Improving resource efficiency in construction product manufacture

BeAware Supply Chain Resource Efficiency
Sector Report

Timber Windows
BeAware is a TSB\(^1\) and industry funded project helping construction product manufacturers to make more efficient use of materials and processes. Use of resources and waste generation associated with the product across its supply chain are the two key areas of focus.

The British Woodworking Federation (BWF) is the trade association for woodworking manufacturers in the UK and is an industry partner on the BeAware project.

## Project background

Resource efficiency improvements should always be addressed within the context of the overall environmental impact of the product. A simplified environmental assessment was carried out on 20 construction products as part of the BeAware project, using life cycle assessment (LCA) data. See the Overview of Methodology document for further details on how this was carried out.

The supply chain for each product was also investigated to ascertain where resource efficiency improvements could be implemented. This involved examining how a product is distributed, installed, maintained and eventually disposed of. Identified areas of improvement included reduction of waste, efficient raw material use, material substitution, recycled content, packaging materials and options, and diversion of waste from landfill.

The results of the BeAware timber windows assessments form the basis of this guidance document. Also included are the findings from an interactive workshop held in conjunction with the BWF in June 2008, whereupon 12 manufacturers of windows, doors and stairs discussed the combined results generated from the BeAware studies.

This guidance has been developed for those working in, representing or advising the timber window sector to raise awareness of the importance of reducing material resource usage across a product’s lifecycle. Although some recommendations are focused specifically on timber windows, most are applicable to all woodworking products.

Rising costs of materials, the drive to divert waste from landfill and an increased focus on protecting the environment are the key drivers to improving resource efficiency. Moreover, using materials efficiently and reducing waste can produce significant cost savings, as well as improving productivity and contributing to a company’s triple bottom line.

This document builds on existing industry advice and activities, whilst highlighting additional sector based improvements to further improve resource efficiency. It is a part of a series of reports that are free to download from the BeAware website\(^2\). Similar sector guidance is available for precast concrete, polymers and modern methods of construction (MMC).

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1. Previously DTI, now the Technology Strategy Board (TSB) under the Department for Innovation, Universities and Skills (DIUS) [http://www.berr.gov.uk/dius/innovation/technologystrategyboard/page40217.html](http://www.berr.gov.uk/dius/innovation/technologystrategyboard/page40217.html)
2. [http://www.beaware.org.uk](http://www.beaware.org.uk)
The joinery sector and timber windows

The timber window sector has a number of existing initiatives to drive forward best practice and improve standards through the use of accreditation schemes.

The Timber Window Accreditation Scheme (TWA) was set up by BWF members to develop a new, higher standard of wood windows and promote them to the market. To increase buyers’ confidence, all windows accredited under the TWA are independently tested and audited to ensure they comply to this standard, and scheme members offer a series of additional warranties.

The Wood Window Alliance was formed in September 2007, bringing another 40 companies to develop and promote the quality, performance and sustainability properties of timber windows.

The British Fenestration Rating Council (BFRC) has a scheme to encourage the use of higher performing windows through energy performance labels. The need to improve the thermal efficiency of windows (i.e. how well they minimise heat loss from a building) through window engineering, design and installation is imperative. Although this has no direct link to material resource efficiency, it should be a key consideration when looking at new production methods.

From a government policy perspective, Defra is keen to reduce the environmental impact of key products and materials throughout their whole lifecycle. Reducing the impact of windows is a key priority and it is likely that a product roadmap for windows will be produced.5

In 2006, the total UK manufacturing sales of joinery products was over £3.7 billion3. Windows, french-windows and their wooden frames accounted for around 14% of this value.

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5. BeAware assessment results will be taken into consideration
Current resource efficiency activities in the joinery and timber window sector

In 2005, a survey of the joinery sector was carried out for the Biffaward Report - Wood Used in Joinery: The UK Mass Balance and Efficiency of Use. Results suggested that:

- Windows were responsible for 100,000-150,000 tonnes of joinery products.
- Around 30% wastage was associated with manufacture using hardwood, and around 13% wastage using softwood.
- Nearly one quarter of joinery waste produced is used for animal and poultry bedding, and almost a further quarter is burnt to generate heat (15.2% on-site, i.e. at the factory, and 8.4% off-site). Figure 1 (right) shows the disposal routes in more detail.
- The top five reasons affecting choice of disposal route were reducing heating costs (from burning on-site), convenience, environmental, financial return and cost.

The 2007 Waste Strategy for England identified waste wood as a priority material for action and outlined the Government’s intention to facilitate greater recovery of energy from waste wood. The Waste Infrastructure Delivery Programme has produced a market information report on the use of waste wood as a biomass fuel. The report estimates that over 5 million tonnes of wood waste arises from construction and demolition each year in the UK.

A large number of timber frame manufacturers have their own wood burners to recover energy from their timber waste and use it to heat their factories. Some manufacturers have also investigated turning timber waste into briquettes which can then be sold for use as a fuel for biomass burners and boilers. This process could be costly, especially for small scale manufacturing companies, unless a group of manufacturers in a certain region can work together.

BeAware assessment: The environmental impact of timber frame windows

Manufacturing waste

Timber wastage from manufacturing includes off-cuts of timber chippings and sawdust. It can account for up to 60% of the timber entering the manufacturing process although on average, it is roughly a third. Because most of this timber waste is recovered, it may be more beneficial environmentally to use this waste as an alternative heat/power source than reduce the amount of waste created.

Any wastage from hardware and metals is relatively low and this material is recycled. Paint, stain and preservative wastes tend to be sent for incineration.

A number of packaging wastes arise from raw materials used, including polythene sheeting, cardboard, metal strapping, and paint tins. These are all sent for recycling, aside the paint tins which are sent to landfill (some of these may be hazardous depending on the nature of the product they contained).

Practices could be improved by speaking with suppliers to ascertain whether packaging for the raw materials could be minimised.

**Construction waste**

BRE national waste benchmarks show that on a construction site, typically 733kg of timber waste (excluding timber packaging) is generated for every 100m$^2$ of floor area constructed. This equates to around 12% of all the waste generated on construction sites by volume.

It should be noted, that this relates to all timber waste rather than just windows. The most common causes of on-site timber waste during construction are off-cuts and damage, though with windows, waste is more likely to be due to damage or incorrect sizing/ordering.

**End of life waste**

Timber windows may arise as waste either when they are being replaced or at a building’s end of life. In the former instance, they may be difficult to recycle due to preservatives and surface coatings that may have been used. There are also health and safety considerations with regards to removing the glass from the frame, although there are systems in place for recyclers to overcome this.

Over 50% of timber waste from refurbishment activities is thought to be landfilled. Demolition activities typically see timber windows being removed from a building using a ‘grab’. The glass is shaken out and added to the segregated inert material and the timber frame placed with the segregated timber material, even if the window is treated/painted.

**Simplified environmental assessment results**

The combined results of the simplified environmental assessments for timber windows identify four key areas that yield the most significant environmental impacts:

- **Raw materials**
- **Energy and water**
- **Packaging**
- **Waste**.

Figure 2 shows that the greatest overall environmental impact for the timber windows studied is from raw materials, responsible for 94% of the impact. This is followed by energy/water at 3% and packaging and waste, both at just over 1%.

Figure 3 shows the breakdown of impacts for each raw material used. Transportation of materials has a significant effect on the environmental impact. On average, over 90% of the raw material impacts are due to the transport of timber, mainly from Scandinavia.
Supply chain resource efficiency: opportunities and barriers

An interactive workshop was held for the timber window sector in June 2008, whereupon product manufacturers discussed targeted actions to improve resource efficiency in the sector. Discussions centred around the key areas of waste reduction, diverting waste from landfill (reusing, recycling and recovery) and using recycled materials.

Opportunities and barriers were considered for each stage of the supply chain including manufacture, distribution, installation/use, and end of life. Actions for the industry were prioritised and the major points form the basis of the sector action plan detailed later in this document.

Some of the key workshop discussions and outcomes are listed below. Many issues are already being progressed by the industry via BWF initiatives.

Opportunities for resource efficiency across the supply chain

**Manufacture**
Extend the life of products through design improvements and educate consumers on the service life of new windows.

It is possible to match the design life of timber windows to the design life of new housing, e.g. 60 years. This will reduce waste by avoiding the removal of windows unless absolutely necessary.

Educate the sector to create a better understanding of preservatives and their impacts at end of life, e.g. for recycling.

Continue undertaking research on the necessity of preservatives and whether their impact can be reduced through benign treatment processes.

Establish a network through the BWF to improve the viability of recycling and recovery options for timber waste generated during manufacture.

**Packaging and distribution**
Reconsider packaging options: can it be eliminated, minimised or improved? Can returnable packaging be used?

Paint and preservative packaging presents a big problem for the timber window sector as a large amount of the product is used, resulting in a lot of waste that is difficult to recycle.

Investigate the potential for mixing plants to create different colours of paint easily, thereby reducing waste from paint packaging as colours could be mixed on-site using a base colour and small amounts of concentrated pigment.

This is currently used by only a few UK manufacturers, so a first step would be to investigate the cost and benefits of expanding this option.

**Installation**
Promote the local sourcing of products to reduce transportation, where possible.

Selection of the most appropriate manufacturer is important, along with ensuring windows are ‘fit for purpose’, preferably via independent accreditation rather than simply sourcing from the nearest supplier.

Educate consumers on the importance of cleaning and maintaining windows to prolong their life.

**End of life**
Develop a better recycling infrastructure, linked to regulation and incentives to promote and encourage recycling.

There is a growing market that could be exploited for use of wood waste as a fuel for biomass burners and boilers by turning it into briquettes/pellets.

Pellets are well suited to domestic heating systems because they are lightweight and can be used in automated pellet boilers, thus replacing traditional gas fired boilers. Pellets are currently being imported from countries such as Canada to meet demand.

Briquettes are formed in a similar way to pellets, though they are larger (like logs). These are well suited to wood burners where automated supply is not required.

The capital costs of producing either fuel is expensive and can be uneconomical on a small scale. Small companies could consider working with other similar sized organisations in the same region to collate waste for briquetting and pelletisation.

This is a crucial area to explore as it turns waste into a resource, reduces reliance on fossil fuels and reduces transport impacts and purchaser costs involved in importing alternative fuels.
**Barriers to resource efficiency across the supply chain**

**Manufacture**
The small amounts of timber waste produced during manufacture make it difficult for individual companies to recycle or recover energy economically. This could be improved by developing a 'round robin' collection service amongst small clusters of manufacturers and timber processors.

**Packaging and distribution**
It is often difficult to get customers to return packaging which is designed to be reused by the manufacturer.

**Installation**
Customers often replace windows solely for aesthetic purposes before they reach their end of life.

**End of life**
Contamination can reduce the amount of timber recovery that can be achieved. Old timber windows and doors are frequently removed by other replacement window sectors, therefore the timber window sector has limited control over how some products are managed at their end of life.

Windows are often uniquely sized to fit a building and this can be another barrier to their reuse. Standard sized windows, however, have been used in new large housing developments since the 1950s which may mean there may be more scope for reuse in these instances.

Coatings and preservatives used on timber frames could be hazardous and so also pose a problem with regards to recovery and recycling.

Building Regulations and changes to legislation may affect how windows can be salvaged and reused at their end of life, as what is acceptable today may not be usable next year.

Upgrading of windows to meet Building Regulations is feasible and particularly relevant for windows in listed buildings and conservation areas.
### 1. Production and design

**Issue:**
It is important to ensure that timber from sustainable resources is being used. In addition, there is a need to reduce potential for waste at point of purchase and consider opportunities for increasing the use of reused and recycled content.

**Action:**
Encourage specification and use of sustainably produced timber. Increase use of chain of custody certification through the manufacturing process, along with other tools such as the Timber Trade Federation’s Responsible Purchasing Policy.

**What next:**
Investigate potential for using recycled material.

**Who to take it forward:**
BWF, TTF, other timber trade associations, timber suppliers.

### 2. Paint containers

**Issue:**
Many timber frame manufacturers use paint in their processes which amounts to a high volumes of paint tins (metal and plastic) arising in their waste stream, some of which may be hazardous.

**Action:**
Manufacturers to take forward discussions with paint suppliers (in conjunction with the BWF) to reduce the amount of packaging requiring disposal.

**What next:**
BWF to engage with the Paint 2005 group to convert discussions into clearly defined actions.

**Who to take it forward:**
BWF and Paint 2005.

### 3. Timber window industry recycling and recovery network

**Issue:**
Small amounts of waste are expensive to recycle or convert into fuel on an individual manufacturing site basis.

**Action:**
Many BWF members are situated close to each other and could benefit from a network to improve the viability of waste recycling and recovery options.

**What next:**
BRE’s BREMAP tool, or similar mapping software, could be used to map existing manufacturing sites and the waste materials they produce, to evaluate potential recycling and recovery opportunities in targeted areas.

**Who to take it forward:**
Map the BWF members geographically and link this to the types of waste being produced from each site.
4. Improved infrastructure for reuse and recycling

**Issue:**
Most waste materials from the timber window sector have the potential to be recycled, however, recycling activity is fragmented. There is no co-ordinated strategic liaison between the recycling industry and the wood industry which exacerbates this fragmentation.

The recycling industry does not fully understand wood treatment and preservation and so may label wood as hazardous waste unless it knows it can treat it otherwise. Some products require expensive recycling equipment to extract maximum value from the materials by reducing contamination, for example, timber window recycling.

**Action:**
The timber frame industry needs a coherent strategy to improve waste disposal and recycling. The BWF and other trade associations should work with the wood recycling industry to understand how best to do this and establish appropriate mechanisms.

The BWF and Wood Preserving Association should provide guidance to the recycling industry on waste categorisation of wood products and methods for testing/identifying preservatives.

Best practice from other European countries should be adopted by the UK. For example, Germany provides funding to assist the industry in purchasing window recycling machines.

Lobbying of government and / or business support agencies such as WRAP could identify routes to subsidise the required infrastructure so that maximum resource recovery can be achieved. These issues are closely linked to the Windows Roadmap that Defra is currently producing.

**What next:**
Identify required recycling equipment and infrastructure to manage wastes arising from the relevant activities. This should then be cross referenced with existing resource management facilities to identify potential candidates for the necessary equipment. The BREMAP tool could be used to help with this.

The results of action 3 could also feed into this. It is imperative to coordinate strategic liaison between the recycling industry and the wood industry in order to increase communication between the groups.

**Who to take it forward:**
BWF, other timber trade associations, Wood Preserving Association, Wood Recyclers Association, WRAP, Defra.

5. Extending the life of products

**Issue:**
Common products with a short, single lifespan produce more waste and have higher impacts over the life of a building than long-life reusable products.

Industry experts feel it is possible to match the service life of products such as windows or doors to the design life of housing e.g. 60 years. Specifiers and consumers would need to be educated on the improved service life of new windows.

**Action:**
Improve the durability of products so that they need to be replaced less often and make it more viable to reuse products in a similar application. Improved durability links to enhanced design and production techniques, along with planned maintenance of windows in situ, i.e. repainted as required.

Reusing products could be more problematic, especially if the particular product requires certain levels of thermal performance or fire resistance. However, assuming the product is still fit for purpose, there is scope to reuse rather than recycling or sending to landfill.

**What next:**
Develop an awareness campaign on the importance of repainting wood windows, linking to environmental and cost benefits. If whole life costs are demonstrably lower, this presents a good business opportunity.

It may be necessary to a) demonstrate that highly durable products can be produced and b) work with key customers (e.g. social housing providers) to put into buildings and monitor their long term performance.

**Who to take it forward:**
BWF members who wish to take forward this business opportunity and registered social landlords with Decent Homes commitments.

Improving resource efficiency in construction product manufacture

BeAware is managed by BRE. The project is carried out in partnership with an industry consortium, led by a steering group chaired by the Construction Products Association. The consortium includes representative bodies from the timber and woodworking, plastics, composites and concrete manufacturing industries, the packaging sector, modern methods of construction, construction clients and advisors, waste processors and technical experts.

www.beaware.org.uk