Review of International EPR schemes & timber recycling for the Timber Development Association (NSW)

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Summary

Infield was commissioned by the Timber Development Association (TDA) to review international extended producer responsibility (EPR) initiatives and assess their applicability to product stewardship of waste timber in Australia.

The following report discusses the background to producer responsibility, different interpretations that apply in different parts of the world and the current status of EPR programs.

Only one example of EPR applied to timber was identified. This operates in Finland. However a number of industry examples of timber recycling product stewardship were identified in Europe and the United States.

Although some forms of timber recycling are well developed throughout the world, other options have a more sporadic take up. In countries that have regulations in place that limit disposal options and drive recycling, the timber recycling industry is generally better developed.

What has emerged from the research is that data for the generation and recycling of waste wood is lacking throughout the world. The UK has made the best attempt to date to quantify this information.

It is recommended that the timber industry in Australia works with government to obtain reliable national data. With this information it will be possible to develop properly targeted education programs and commercially viable recycling schemes.
Background to EPR

The term ‘Extended Producer Responsibility’ and its original concept are attributed to Thomas Lindhqvist of the International Institute for Industrial Environmental Economics (IIIEE). He defined EPR in a report to the Swedish Ministry of the Environmental and Natural Resources in 1990. However the model was first adopted in the German Packaging Ordinance of 1991.

The catalyst for the Ordinance was concern about the levels of waste generation and rapidly filling landfills. This was coupled with government’s desire to stimulate innovation in product design and material reuse. It was considered that moving responsibility for end-of-life products from municipalities to producers would drive such innovation and also make Germany a leader in the development of environmental technologies.

The concept has spread throughout Europe and is implicit in several Directives of the European Union. Outside Europe, Canada, Japan, Korea and Taiwan have been leaders in adopting EPR as a policy and enshrining it in legislation.

Drivers for EPR

Products are targeted for EPR for a number of reasons, however the rise of EPR has coincided with increased consumerism in western countries and a corresponding rise in the level of waste arisings. In many countries this also coincided with an impending shortage of landfill capacity.

Reasons quoted for the establishment of EPR schemes include:

- Rapidly increasing volumes of waste to disposal either via incineration or landfill and a prevalence of the targeted product in the waste stream
  
  Example: At the time Germany’s Packaging Ordinance was developed, packaging was estimated to comprise about 30% by weight of the waste stream.

- Perceived risks posed to human health and the environment created by the disposal of products containing toxic components

  Example: NiCd batteries were considered to pose a threat in both landfills and incinerators. Refrigerators (CFCs) and computers (lead & other chemicals) are subject to EPR for similar reasons.

- Dumping of products that were banned from landfill or incineration due to handling difficulties or toxicity concerns

  Example: Tyres make it difficult to compact waste in landfills and operators have increased charges for their disposal. As a result they have been stockpiled and subject to arson, or dumped around the countryside.
- Waste of potential resources

  Example: Although resource conservation and reuse has not been a driver for specific EPR schemes, it forms one of the major policy drivers for the concept as a whole.

**What is EPR?**

There has been much discussion about the definition of Extended Producer Responsibility. All implementation schemes differ to greater or lesser degrees depending on local circumstances and the type of product.

What is generally agreed in the European context is that EPR has three core elements:

- It extends the responsibility of producers to the post-consumer stage of a product
- The responsibility of the producer is either physical or financial
- Guidelines are set by government with regard to recycling targets and acceptable treatment options

This understanding of EPR is focussed on the end-of-life of products but with an implicit objective to make producers aware of the disposal costs of their products and thus encourage ‘design for recycling’ (DfR).

The United States has adopted a different approach to EPR. The USEPA defines EPR as Extended Product Responsibility and prefers the term Product Stewardship. It calls for all the players involved in the product lifecycle to ‘reduce the environmental impacts of products’. The effect of this modification is to broaden the concept of EPR and include discussion on the often-conflicting aspects of lifecycle assessment. It thus takes much of the focus away from producers and increases the emphasis on the roles of retailers, consumers and the waste industry.

In Australia, the Western Australian Government’s policy is that Extended Producer Responsibility is a subset of Product Stewardship / Extended Product Responsibility. The NSW Government has refrained from defining either EPR or Product Stewardship with the premise that the objective and outcome of a product-based project are more important than a definition of terms. However, it is implicit that producers have a key role in any EPR programme.

Regardless of the definition of EPR, implementation schemes (including those enacted by American States) have in common that certain products are treated separately to the rest of the waste stream and that the producer (being the manufacturer or the brand owner) has some form of physical or financial role in the collection and treatment of its products.
Types of EPR schemes

Schemes developed to implement EPR vary widely and reflect the national and local situation as well as industry and product characteristics. They range from voluntary to regulated; can be national, state or locally based; industry wide or limited to individual companies; and focused on a single product or a related range of products.

As discussed by Fishbein\(^{15}\), although EPR programs are generally described as either ‘voluntary’ or ‘regulatory’, realistically they “fall along a continuum from mandated to truly voluntary. Mandatory programs are those that result from laws and regulations. Truly voluntary EPR initiatives are generally implemented when a company is able to make a profit or gain a marketing advantage by taking back its products.” Programs that are instituted on a ‘voluntary’ basis to pre-empt legislation are “not truly voluntary, and fall midway along the continuum”.

Under mandatory EPR schemes, rarely is the ‘producer’ solely responsible. Retailers, governments, municipalities, the public and even the waste industry can all be assigned a role. However for individual company initiated voluntary schemes, the company may take responsibility for the entire collection and take-back operation.

The ‘producer’ responsible under an EPR scheme is usually the brand owner but may include the:

- manufacturer of the final product
- manufacturer of a part of the product
- importer
- ‘filler’
- distributor

For schemes shared among a number of producers, the method of raising and allocating operational funds varies markedly. Industry, through contributions from various players in the product value chain may bear all costs, or some contributions may be forthcoming in the form of physical collection services by municipalities, or financial grants from central governments. Almost inevitably at least the majority of the operational costs end up being covered through increases in the prices of new goods either as a transparent levy or incorporated cost.

A common vehicle for a shared scheme is for a company to be established by an industry association to manage the financial and operational aspects of the scheme. This model can be found throughout Europe and has also been adopted in Japan. A slightly different model has been adopted in Canada where a body, established by government incorporates both private and public representatives.

The following table sets out some of the roles assigned to different players under various mandatory EPR schemes.
<table>
<thead>
<tr>
<th>Element</th>
<th>Variations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of producer</td>
<td>Manufacturer, Filler, Importer, Retailer</td>
</tr>
<tr>
<td>Role of producer</td>
<td>Take-back their products, Arrange for take-back sites,</td>
</tr>
<tr>
<td></td>
<td>Arrange for recycling/treatment, Design for durability and repair,</td>
</tr>
<tr>
<td></td>
<td>Fund take-back, transport and treatment, Advertise the scheme,</td>
</tr>
<tr>
<td></td>
<td>Publish recycling data</td>
</tr>
<tr>
<td>Role of retailer</td>
<td>Take back product they have sold, Take back product on purchase of new similar product, Organise transfer of product to the producer, No role at all</td>
</tr>
<tr>
<td>Role of local government</td>
<td>Organise special product collection systems, Transfer products to producer,</td>
</tr>
<tr>
<td></td>
<td>Promote recycling scheme, No role at all</td>
</tr>
<tr>
<td>Role of central government</td>
<td>Enforcement of legislation, Monitoring of implementation, Setting and revision of targets, Data collection, Promotion of recycling scheme, Provide low interest loans to support scheme, Carry out R&amp;D, Act as intermediary in the recycling market, Participate in EPR scheme management</td>
</tr>
<tr>
<td>Role of public</td>
<td>Hand in used products to retailers, Dispose of used products correctly, Pay for disposal of product, Pay levy on new product</td>
</tr>
<tr>
<td>Operational model</td>
<td>Managed by division of industry association, Managed by separate company set up by industry association, Managed by group of producers, Managed by individual producer, Managed by central government</td>
</tr>
<tr>
<td>Funding model</td>
<td>Disposal fees paid by product users, Fees incorporated into cost of new goods, Visible levy applied to new goods, Fees paid by producers to government</td>
</tr>
</tbody>
</table>
International EPR - Current status

Packaging, batteries, refrigerants, electrical and electronic equipment, oil and tyres are the most common products targeted for EPR schemes. Various schemes also exist for separate collection of pharmaceuticals, used paint, used pesticides and pesticide containers.

A voluntary scheme in Finland is the only EPR programme that has been identified for the recycling of treated timber.

The following table sets out some of the recognised national and state based EPR schemes. It is by no means comprehensive as a plethora of sub-regulatory and voluntary schemes exist throughout the world ranging from municipality focused programs to company based international systems.

<table>
<thead>
<tr>
<th>Region</th>
<th>Country</th>
<th>Type of scheme</th>
<th>Products covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oceania</td>
<td>Australia</td>
<td>Voluntary</td>
<td>Packaging; waste oil; tyres; pesticide containers (drumMUSTER); mobile phones; pharmaceuticals; plastic shopping bags</td>
</tr>
<tr>
<td></td>
<td>New Zealand</td>
<td>Voluntary</td>
<td>Packaging</td>
</tr>
<tr>
<td>Asia</td>
<td>China</td>
<td>Regulatory</td>
<td>Electrical and electronic goods (as per EU WEEE Directive) in train.</td>
</tr>
<tr>
<td></td>
<td>Japan</td>
<td>Regulatory</td>
<td>Containers &amp; packaging; Home appliances – TVs, refrigerators, air conditioners, washing machines; PCs and peripherals, storage batteries; End-of-Life Vehicles</td>
</tr>
<tr>
<td></td>
<td>South Korea</td>
<td>Regulatory</td>
<td>TVs, refrigerators, air conditioners, washing machines, PCs, audio cassettes, cell phones, lubricating oil, fluorescent tubes, packaging film, batteries, metal cans, glass bottles, paper packs, plastic packaging/ synthetic resins, printers &amp; copy machines, fax machines.</td>
</tr>
<tr>
<td></td>
<td>Taiwan</td>
<td>Regulatory</td>
<td>TVs, air conditioners, refrigerators, washing machines, computers, computer accessories, batteries, tyres, packaging etc.</td>
</tr>
<tr>
<td>North America</td>
<td>Canada</td>
<td>Regulatory</td>
<td>Refrigerants</td>
</tr>
<tr>
<td></td>
<td>Alberta</td>
<td>Regulatory</td>
<td>Used oil; Electronics – TVs, all IT, audio &amp; video, telecom, games</td>
</tr>
<tr>
<td></td>
<td>British Columbia</td>
<td>Voluntary</td>
<td>Batteries; packaging; beverage containers; pesticide containers</td>
</tr>
<tr>
<td></td>
<td>Manitoba</td>
<td>Regulatory</td>
<td>Packaging, used oil, paper &amp; cardboard, some plastics; tyres</td>
</tr>
<tr>
<td></td>
<td>New Brunswick</td>
<td>Regulatory</td>
<td>Beverage containers; tyres</td>
</tr>
<tr>
<td>Region</td>
<td>Country</td>
<td>Type of scheme</td>
<td>Products covered</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------</td>
<td>----------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Newfoundland</td>
<td>Regulatory</td>
<td>Beverage containers</td>
<td></td>
</tr>
<tr>
<td>North West Territories</td>
<td>Voluntary</td>
<td>Beverage containers</td>
<td></td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>Regulatory</td>
<td>Beverage containers; oil; tyres</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Voluntary</td>
<td>Milk packaging</td>
<td></td>
</tr>
<tr>
<td>Ontario</td>
<td>Regulatory</td>
<td>Packaging, tyres, oil, WEEE (in train)</td>
<td></td>
</tr>
<tr>
<td>Quebec</td>
<td>Regulatory</td>
<td>Beverage containers; used oil; paint; tyres</td>
<td></td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>Regulatory</td>
<td>Beverage containers; used oil; tyres</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>Voluntary</td>
<td>Batteries; End-of-Life Vehicles; carpets</td>
<td></td>
</tr>
<tr>
<td>USA – California</td>
<td>Regulatory</td>
<td>Electronic waste</td>
<td></td>
</tr>
<tr>
<td>USA – Maine</td>
<td>Regulatory</td>
<td>Computers, TV screens</td>
<td></td>
</tr>
<tr>
<td>South America</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brazil</td>
<td>Regulatory</td>
<td>Used oil; tyres; pesticide containers; batteries</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Voluntary</td>
<td>Mobile phones</td>
<td></td>
</tr>
<tr>
<td>EU – Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Holland, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, Slovenia, Slovakia, Spain, Sweden, UK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regulatory</td>
<td>Packaging &amp; Packaging waste **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regulatory</td>
<td>Waste oils</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regulatory</td>
<td>Batteries</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regulatory</td>
<td>End-of-life Vehicles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regulatory</td>
<td>Waste Electrical &amp; Electronic Equipment (WEEE) under the following categories:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Large household appliances (fridges, washing machines, stoves, etc)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Small household appliances (vacuum cleaners, clocks etc)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. IT and telecommunications equipment</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>4. Consumer equipment (radios, TVs, etc)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>5. Lighting equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Electrical &amp; electronic tools</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Toys, leisure &amp; sports equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. Medical devices</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9. Monitoring &amp; control equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10. Automatic dispensers</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>Voluntary</td>
<td>Treated timber</td>
<td></td>
</tr>
<tr>
<td>Holland</td>
<td>Regulatory</td>
<td>Tyres</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Voluntary</td>
<td>Agricultural plastic films, PVC</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>Voluntary</td>
<td>Direct mail &amp; promotions material (junk mail), magazines, newsprint recycled content, farm plastic (pending)</td>
<td></td>
</tr>
<tr>
<td>Other Europe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>Regulatory</td>
<td>Packaging: WEEE - all types of electrical and electronic goods; batteries; end-of-life vehicles; tyres,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proposed</td>
<td>Treated timber</td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>Regulatory</td>
<td>Packaging: WEEE - all types of electrical and electronic goods; lamps; batteries &amp; accumulators</td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>Voluntary</td>
<td>Refrigerators; tyres</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Latest amendments to the EU Packaging Directive provide specific material recycling targets, including wood (eg used pallets).
There is currently a proposal in France for an EPR scheme to cover textile recycling. A bill is in train to enable a recycling fee to be applied to the cost of new clothes. Should the bill become law, it is anticipated similar schemes would be established throughout the EU.53
Effectiveness of EPR Schemes

The effectiveness of EPR schemes can only be measured against the objectives that applied at the establishment of any particular program, be it hazardous waste reduction, reduction in waste to landfill or better product design.

Recent studies have focussed on the effectiveness of EPR in achieving its ultimate objective of influencing producers to design for the environment. It has been concluded that a number of examples exist to show that EPR regulation has been effective in encouraging some manufacturers to rethink their designs to make products less resource intensive and more easily recyclable.

It is also recognised that this objective is more often achieved when EPR programs are company rather than collectively based. Companies are willing to take responsibility for their own products in a competitive market, but have no incentives if their efforts are lost in the lowest common denominator of a collective system.

Many EPR schemes have been criticised for their cost of operation and the ultimate burden on the consumer, however it is difficult to obtain detailed information on costs from the various operators.

EPR programs do help to divert material away from landfill and are effective at separating hazardous wastes from the remainder of the waste stream. However many materials, especially mixed plastics are often ‘recycled’ as an energy source due to both difficulties in achieving total separation and to undeveloped markets for specific recyclates.
EPR and Wood

It is rare to find a producer responsibility scheme aimed solely at timber products. The only formal program identified in this review was one in Finland specific to CCA and creosote treated timber^24. However timber boxes, pallets and large industrial packaging are included under the European Packaging Directive.

The Finnish program was instigated in 1996 when the Finnish Environment Institute requested the Wood Preserving Industry to develop a method of recycling ‘impregnated’ (CCA and creosote only) timber. The first trial recycling project commenced in 1997. In 1998 the industry signed a producer responsibility agreement with the Environment Institute for collection and recycling of waste wood treated with preservatives.

Demolite Oy is the company set up by the Finnish Wood Preserving Association to manage the collection and recycling of treated timber. Since its establishment in 2000, significant research has been carried out into appropriate means of burning treated timbers for energy recovery. Demolite Oy is currently collecting, shredding and stockpiling treated timber at a special depot established at Tuulos 100km north of Helsinki. A special furnace to burn the timber for heat and energy recovery is under construction as a joint venture between Demolite Oy and the local energy company.

Costs for the scheme are covered by a recycling payment at the time of purchase as well as a disposal charge for large volumes of material.

Norway^12 classified CCA and creosote treated timber as hazardous waste in early 2003. Following this the government entered into negotiations with the treated timber industry to set up a producer responsibility scheme similar to the one in Finland. As at March 2004 these discussions were in abeyance awaiting the technical outcome of a number of incineration trials. Recent information^13 has confirmed that no producer responsibility schemes for treated timber have yet been developed in Norway.

Pallets and other timber packaging fall under ‘packaging’ as defined in the European Packaging and Packaging Waste Directive 94/62/EC of December 1994. A 2004 amendment to the Directive sets up specific recycling targets for a range of packaging materials including wood. By the end of 2008, EU countries are to recycle at least 15% of all wood packaging. The UK has included recycling targets for wood packaging since 2001^38.

Producer responsibility legislation and agreements are not however the only drivers for recovery and recycling of timber wastes and a variety of recycling initiatives have been identified throughout the world.
Other recycling drivers

Some forms of timber recycling have been established for many years. These are driven by the prospect of commercial returns and have been operating as part of mainstream business for tens, or sometimes hundreds of years. A particular example is the antique furniture trade.

Pallet recycling, which is now well organised throughout Europe, the US and Australia, has been operating at the local level since the 1950s.\(^{32}\)

More recently a market for good quality demolition timber and ‘antique’ house fittings has become established, mostly aimed at home renovators. A small industry has also developed to remanufacture old timbers from the demolition of industrial buildings, jetties and bridges, into sought-after timber floorboards and furniture pieces.

It is only when it is more economic to dispose of timber waste than to recycle it that it finds its way into the waste stream. Where disposal options are limited and charges for waste acceptance are high, more timber recycling operations are established.

Timber wastes being presented at landfill are usually badly damaged manufactured products or low value timbers such as one-use imported pallets and packaging, degraded pine, small dimension hardwoods, particleboard or composite products made from timber and other materials.

Where market forces fail, governments use a number of mechanisms to encourage recycling in preference to disposal. Examples include:

- **Levies on disposal** such as those now operating in NSW, Victoria and Western Australia. The NSW waste levy in particular has raised the costs of disposal of demolition waste to the point where the majority is now recycled.

- **Bans on certain wastes in landfill.** In Europe the landfill directive restricts the disposal of high calorific value wastes in landfill. This includes wood. In the US, Massachusetts has recently banned all construction and demolition wastes from landfill.

- **Timber specific legislation.** Germany’s Waste Timber Ordinance came into force in 2003. It sets guidelines for the classification and acceptance of timber wastes with the objective of creating business certainty for timber recyclers.

- **Regulations and linked strategies or guidelines that place recycling targets on local authorities.** Examples are the waste strategies prepared by Australian States.

- **Extended Producer Responsibility** as discussed in previous sections. EPR moves responsibility from local government to the commercial sector.
- Grants to assist companies establish recycling operations. The Waste and Resources Action Programme (WRAP) in the UK is a major provider of seed funding to businesses.

- Other forms of economic incentive. The UK Landfill Tax Credits Scheme allows landfill operators to direct up to 20% of the tax they have collected towards local environmental programs (as long as 10% of the funding for each program comes from other sources).

The timber industry has responded to the changing mood about waste generation and the environment in general, by setting up a number of programs of its own.
Industry recycling initiatives

Research for this study has identified three major initiatives by timber industry associations to promote recycling, although others may also exist. The organisations are:

- TRADA (Timber Research and Development Association) in the UK
- GROW (Group Recycling of Wood) in Europe
- AFANDPA (American Forest and Paper Association) in the US.

TRADA

TRADA has been instrumental in setting up the Timber Recycling Information Centre (TRIC) in the UK which operates an information website and conducts a number of associated projects. The diagram above outlines the relationships between TRADA, and TRIC and the funding mechanisms used to run the project. Both the Timber Industry Environment Trust and Biffaward can obtain funds from the Landfill Tax Credit Scheme.

Through TRIC, the industry has carried out a number of mass balance and sustainability studies as well as a significant report into timber waste management in the UK.56

GROW

GROW was set up by originally in 1991 by manufacturers of wooden packaging from Germany Belgium, France, Luxembourg, Holland and Spain. It grew in
response to packaging legislation and now has a network including Austria, Italy, Greece, Portugal, Switzerland and Turkey.

GROW manages the collection and recycling of wooden packaging particularly for the fruit and vegetable industry.

AFANDPA
In 1996 AFANDPA published the National Wood Recycling Directory that listed over 700 companies in the USA that accepted and reprocessed wood wastes. The Directory went online in 1998. In 1999 AFANDPA also set up the Wood Recovery Alliance to improve the recovery of used and scrap wood.
Waste timber management options

The diagram on the following page depicts the major categories of wood wastes generated by the industry. Also shown are the recycling and waste management options that have been identified for specific timber and wood waste streams. These include:

- Energy recovery
- Mulch/compost
- Particleboard
- Animal bedding
- Landscape/play surfaces
- Plastic/wood ‘flour’ composite
- Concrete additive
- Reuse and remanufacture in buildings & furniture
- Reuse in landscaping
- Package filler
- Pet litter

With minor exceptions, the same options apply for both pre-consumer and post-consumer timber wastes.

Options for recycling of timber wastes that are impregnated with or coated with problem substances are either restricted or require special conditions for processing.

A study by TRADA in the UK identified a number of possible ways that treated timber could be decontaminated or put to useful purposes viz:

- Burning for energy recovery
  - With special filters to capture arsenic
- Chemical extraction of metals with acids
- Bio-degradation with bacteria
- Bio processing with wood decay fungi
Waste wood management options

Pre-consumer wood waste
- Harvest/milling whole wood discards
- Milling/processing residues - chips, shavings, sawdust, bark etc.
- Manufacturing wood residues - offcuts (may have non-hazardous coatings)

Post consumer wood waste
- Used whole timber
- Problem whole timber - (chemical coatings/impregnation)

Disposal
- Landfill
- Combustion without energy use
- Natural degradation

Other recycling
- Reprocess - mulch/compost
- Reprocess - animal bedding/litter
- Reprocess - particleboard
- Reprocess - landscape surfaces
- Reprocess - play surfaces
- Reprocess - wood/plastic composites
- Reprocess - concrete additive

Reuse
- Reuse - construction
- Reuse - remanufacture - furniture
- Reuse - horticulture/agriculture
- Reuse - landscape fittings

Energy Recovery
- Use/reuse - fuel
- Reprocess - fuel logs/pellets
- Reprocess - syngas

Use
- Use - package filler
- Use - pet litter

Limited volumes
With special filters
Recycling into other products

- Timber telegraph poles into horticulture & agriculture
- Railway sleepers into garden edging/supports
- Timber decking into garden fittings
- Proportion into particleboard
- Wood/cement composite

It was noted that as with all waste residues recycling operations are dependent on having sufficient volumes of the material available to make them commercially viable.

Markets for a number of wood wastes are well established, however it is often easier to find buyers for the clean, homogenous products that come from pre-consumer wood processing operations than from the often mixed products resulting from post-consumer collections.
Timber recycling

Europe

Europe is a leader in recycling and sustainable waste management. In the Nordic countries and Germany where restrictions on disposal in landfill have been in place for some time, post consumer recycling of timber is the most advanced.

In the UK the Waste Resources and Action Programme (WRAP) set up and funded by the UK Government, is providing a stimulus for wood recycling projects throughout Britain. It has a range of programs and issues a number of grants that provide seed funding for capital expenditure on timber recycling operations.

European Union law provides drivers for timber recycling for the whole of Europe through the -

- Landfill directive – which limits biodegradable waste going to landfill,
- Packaging Directive – which includes targets for recycling wood packaging.

A considerable amount of research has been, and is being, undertaken in Europe in order to increase the amount of waste wood that is recovered for some form of recycling.

Research is coordinated predominantly through programs under COST. COST (European Co-operation in the field of Scientific and Technical Research) is an intergovernmental network with 35 member countries that organises scientific collaboration on specific projects. Under its ‘Forests – Products & Services’ domain it has established 58 Actions to date. Three of these have focussed on recovered and/or treated timber;

- Action E22 – Environmental Optimisation of Wood Protection
- Action E31 – Management of Recovered Wood
- Action E37 – Sustainability through New Technologies for Enhanced Wood Durability

The TRADA study identified the following utilisation of wood-based residues in the United Kingdom, although some applications were of a minor nature:

- Animal bedding and litter
- Boiler fuel
- Concrete addition
- Compost amendment
- Erosion control
- Fire starter & replacement logs
- Insulation material
- Landfill cover
- Landscape mulch
- Motorway Run-off
- Oriented Strand Board OSB
- Packaging filler
- Particleboard
- Pet litter
- Playground cover
- Potting soil
- Pulp and paper
- Road stabilisation
- Soil amendment
- Syngas/methanol production
- Wood pellets
- Wood/plastic composites
Drivers for timber recycling vary to some degree throughout the US depending on the laws in each State. The more populous States that have limited landfill space generally have more advanced recycling operations.

In July 2006, Massachusetts was the first State to ban construction and demolition waste from landfill. This has driven the establishment of new processing facilities for all C&D wastes, including timber.

According to the 1998 report on recycling markets by the North Carolina Government, primary wood residues in the form of bark, chips, shavings and sawdust have well established markets as ‘fuel, mulch feedstock for paper and other products, and animal bedding.’ On the other hand offcuts of wood from manufacturing or building operations are more difficult to recycle as they need to be shredded before they can reused and often generators find it cheaper to send the waste to disposal.

The US surveys also reveal that there is a high level of recycling of wooden pallets. Broken pallets are either repaired and reused or shredded and composted with other organic waste products.

The American Forest and Paper Association ‘National Wood Recycling Directory’ was not able to be accessed during research for this report, however a 2000 article by Kunzler analysed the sources and markets for wood waste collected and processed by the 700 processors listed on the directory.

The analysis of the National Wood Recycling Directory by Kunzler in 2000 showed the sources and markets for wood waste collected and processed by the 700 companies listed on the directory were as follows:

<table>
<thead>
<tr>
<th>Source</th>
<th>% of Processors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used pallets for reuse</td>
<td>67%</td>
</tr>
<tr>
<td>Brush trimmings &lt;12” diam</td>
<td>52%</td>
</tr>
<tr>
<td>Tree residue &gt;12” diam</td>
<td>41%</td>
</tr>
<tr>
<td>Construction &amp; lumbar trim</td>
<td>46%</td>
</tr>
<tr>
<td>Demolition wood</td>
<td>30%</td>
</tr>
<tr>
<td>Engineered wood</td>
<td>22%</td>
</tr>
<tr>
<td>Pervasive treated wood</td>
<td>7%</td>
</tr>
<tr>
<td>Other miscellaneous - Roofing shingles, movie sets, cable reels, antique structures, river-recovered logs, dimensional lumber stumps, furniture production residue, telephone poles, salvage flooring</td>
<td>27%</td>
</tr>
</tbody>
</table>

Most of the wood from yard trimmings was chipped for use in compost, and demolition and treated woods were chipped for hog fuel

**Note:** “Hog Fuel - A specific grade of ground up wood and bark. It varies in size but is generally between ½” and 6” screen size. In the Pacific Northwest, hog fuel from C&D recycling facilities is generally used to fuel boilers for the wood and paper processing or other industries.” - King County Solid Waste Division

Processors in the directory indicated their processed wood product was destined for the following markets:
<table>
<thead>
<tr>
<th>Market</th>
<th>% of Processors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mulch</td>
<td>42%</td>
</tr>
<tr>
<td>Compost</td>
<td>16%</td>
</tr>
<tr>
<td>Wood chips for various products</td>
<td>12%</td>
</tr>
<tr>
<td>Pallets - reconditioned and remade</td>
<td>17%</td>
</tr>
<tr>
<td>Fuel</td>
<td>17%</td>
</tr>
<tr>
<td>Engineered wood composite</td>
<td>8%</td>
</tr>
<tr>
<td>Particleboard</td>
<td>5%</td>
</tr>
<tr>
<td>Fibreboard</td>
<td>2%</td>
</tr>
<tr>
<td>Hardboard panels, plywood etc</td>
<td>Handful</td>
</tr>
<tr>
<td>Animal bedding</td>
<td>2%</td>
</tr>
<tr>
<td>Absorbents, wood plastic composites (wood flour)</td>
<td>2%</td>
</tr>
<tr>
<td>Furniture and fitout (high quality woods)</td>
<td>Not stated</td>
</tr>
</tbody>
</table>

From the above table it is evident that only a small percentage of waste wood is being processed for high level recycling, such as fibreboard, absorbents, wood flour for plastic/wood composite materials and remanufactured furniture.

**Australia**

No comprehensive survey of timber recycling in Australia has been undertaken to date however the following operations have been identified.\(^{31}\)

**ACT**

- A second hand timber merchant operates close to the CBD.
- An organics processor shreds waste timber for mulch and fuel products.

**NSW**

- Power stations currently co-combust small quantities of shredded timber with coal.
- There is a well established market for high value used hardwoods and Douglas fir from demolition sites.
- There is also a well established market for timber fittings from demolition sites.
- The majority of shredded waste timber is used as mulch products in the landscaping industry.
- VISY uses forestry and sawmill residues as biofuel in its paper mill at Tumut. Until recently large quantities of urban wood residue were used at the mill.
- Two companies are investigating the use of post consumer waste timber for use in particleboard.
- Two companies are also considering the installation of equipment to use urban wood residue as biofuel.
QLD
- Kennedy’s Classic Aged Timber has set up a new timber recycling plant to process 20,000 m³ per year of waste timber into high value products.
- Rocky Point Power Station uses approximately 20,000 tpa of C&D waste timber as biofuel.
- A number of organic processors shred waste timber for sale as mulch.

SA
- ResourceCo and Adelaide Brighton Cement have formed The Alternative Fuels Company to source, separate and process C&D waste timber into a fuel product.
- There is a high demand for mulch products made from waste timber packaging.
- There is work on developing end markets for used CCA treated vineyard posts that are now banned from landfill when presented in large quantities.

TAS
- A number of salvage operations that sell second hand building materials are run at local tips.

VIC
- A number of businesses process waste timber products such as timber pallets and packaging for mulch used in landscaping
- D&R Henderson is using waste packaging to produce new particleboard at its plant at Benalla
- A new facility to process timber for use as biofuel is being established at Dandenong
- A number of large businesses in urban and rural Victoria salvage second-hand timber and house fittings, including importing salvaged timber from as far away as Western Australia.

WA
- Large quantities of high value Australian hardwoods are salvaged from demolition sites by more than 40 businesses. Some is transferred interstate or exported to Asia.
- Laminex is recycling particleboard offcuts and waste timber packaging into new panel products.
- There is a small but growing mulch industry.

General
It is expected that as overseas, the majority of waste wood from the primary processing industry has established markets as:
- Industrial fuel
- Particleboard
- Landscaping mulch

Recovery of wood from the construction and demolition sector has been driven over the past decade or so by agreements with Government (such as the Commonwealth Waste Wise Construction Program – Phases I and II), together with increasing costs of disposal in landfill. High value timber and wood products have markets through second hand building outlets, however most of the low-grade wood is chipped and sold as mulch or composted together with garden wastes. Similarly, broken pallets are accepted for chipping and used as mulch or included in compost products.
Timber recycling statistics

The success of timber recycling initiatives can only be ascertained through an understanding of the amount of wood waste generated at different points along the value chain and how much of this waste is recycled or disposed of.

What is evident from the literature is that data on wood waste generation, recycling and disposal is scarce. Attempts have been made to estimate this information at the national level, both within Europe and the USA.

As part of this study, data supplied for Europe, the UK and the US has been analysed on a per capita basis and compared with the limited data available for Australia. This was done in order to establish the degree of effort that should be directed towards establishing a better understanding of timber waste generation and recycling in Australia.

Europe & the UK

A major issue for all countries participating in the Action programs has been a lack of national data.

Annexure A shows data that was collected under COST Action E22 in 2004 and converted to per capita figures for this report.

The per capita figures vary enormously. This may be due in part to differences in what has been included as ‘waste wood’. It is common to exclude wood waste from forestry and sawmilling operations and some countries may have included garden and/or urban tree waste.

European countries participating in the COST E31 program have acknowledged that studies undertaken in the UK have provided the best information available to date, although there are still many qualifications on the data.

The TRADA study into wood waste in the UK attempted to quantify the generation of wood waste at each stage of the timber product value chain as outlined in the diagram below. It focussed on a number of key industries and conducted over 600 interviews with industry representatives.

Separately, a desktop survey was commissioned by WRAP (the Waste & Resources Action Programme) that looked at all reports on wood waste arisings available in the UK.

Annexure B shows data derived from these sources, again with per capita figures derived for this report. Excluding timber destined for use in paper manufacture, the UK consumes approximately 135 kg of timber per capita each year. Data derived by WRAP indicates that 122.2 kg of post consumer timber waste per capita is generated.
Timber waste arising data collected by the USDA in 1999 is shown at Annexure C. Excluding ‘woody yard trimmings’ and primary residues from the data to make it comparable with the UK figures, results in a waste wood generation profile of 156 kg per capita. This is larger than, but comparable with the figure for the UK.

The figures indicate that nearly all primary wood residues (sawmill products) are recovered (94%).

Australia

From data available for Australia and NSW, timber consumption and disposal figures have been derived for NSW on a per capita basis. These are included at Annexure D. Australia’s timber consumption rate (excluding timber used for paper manufacture) is 163 kg per capita. The most recent figure for post consumer generation of timber waste in NSW is for 2002/03 with a total 446,000 tonnes estimated for the State (or 65 kg/c).

In 2002/03 the NSW Department of Environment & Conservation (DEC) estimated that approximately 17% of post consumer timber (or 76,000 tonnes) was recovered for reuse and recycling.
Comparisons

The following table sets out key timber consumption, waste arisings and recycling data that is available for the US, UK and Australia. Total apparent timber consumption figures do not appear to be available for the US. Information for each category of forest product is provided and it is not known whether these numbers overlap.

<table>
<thead>
<tr>
<th>Country</th>
<th>Timber consumption (excl paper) kg/c</th>
<th>Post consumer wood waste kg/c</th>
<th>% of consumption</th>
<th>% of waste timber recovered / recycled</th>
<th>% of waste timber available for recycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>?</td>
<td>155.8</td>
<td>?</td>
<td>?</td>
<td>44.8%</td>
</tr>
<tr>
<td>UK</td>
<td>135.9</td>
<td>122.2</td>
<td>89.9%</td>
<td>&gt;20%</td>
<td>&lt;80%</td>
</tr>
<tr>
<td>Australia</td>
<td>163.0 (NSW)</td>
<td>65.5</td>
<td>40.2%</td>
<td>(NSW) 29%</td>
<td>(NSW) 71%</td>
</tr>
</tbody>
</table>

Consumption of wood products in Australia (and by inference, NSW) at 163 kg per capita is similar to, although slightly higher than, that of the UK\(^1\). Limited data on waste timber arisings is available for Australia. In NSW figure of 446,000 tonnes at 6.5 kg/capita represents only 40% of total consumption. This is about half the per capita generation rate obtained for the UK.

Given that general consumption and waste generation patterns for the UK and Australia are similar and that the timber consumption figure for Australia is higher than that for the UK, the timber waste generation rate for NSW appears extremely low.

The table at Annexure D shows the accepted estimates for timber waste generation in NSW (in black) with possible realities (in blue) should it be revealed that Australians do indeed have similar disposal patterns to the British.

It would appear that in Australia more effort needs to be directed towards firming up waste timber generation and recycling rates along the manufacturing value chain, not least to provide a sound basis for companies wanting to establish timber recycling operations.
Barriers to timber recycling

As mentioned previously, the timbers that are highly valued are unlikely to find their way into the waste stream. Recycling will occur naturally wherever there is a commercial stimulus.

In Australia, the rising cost of landfill disposal has made it more cost effective to recycle a greater range of timber wastes than to dispose of them, and reprocessing operations are becoming established.

A major component of the cost of recycling is the system of collection and sorting required to establish and maintain a regular supply of feedstock to a reprocessing operation. The number of small businesses that work with timber or dispose of timber packaging, and their geographic distribution, can make it expensive to concentrate their wastes for reprocessing.

The following barriers to recycling were identified as part of a Scottish study into wood waste arisings and recycling:\(^{48}\)

- Contamination
- Lack of end markets
- Building regulations / material specifications
- Consistency of supply / sporadic arisings
- Demolition rather than deconstruction
- Lack of quality data
- Capital costs
- Volatility of market
- Education
- Product labelling
- Chemical / preservative treated wood

In addition, a survey conducted as part of the TRADA study in the UK found that “within the UK timber-using industries, there is generally:

- a poor understanding of waste and environmental management methods
- scant knowledge of best practice in waste minimisation
- ignorance of the potential for the use of timber residues
- a poor understanding of the concepts of sustainability and mass balance (this applies to UK industry as a whole)
- poor knowledge about recycling and re-use of wood
- existing practices which ignore the issue of waste
- A clear need to take responsibility is not recognised. 'End of pipe' approaches and solutions to waste predominate as a result
- a cavalier approach to waste in both design and execution, with the construction industry-timber supply chain the main problem – and the main opportunity
- measurement of timber waste generation is negligible
- a lack of awareness of all their legal obligations with responsibility to waste and waste management."

To overcome these barriers, a range of actions are required.
Findings

This study set out to review extended producer responsibility schemes overseas and their application to timber recycling in Australia.

The fact that only one timber EPR scheme was identified and another that was under negotiation in Norway, has not been implemented, attests to the problems inherent in establishing EPR for this type of product.

What most countries have developed is a working relationship between government and the timber industry in general to promote increased recycling of all timber products, raise awareness of the problems caused by mixing treated timber with untreated timber in the waste stream, and help develop methods for identifying and processing problem timber. This could be considered a product stewardship approach.

As market forces and government regulations act to make disposal of timber waste more difficult and more costly, commercially viable recycling operations are developing. However there are still a number of barriers to increasing the current levels of recycling, particularly for low value timbers and timber products.

A major barrier is lack of data on the amount of timber available for recycling and where it is being generated. This is key market information needed by prospective recyclers as well as a vital measure of the success of various recycling schemes.

Another is education of both the industry and the public about options for recycling of timber products and the value of keeping different products separated.

A third is development of new markets and this requires governments to work with industry to educate potential buyers and to ensure continuity of supply of suitable feedstock for operators.

The Action Program proposed in the following section has been developed with the research findings and identified barriers in mind. It would put the Australian timber industry at the forefront of sustainability practices worldwide.

To start, a survey of selected companies in the timber value chain will help to develop reliable estimates of the amount of timber waste being generated and available for recycling, as well as identify more precisely the barriers to recycling that exist in Australia. This information will form a sound basis for the development of education programs and further recycling operations.
**Action program**

The timber industry and governments can work together to increase the recycling of timber in Australia through a joint action program that would encompass the following key areas:

- Data and information surveys of industries in the timber value chain
- Education of operators within the timber value chain
- Technical development of methods to identify and recycle treated timber
- Further development of the timber recycling industry

**Stage 1 - Survey information**

Surveys of a representative selection of companies that operate at each level of the timber value chain and/or selected sectors of the industry, including those currently reprocessing timber into new products, would aim to establish:

- Current practices within the industry
- Estimates of the current level and type of timber waste generation, recovery and disposal
- Data on the existing timber recycling infrastructure
- Details of the perceived barriers to recycling within Australia
- Attitudes towards marking chemically treated wood products
- The type of education program that would most benefit the industry
- The amount of seed funding needed to jump-start recycling operations

**Stage 2 - Education**

From the above survey a number of education tools and programs can be designed for the industry and the public who dispose of timber wastes. These could include:

- Extensions of current government waste minimisation programs
- Web site to bring buyers and sellers of waste timber together
- Joint listing of producers of recycled timber products with the Buy Recycling Business Alliance
- News articles in industry journals
- Web site of case studies
- Lesson plans for schools
Stage 3 - Technical development

Australia has the benefit of drawing on the extensive technical research that has already been carried out in Europe and the US. It could tap into this work by establishing working relationships with The Hinkley Centre in Florida which specialises in treated timber, and COST. (It is understood that in principle agreements are in place between COST and DEST [Department of Education Science and Training]).

Stage 4 - Coordinate Timber Recycling Industry

A final stage of the program would be to assist the existing recycling industry and foster development of further timber recycling infrastructure:

- Development of end markets
- Development of recognised sorting and grading guidelines for the timber recycling industry
- Identification of additional collection sites
- Establishment of testing sites for treated timber
- Establishment of specific treatment and reprocessing operations

Funding

The funding model adopted by the UK appears to be working well and encouraging the establishment of a number of new timber recycling operations. Funding from the landfill tax levy is made available to specific bodies for approved projects that also have a minimum funding component from industry. It is a model that could be explored in more detail for Australia.

Process

A national timber product stewardship group with representatives from different sectors of the timber industry and government, would be a suitable body to oversee and manage such an Action Program.

It may be appropriate for the group to undertake an overseas fact finding mission to help identify the particular issues that are most relevant to Australia and also establish closer working relationships with TRADA, GROW, the Hinkley Centre in Florida and COST in Europe. Further information on the EPR scheme operating in Finland would assist with evaluation of suitable processing or disposal options for treated timbers.
Annexure A

Timber recycling data - Europe

In March 2004, the countries listed below provided data to the secretariat of COST Action E22 in response to a distributed questionnaire. Most figures are highly qualified but were the best information available at the time. Figures provided on the left side of the table are as presented by COST. Any data supplied in units of volume were changed to tonnes by multiplying by a factor of 0.5.

In order to be able to compare the results and to make the information more meaningful for this report, the figures have been divided by relevant population statistics and converted into kilograms per capita.

<table>
<thead>
<tr>
<th>Country</th>
<th>Post consumer waste wood (tonnes)</th>
<th>Post Consumer waste wood per capita (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Generated</td>
<td>Recycling/ Reuse</td>
</tr>
<tr>
<td>Belgium</td>
<td>1,400,000</td>
<td>972,000</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Germany</td>
<td>8,235,000</td>
<td>0</td>
</tr>
<tr>
<td>Denmark</td>
<td>123,500</td>
<td>123,500</td>
</tr>
<tr>
<td>Finland</td>
<td>549,000</td>
<td>5,000</td>
</tr>
<tr>
<td>France</td>
<td>15,850,000</td>
<td>6,110,000</td>
</tr>
<tr>
<td>Greece</td>
<td>106,000</td>
<td>50,000</td>
</tr>
<tr>
<td>Ireland</td>
<td>5,000</td>
<td>0</td>
</tr>
<tr>
<td>Holland</td>
<td>1,564,000</td>
<td>971,000</td>
</tr>
<tr>
<td>Norway</td>
<td>385,000</td>
<td>84,000</td>
</tr>
<tr>
<td>Romania</td>
<td>2,362,300</td>
<td>260,000</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>7,420,000</td>
<td>1,470,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>Post consumer waste wood (tonnes)</th>
<th>Post consumer waste wood per capita (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Untreated</td>
<td>Treated</td>
</tr>
<tr>
<td>Belgium</td>
<td>1,200,000</td>
<td>N/A</td>
</tr>
<tr>
<td>Switzerland</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Germany</td>
<td>8,000,000</td>
<td>900,000</td>
</tr>
<tr>
<td>Denmark</td>
<td>0</td>
<td>65,000</td>
</tr>
<tr>
<td>Finland</td>
<td>530,000</td>
<td>10,000</td>
</tr>
<tr>
<td>France</td>
<td>12,100,000</td>
<td>3,600,000</td>
</tr>
<tr>
<td>Greece</td>
<td>90,000-100,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Holland</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Norway</td>
<td>1,044,000</td>
<td>400,000</td>
</tr>
<tr>
<td>Romania</td>
<td>270,000</td>
<td>100,000</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2,320,000</td>
<td>42,300</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>7,300,000</td>
<td>80,000</td>
</tr>
</tbody>
</table>
**Annexure B**

**Timber recycling data - UK**

The following table has been compiled from various sources that discuss UK timber waste statistics.\(^{50,25,30,44,58}\)

### UK Timber Products consumption & disposal

<table>
<thead>
<tr>
<th></th>
<th>Tonnes</th>
<th>Kg/cap</th>
<th>% of Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber consumption (excluding paper)</td>
<td>8,532,000</td>
<td>135.89</td>
<td>100.0%</td>
</tr>
<tr>
<td>Post consumer wood waste</td>
<td>7,397,000</td>
<td>122.19</td>
<td>89.9%</td>
</tr>
<tr>
<td>Construction</td>
<td>1,200,000</td>
<td>19.82</td>
<td>14.6%</td>
</tr>
<tr>
<td>Demolition</td>
<td>2,100,000</td>
<td>34.69</td>
<td>25.5%</td>
</tr>
<tr>
<td>Packaging from construction</td>
<td>1,300,000</td>
<td>21.48</td>
<td>15.8%</td>
</tr>
<tr>
<td>Commercial (mostly packaging)</td>
<td>750,000</td>
<td>12.39</td>
<td>9.1%</td>
</tr>
<tr>
<td>Industrial (mostly packaging &amp; furniture)</td>
<td>840,000</td>
<td>13.88</td>
<td>10.2%</td>
</tr>
<tr>
<td>Civic amenity sites (mostly furniture)</td>
<td>672,000</td>
<td>11.10</td>
<td>8.2%</td>
</tr>
<tr>
<td>MSW (mostly furniture)</td>
<td>140,000</td>
<td>2.31</td>
<td>1.7%</td>
</tr>
<tr>
<td>Furniture manufacturing</td>
<td>335,000</td>
<td>5.53</td>
<td>4.1%</td>
</tr>
<tr>
<td>Fencing</td>
<td>60,000</td>
<td>0.99</td>
<td>0.7%</td>
</tr>
<tr>
<td>Sawmill waste/co-products</td>
<td>1,700,000</td>
<td>28.08</td>
<td>20.7%</td>
</tr>
</tbody>
</table>

**Note:** Assuming no garden or urban tree waste has been included with the MSW data, it appears that more waste timber is being generated than is replaced by new products. This may reflect substitution of other materials for timber, however some additional timber waste may be related to the production of paper that has been excluded from the consumption figure.

Of the above total of post consumer waste wood, approximately 80,000 to 120,000 tonnes are thought to comprise treated timber (~1.08%).

The destination of post consumer wood waste in the UK is estimated as follows:

<table>
<thead>
<tr>
<th>Post Consumer Wood Waste Treatment</th>
<th>Tonnes</th>
<th>% of Total PC waste wood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panelboards</td>
<td>993,000</td>
<td>13.4%</td>
</tr>
<tr>
<td>Horticultural surface products</td>
<td>109,000</td>
<td>1.5%</td>
</tr>
<tr>
<td>Animal bedding</td>
<td>85,000</td>
<td>1.1%</td>
</tr>
<tr>
<td>Combustion - small boilers</td>
<td>224,000</td>
<td>3.0%</td>
</tr>
<tr>
<td>Incineration - energy recovery</td>
<td>60,000</td>
<td>0.8%</td>
</tr>
<tr>
<td>Compost</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Combustion at panelboard manufacturers</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Combustion co-fired power stations</td>
<td>?</td>
<td></td>
</tr>
</tbody>
</table>

\( >19.9\% \)
Sawmill co-products (unused wood) are utilised as follows:

- Mulches & surfaces: 187,000 tonnes (11%)
- Panel products: 1,411,000 tonnes (83%)
- Fuel, local heating: 34,000 tonnes (2%)

(It is not known whether the remaining 4% or 68,000 tonnes is disposed of or has some other beneficial use)
## Annexure C

### Timber recycling data - USA

A study in 1999 by David McKeever of the USDA Forest Products Laboratory produced the following information on recovery of wood waste in the USA:

<table>
<thead>
<tr>
<th>Source</th>
<th>Generated (tonnes)</th>
<th>Recovered, Combusted or Not Usable (tonnes)</th>
<th>Amount available for recovery (tonnes)</th>
<th>% of Total Available</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MSW</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste wood</td>
<td>11,800,000</td>
<td>6,400,000</td>
<td>5,400,000</td>
<td>18.18%</td>
</tr>
<tr>
<td>Woody yard trimmings</td>
<td>25,200,000</td>
<td>18,400,000</td>
<td>6,800,000</td>
<td>22.90%</td>
</tr>
<tr>
<td><strong>Total MSW</strong></td>
<td>37,000,000</td>
<td>24,800,000</td>
<td>12,200,000</td>
<td>41.08%</td>
</tr>
<tr>
<td><strong>C&amp;D</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>8,700,000</td>
<td>2,100,000</td>
<td>6,600,000</td>
<td>22.22%</td>
</tr>
<tr>
<td>Demolition</td>
<td>26,400,000</td>
<td>17,400,000</td>
<td>9,000,000</td>
<td>30.30%</td>
</tr>
<tr>
<td><strong>Total C&amp;D</strong></td>
<td>35,100,000</td>
<td>19,500,000</td>
<td>15,600,000</td>
<td>52.53%</td>
</tr>
<tr>
<td><strong>Primary timber processing residues</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bark residues</td>
<td>24,500,000</td>
<td>23,900,000</td>
<td>600,000</td>
<td>2.02%</td>
</tr>
<tr>
<td>Wood residues</td>
<td>65,800,000</td>
<td>64,500,000</td>
<td>1,300,000</td>
<td>4.38%</td>
</tr>
<tr>
<td><strong>Total primary residues</strong></td>
<td>90,300,000</td>
<td>88,400,000</td>
<td>1,900,000</td>
<td>6.40%</td>
</tr>
<tr>
<td><strong>Total waste wood</strong></td>
<td>162,400,000</td>
<td>132,700,000</td>
<td>29,700,000</td>
<td>100.00%</td>
</tr>
<tr>
<td><strong>Total excluding primary residues</strong></td>
<td>137,200,000</td>
<td>114,300,000</td>
<td>22,900,000</td>
<td></td>
</tr>
<tr>
<td><strong>Total excluding primary and woody yard trimming</strong></td>
<td>46,900,000</td>
<td>25,900,000</td>
<td>21,000,000</td>
<td></td>
</tr>
</tbody>
</table>
## Annexure D

### Timber recycling data - NSW

**NSW timber consumption & disposal figures**

<table>
<thead>
<tr>
<th>Category</th>
<th>Actual Tonnes</th>
<th>Tonnes inferred from UK results</th>
<th>Actual Kg/cap</th>
<th>Kg/cap inferred from UK results</th>
<th>% of Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber consumption (excl paper)</td>
<td>1,108,954</td>
<td>162.97</td>
<td></td>
<td></td>
<td>100.0%</td>
</tr>
<tr>
<td>Post consumer wood waste</td>
<td>446,000</td>
<td>831,464</td>
<td>65.54</td>
<td>122.19</td>
<td>40.2%/75.0%</td>
</tr>
<tr>
<td>Construction</td>
<td>134,887</td>
<td></td>
<td>19.82</td>
<td></td>
<td>12.2%</td>
</tr>
<tr>
<td>Demolition</td>
<td>236,052</td>
<td></td>
<td>34.69</td>
<td></td>
<td>21.3%</td>
</tr>
<tr>
<td>Packaging from construction</td>
<td>146,127</td>
<td></td>
<td>21.48</td>
<td></td>
<td>13.2%</td>
</tr>
<tr>
<td>Commercial (mostly packaging)</td>
<td>84,304</td>
<td></td>
<td>12.39</td>
<td></td>
<td>7.6%</td>
</tr>
<tr>
<td>Industrial (mostly packaging &amp; furniture)</td>
<td>94,421</td>
<td></td>
<td>13.88</td>
<td></td>
<td>8.5%</td>
</tr>
<tr>
<td>Civic amenity sites (mostly furniture)</td>
<td>75,537</td>
<td></td>
<td>11.10</td>
<td></td>
<td>6.8%</td>
</tr>
<tr>
<td>MSW (mostly furniture)</td>
<td>15,737</td>
<td></td>
<td>2.31</td>
<td></td>
<td>1.4%</td>
</tr>
<tr>
<td>Furniture manufacturing</td>
<td>37,656</td>
<td></td>
<td>5.53</td>
<td></td>
<td>3.4%</td>
</tr>
<tr>
<td>Fencing</td>
<td>6,744</td>
<td></td>
<td>0.99</td>
<td></td>
<td>0.6%</td>
</tr>
<tr>
<td>Sawmill waste/co-products</td>
<td>191,090</td>
<td></td>
<td>19.82</td>
<td></td>
<td>17.2%</td>
</tr>
<tr>
<td><strong>Total wood waste</strong></td>
<td><strong>1,022,554</strong></td>
<td></td>
<td><strong>150.28</strong></td>
<td></td>
<td><strong>92.2%</strong></td>
</tr>
</tbody>
</table>
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