch on-site saves transport costs to the landfill and transport costs associated with the delivery of mulch by the landscape supplies. On-site mulching of waste timber is not included in the recycling figures.

4.2.1.1 Dyed mulch
A small but growing area of mulch products is dyed mulch. Due to their lower moisture content and ability to soak up dye, dyed waste timber mulches have superior colour fastness than naturally coloured wood chips (such as red gum). They also hold their colour for longer making them a popular choice among landscapers. Colours available include red, brown, gold, black, terracotta, green and blue.

Producers include Twigg Garden Supplies in Victoria, Australian Native Landscapes in New South Wales, Jeffries in South Australia and Rainbow Mulch in Western Australia. Sustainability Victoria has assisted some companies in Melbourne to purchase dying machines to produce this value added product.

4.2.2 Compost/ Soil Mixes
Fine matter from chipping of waste timber was added to composted garden organics by one of the processors interviewed. The timber added body and water holding capacity to the compost mix. This practice is an extension of existing practices that use sawdust and bark from primary processing of timber.

Similarly, another soil mix company is adding shredded particleboard off cuts to their product mixes supplied to the horticultural market. The company cited particleboards ability to hold 400% of its weight in water as a significant advantage as it displaced the use of purchased costly commercial water retention additives. The quantities added to the product were small, in the order of 400 tonnes per annum.

4.2.3 Playground Soft fall
While some overseas sources such as WRAP in the UK cite playground soft fall as a use for waste timber, there is no evidence that this waste timber is used for this purpose in Australia. This market appears well catered for from pine bark produced from forest and primary processing residues.
4.2.4 **Mushroom substrate**
Mushroom substrate is made from wheat straw, stable bedding, poultry litter, and other organic materials. As sawdust and shavings, some sourced from waste timber, are commonly used in poultry litter, indirectly waste timber is used in mushroom substrate production. This waste gets a third use if the spent mushroom substrate is sold as mushroom compost.

Huon Valley Mushrooms in Tasmania are using small quantities of eucalyptus sawdust to produce mushroom substrate for high value exotic mushrooms.

4.2.5 **Landfill Cover**
Some shredded waste timber products are used in applications such as environmental remediation (DEC 2006a) including as landfill cover to reduce odours and windblown litter.

One landfill in Melbourne related that, following attempts to extract timber from a mixed waste stream, the physical contaminants still in the separated material was too great to be sold as mulch. Subsequently they were now using the 30,000 cubic metre stockpile in landscaping around the landfill.

Another landfill interviewed in Sydney related that they used to set aside large quantities of waste timber for periodic shredding and use as landfill cover. However, as the NSW Department of Environment and Conservation had recently changed the regulations so that the landfill operators could no longer claim a rebate for this activity, they had discontinued this practice and now let it all go though to the landfill.

In Victoria, a fixed rebate of 15% is provided for in the Act to allow for a sufficient amount of cover material (EPA VIC 2006). The existence or otherwise of a recycling rebate system was not raised as an issue by landfill operators interviewed in other states.

The University of New South Wales and GHD have successfully trialed the use of shredded garden and timber waste as a bio-filtration medium to reduce greenhouse gas emissions from old landfills (DEC 2006b). No company interviewed was currently utilizing wood waste for this purpose.

Nicky Bailey of Chipmunks Recycling Services in Western Australia has extensive experience processing waste timber for markets in Europe before moving to Australia. He related that the use of shredded waste timber in Europe for access roads for landfills and quarries was very common, as it made it easier for trucks and other vehicles to move around these types of sites in wet weather.
4.3 Equestrian Products

Sawdust and shavings are both used extensively in products for the equestrian industry including surfaces for arenas, horse bedding and even hoof drying for Clydesdales.

Due to the high value of horses, many owners do not like to use hardwoods or material that is too fine, too coarse or may have splinters in it. By-products of sawmills and wood processing industries using new pine are more popular for this application than waste timber.

Softwood shavings are very popular for this application and a timber dressing facility in Western Sydney can get $13-16 per tonne from customers for this waste product.

4.4 Animal Bedding

Bedding for animals is an important outlet for some waste wood. Bedding material provides warmth as well as drainage and/or absorbency. Bedding medium made from wood is reasonably long lasting compared to other beddings which has cost savings benefits. The biggest markets for these products are for horse and poultry bedding but there are also important markets for cattle and pigs as well as domestic pets such as cats.

4.4.1 Poultry Bedding

Large quantities of sawdust and shavings are used to provide bedding for poultry bedding. According to a report prepared for the Rural Industries Research and Development Corporation (RIRDC) in 2006, approximately 236,370 cubic metres of sawdust were used for chicken bedding in addition to 486,065 cubic metres of wood shavings (RIRDC 2007).

It is very difficult to identify what proportion of shavings and sawdust is from primary processing operations (residues) as opposed to being sourced from secondary processing (wastes). Material sourced from secondary processing businesses such as furniture makers and joineries ranged from 0% to 95% of those interviewed. For the purposes of this study we have estimated that 20% of shavings and sawdust is from secondary processing sources.

Sawdust and shavings are relatively light weight materials and are sold on a cubic metre basis. Businesses stated that 30 cubic metres of sawdust weighed five tonnes while the same volume of shavings only weighed 3.5 tonnes. These density estimates have been used to convert volumes into tonnages in Table 4 below.
The price paid for new poultry bedding varies from state to state depending on supply and demand. Prices for sawdust range from $7.80 in Tasmania to as high as $14.50 in New South Wales. Prices for shavings vary from $6.70 in Victoria to $16.00 in New South Wales.

One company in Melbourne is now producing sawdust from pallet waste (post-consumer waste) due to a reduction in the number of businesses generating sawdust in recent years and increased demand from poultry sheds due to a reduction in the availability of other bedding materials such as rice hulls.

The RIRDC report cites a company in the United States producing poultry litter called LitterPlus from pallet waste though we were unable to verify this.

### 4.4.2 Cattle and Pig Bedding
Small quantities of sawdust are also used in cattle bedding. Sawdust and shavings can be used to provide bedding for pigs (NSW DPI 2006) as well as provide an excellent way of disposing of carcasses with minimal environmental problems (Steve Small EPA NSW pers comm.).

### 4.4.3 Domestic Pets
A large number of suppliers act as brokers in supplying primary and secondary processing residues and wastes to the pet bedding market for reptiles, birds, ferrets, cats and dogs.

### 4.4.4 Cat Litter
Production of quality cat litter is also a popular use for sawdust and shavings. Pellet Heaters Australia also makes a pellet product specifically for this purpose which is highly regarded for its adsorption and odour reduction characteristics as well as its longevity.

### 4.5 Energy Products
A range of products are currently produced from residues and waste timber products. Next to mulch, it is the greatest use for waste timber.

#### 4.5.1 Domestic
Wood fuels have been used for cooking and heating houses for centuries. Traditional wood energy use still accounts for approximately 10% of the world’s energy supply.
(Hillring 2003). About 55% of the 4.5 billion m³ of wood used annually by the world’s population is used directly as fuel wood or charcoal. This figure is expected to increase on average by around 1.5% per annum (FAO, 1999).

In Australia it is estimated that 6 million tonnes of firewood are used in Australia for domestic firewood each year with 4.6% (~280,000 tonnes) being sourced from sawmills/joineries (Environment Australia 2001). In general, both production and use are local and largely informal. Even in the past, strong competition appeared between wood for energy use and other uses of timber (shipbuilding, charcoal for iron industry etc.).

It is still relatively common to see frame & truss and packaging manufacturers with bins just inside or outside the factory gates with a “free firewood” sign attached. Most recycling occurs through informal arrangements with members of the public.

However, those interviewed report that the use of waste timber for this purpose has been significantly reduced over the years as air quality requirements in urban areas have increased and people install electric or gas heating and cooking. Additionally OH&S and public liability concerns have meant that factory managers are less likely to welcome people onto their sites to pick-up wood dockings or leave dockings on the verge outside for people to take away for free.

In the United Kingdom the increased use of renewable wood fuel for domestic heating is actively encouraged by the National Energy Foundation with the support of the Department of Environment – DEFRA. Log Pile is a project from the National Energy Foundation (NEF 2007). The National Energy Foundation is an independent educational charity.

A study by Meinhardt (Vic) on behalf of WM Waste Management in 1997 found that many timbers off cuts were used for firewood, as well as by schools and kindergartens in craft activities and by toy manufacturers (Meinhardt 1997).

4.5.1.1 Pellets
Pellets for use in domestic wood pellet stoves are currently produced from hardwood processing residues at Woodburn in Northern NSW by Pellet Heaters Australia and in Tasmania by Scottsdale Hop Growers from pine sawmill residues. Production of wood pellets is very common in Europe, North America and New Zealand.

Wood pellets are made from sawmill wood wastes, principally untreated sawdust, timber chips and shavings. These wastes are pulverized in a hammer mill and then fed into a drum drier to remove moisture. Dried particles are then extruded into hard, dry, compressed pellets about 12mm long and 6mm in diameter. After cooling, conditioning and quality control screening, the pellets are packed into bags for distribution to the customer.

In the USA there are now 80 pellet mills recycling wood processing by-products to manufacture high-quality fuel. Europe’s annual consumption of pellet fuel now surpasses
that of the USA. Market share of pellet fires and fuel has been steadily increasing in these countries (Carey 2001).

There are two pellet production plants in New Zealand with two more planned. Pellets made from Australian hardwood have very low ash content and attract a premium in the European market. Demand is good and increasing in cooler parts of Australia. Capital costs are reasonably high with a 1 tonne per hour plant costing about $1 million and a 10 tonne per hour plant costing about $12 million.

Wood pellets power industrial and commercial facilities in Europe and the United States.

4.5.1.2 Briquettes
Due to the relatively low capital costs, compressing waste timber sawdust into briquettes for use as fuel is a widespread practice around the world. Briquettes can be manufactured directly from mill waste and sawdust as well as from the wood pulp residue following oil extraction. They are manufactured in a simple hydraulic press and chemical bonds are created without the addition of glue.

Producers and sellers of briquettes made from sawdust in Australia include National Cedar Company in Berry, NSW and Shiver Me Timbers in Melbourne. Sustainability Victoria report that a number of furniture manufacturers briquette sawdust for sale as a fuel in Melbourne and Geelong.

Acora Reneco, who supply briquetting machines to industry report that they have sold numerous briquetting machines to a diverse range of wood processing companies including window and door manufacturers. Many of these are for compacting waste for size reduction and to reduce OH&S issues with handling the dust waste rather than for supplying fuel products.

4.5.2 Industrial
The major industrial user of wood residues for energy production is the timber industry itself. Wood residues from sawmills are used to provide heat for kiln drying of timber. Other major energy users of sawmill residues are the paper industry. Visy Pulp and Paper use forestry and sawmill and their own residues to power a cogeneration facility in Tumut, NSW. A number of sugar mills in Queensland also use wood chips from sawmills residue to supplement their energy needs from sugar cane bagasse.

Utilisation of post consumer waste timber for industrial energy is restricted to a smaller number of facilities.
The current major user of post consumer waste timber for energy in Australia is Adelaide Brighton Cement in Port Adelaide. Adelaide Brighton have formed a joint venture, the *Alternative Fuel Company* with ResourceCo, an Adelaide based waste management company. The *Alternative Fuel Company* accepts mixed construction, demolition and commercial waste at a specially built facility in Wingfield. The incoming material is crushed, sorted and separated into various recyclable component materials (see Figure 3 below). Timber and woody material is kept with paper and plastic to and further processed into a timber rich fuel. The fuel is transported to Adelaide Brighton Cement’s cement kiln which is located about 5km away at Port Adelaide.

Other users of post consumer waste timber for energy include Delta Electricity in the Hunter Valley of NSW and Rocky Point Power Station located south of Brisbane. Until recently Visy also used post consumer waste timber at their Tumut facility. The ‘urban wood residue’ was mainly comprised of waste timber packaging, demolition timber not suitable for salvage and solid wood offcuts from secondary wood processing facilities such as frame and truss manufacturers. Visy have expressed an interest in using post-consumer waste timber again when the mill doubles its capacity in coming years (*Kenneth Epp pers comm.*).

Other companies have expressed a strong interest in using waste timber as fuel to produce electricity and or process heat. Consolidated Energy is currently building a facility in Dandenong, in eastern suburbs of Melbourne to combust waste timber and woody material from gardens to generate electricity. Due to commence operations in June 2007, it is anticipated that the facility will use 20,000 tonnes per year. A similar facility using about the same quantity is planned for western Sydney but is yet to get development approval. Another biofuel facility is planned for Perth but has not yet submitted a development application.

Particleboard, MDF, plywood and other engineered wood offcuts, off-spec materials and returns are used to generate energy in all particleboard, MDF and engineered wood products plants. Carter Holt Harvey at Tumut and Oberon was the only facility found that accepted post consumer offcuts of particleboard from a major customer for use of fuel to generate process heat. Significant quantities of post-consumer waste wood of this type, commonly in the form of fine sawdust, are generated at joineries and furniture makers.

Wood residues and waste timber can be used directly, co-fired with other fuels or converted into another form for use as a fuel at another site.
Figure 3: Waste sorting and fuel preparation process of the Adelaide Brighton Cement and ResourceCo Joint venture – Alternative Fuel Company
Boral Hancock fully utilises its log timber input at its Ipswich plywood mill in Queensland. Bark, timber log ends, cores and other waste products are recycled and used as fuel for heat and steam production or sold to a local landscaping company.

Boral Timber report that in financial year 2006 95% of its wood processing residue was re-used or recycled for fuel, landscaping or agricultural purposes. Waste wood per unit of production remained relatively constant compared to the previous two years however total waste production in terms of tonnage increased from 538,000 tonnes in 2005 to 560,000 tonnes in 2006.

Hyne at Tumbarumba in NSW uses large quantities of their sawmill residues to heat oil to kiln dry their pine timber. Notaras in Grafton, NSW also generate low pressure steam to kiln dry their hardwood timber from burning shavings generated on-site in a boiler.

A number of power stations throughout Australia use waste wood co-fired with coal. Pinetec and Western Power have a partnership in Collie, Western Australia which results in 78,000 tonnes of pine sawmill residue being used per year to co-fire with coal. Up to 5% of their total fuel requirements can be wood processing residue.

This is also the case with Macquarie Generation and Delta Electricity in NSW using sawmill and forest residue. Hazelwood Power Station in Victoria is using wood from a plantation destroyed by bushfire.

4.5.3 Gas and Liquid Fuels

No commercial plants in Australia convert wood residue, pre or post consumer, into gas and or liquid fuel. However, one pilot plant in Somersby, north of Sydney has trialed the use of sawmill residue to produce liquid fuels (BEST Energies 2007). There is also one pilot gasification plant in Canada uses primary wood processing residues to produce a liquid fuel (Tolko 2007). There have been significant recent policy changes in Europe which are encouraging rapid development of processes to produce both gas and liquid fuels from wood processing residues (BioPact 2007). Most of these are at the early stages of development.

4.6 Charcoal

Simcoa at Kemerton in Western Australia manufacture charcoal to produce high quality silicon. Simcoa are using a mixture of approximately 100,000 tonnes of mixture of forest residues (from commercial logging for sawn timber) and sawmill sawdust and off cuts each year.

Simcoa have expressed an interest in trialing the use of waste particleboard and MDF in the production of charcoal.

4.7 Other

Other uses for residue and untreated secondary processing wastes include, packaging, smoking foods adsorption (Pollards 2007), fertilizer additive and wood flour.

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7 Hazell Brothers in Tasmania are mixing sawdust with fish guts to make a fertilizer product.
4.7.1 Wood Flour
Wood flour has major industrial markets in industrial fillers, binders, and extenders in industrial products like epoxy resins, fertilizers, adhesives, absorbent materials, felt roofing, inert explosive components, ceramics, floor tiles, cleaning products, wood fillers, caulks and putties, soil extenders, and a vast array of plastics. Shavings and sawdust can be reground into wood flour, or wood flour may be recovered as sized “dust” material from sawdust that has been screened and separated (Burden 2006).

5 Carbon Sequestration
Another current use for waste timber is its important role in the sequestration of carbon. The longer the wood stays in use or protected from deterioration, the longer the carbon remains stored within the product.

According to the Australian Greenhouse Office Workbook (AGO 2005), wood waste (including timber) releases very large quantities of methane when disposed of in landfills. Where waste material is diverted from landfill to recycling or to energy use, the AGO considers that these significant landfill emissions are avoided.

Interviews with landfill operators, researchers and local government reveals that this assumption may be very exaggerated. The rate at which timber deteriorates in landfill is questioned by landfill operators (Sam Bateman pers comm) and researchers (Fabiano Ximenes pers comm.) as their experience and research demonstrates that timber deteriorates at a much slower rate than the official AGO figures.

These experiences and findings are supported by government staff digging up landfills to estimate the density of waste timber in Perth. Samples taken of timber deposited in landfills showed little or no evidence of deterioration (Geraldine Busby pers comm.).

One pyrolysis process identified in Australia at pilot stage claims to produce a very stable char product that has significant agricultural carbon sequestration benefits (Nature 2006).

While currently this use has no direct monetary value, the potential introduction of a greenhouse gas emissions trading scheme could alter the value of carbon sequestration dramatically.

6 Disposal
Disposal of wood residues and waste timber by burning, either in the open or in small on-site facilities is still a practice used by a number of facilities. One sawdust and shavings trader in Sydney cited this practice as the reason they no longer were able to obtain material from many businesses in the Sydney area. Other sawmills, particularly small mills a long way from markets in rural areas, cited this as the cheapest form of disposal.
7 Discussion and Recommendations

This study set out to review the current utilisation of waste timber in Australia and internationally.

It found that there while there are many uses for primary processing residues, there is a fairly limited range of uses for secondary processing residues and end-of-life timber.

The main product is the production of mulch and as an ingredient in compost products. Some producers are value adding the mulch products with the addition of dye to make a high value coloured mulch. Other producers are basically shredding the waste timber and using it onsite, forgoing the need for marketing the product.

Some mulch producers, particularly in Melbourne and some parts of Sydney and Adelaide are very well organised, have professional sales staff, produce a consistent product and have access to good outlets for their product.

Other producers are not so well organised and have trouble finding markets for their waste derived products.

Production and utilisation of biofuel is a particularly big utilisation of waste timber in Adelaide. A similar use is proposed in Melbourne with one project already under construction and due to open in June 2007. Similar facilities are proposed for Sydney and Perth but are yet to gain development approval. The one existing biofuel facility utilizing waste timber in South-east Queensland is struggling to source enough waste timber for its cogeneration boiler.

Utilisation of waste timber for recycling into particleboard is occurring in Melbourne and Perth and has potential to double in Melbourne and increase greatly in Perth.

Salvage and sale of waste timber from demolition sites is a common practice in all states of Australia as is utilisation for domestic firewood.

Production and sale of secondhand salvaged timber is expected to increase in Queensland due to the recent opening of a large waste timber salvage operation in the Northern suburbs of Brisbane.

The barriers to increased utilisation in each product stream can be quite specific to a particular city or state given different regulations, economics of transport, type of existing facilities as well as the geographic location of end-users.

It is recommended that the barriers to increasing utilisation of waste timber in the many markets be more closely examined on a state by state basis as well as within each major waste stream to inform the development of a national waste timber strategy.
8 Bibliography


Fabiano Ximanes - Research Officer, NSW Department of Primary Industries, pers comm..


Geraldine Busby - Market Development Officer, Eastern Metropolitan Regional Council, pers comm.


James Grandison – Modwood Technologies, pers comm.


Sam Bateman - Project Manager, Hanson Landfill Services, pers comm.


## 9 List of Interviews

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