Material change for a better environment

Summary Report

Wood Waste Market in the UK

Project code: MKN022 **Research date:** August 2009

WRAP helps individuals, businesses and local authorities to reduce waste and recycle more, making better use of resources and helping to tackle climate change.

Written by: Pöyry Forest Industry Consulting Ltd and Oxford Economics Ltd

Executive summary

The purpose of this project was to undertake both market and economic assessments for wood waste in the UK. The two sections of this report are described separately below.

Wood Waste Market Assessment

This section first identified gaps in wood waste estimates and then presented an approach for closing identified gaps.

A review of current publicly available literature confirmed that there are a range of estimates available on wood waste availability in the UK, and no figures from the reviewed literature were used in this study. The best of the approaches used in the studies were to link the wood consumption and waste generation by wood consuming industries, and wood embedded in buildings with wood generated from demolition activities.

This study then used two approaches to analyse wood waste arising in the UK. Firstly a bottom up approach by carrying out an interview programme with industry players within wood consuming and wood waste generating sectors; and secondly a top-down approach which analysed wood waste arisings by applying waste factors to volumes of wood consumed by various industries.

Whilst there are some good data sources regarding both municipal and industrial (packaging) wood waste, it is much more limited for the construction sector. Interviews with construction companies indicated a general lack of awareness of how much wood is actually consumed. However, almost all are able to indicate how much wood is wasted as a percentage of their consumption. The new requirement for site waste management plans should make it easier to track wood waste in the construction industry at least for large and medium size companies. Similar to the construction industry players contacted, demolition contractors found it difficult to estimate the amount of wood waste generated from demolition activities.

The results using both approaches were remarkably close, with wood waste arisings in 2007 being 4.5 million tonnes using the bottom up approach and 4.6 million tonnes using the top down approach. The construction and demolition sectors are the largest generators of wood waste.

This figure is substantially less than figures presented in previous studies and this is thought to be due mainly to a lack of data for the construction sector. This situation is improving and with the advent of Site Waste Management Plans, estimates for this sector should become increasingly accurate. The current economic climate may also have affected the estimate of wood waste arisings from the Construction and Demolition sectors.

On a regional level London, the South East and the North West have the highest wood waste arisings. This is clearly linked to these areas having the highest population density as well as most construction and manufacturing activity.

Regional analysis by wood waste stream, in thousand tonnes.

	Packaging	Industrial	Construction	Demolition	Municipal	Total waste
East Midlands	101.8	40.3	80.8	73.9	36.1	**332.9**
Eastern	121.8	48.1	96.1	135.1	46.1	**447.2**
London	123.4	48.8	180.9	158.3	23.4	**534.8**
North East	36.7	14.5	50.4	45.6	26.9	**174.1**
North West	125.3	49.5	134.2	110.9	123	**542.9**
South East	162.7	64.3	150.8	190.7	57.6	**626**
South West	106	41.9	96.4	101.2	69.1	**414.6**
West Midlands	126.6	50	95.1	92.8	54.8	**419.4**
Yorkshire and Humber	103.3	40.8	108.7	91.9	69.4	**414.1**
England	1,007.6	398.4	993.4	1,000.3	506.3	**3,906**
Wales	49.6	19.6	45.1	35	55.4	**204.7**
Scotland	76.3	30.2	107.4	87.9	28.3	**330.1**
Northern Ireland	36.4	14.4	38.6	14.2	28.6	**132.2**
United Kingdom	**1,169.9**	**462.5**	**1,184.5**	**1,137.4**	**618.7**	**4,572.9**

Economic trends in the wood waste market

The second half of the paper explores how the wood waste market is likely to develop in the future because of economic drivers and regulatory changes.

Wood waste is generated as part of the manufacturing process or when a wood product is disposed of at end life. Output levels in many of the sectors which heavily use wood inputs and therefore generate waste have fallen sharply since the UK economy entered recession. As a result the quantity of wood waste arising has fallen significantly in the second half of 2008 and first half of 2009. With less new wood products being bought, the quantity of waste arising from the disposal of end of life wood products is also likely to have declined as economic conditions deteriorated.

This analysis looked at output levels in each of the industries which produce wood waste. Forward looking survey and leading indicator evidence was used to explore how output levels are expected to change in the next few quarters. The analysis used the industries experience in previous recessions and recoveries to see how their output levels changed and hence the quantities of wood waste generated may behave in future. Lastly, it deployed forecasts from Oxford Economics' own industry model. The analysis suggests the output of the industries that generate wood waste is likely to fall by around 14% from its peak ahead of the recession. After five years, these industries' output is predicted to be 6% below its' pre-recession level. The quantity of wood waste arising is therefore expected to decline over the next year and take around five years to recover its pre-recession level.

Just under 60% of the wood waste that is recycled is used by wood panel manufacturers. Wood panels are primarily sold to the construction and furniture sectors. Both have been heavily hit by the recession and most UK wood panel manufacturers' annual reports and commentary suggests 2008 was a very difficult year. As a consequence of falling output levels, wood panel manufacturers' demand for wood waste inputs is likely to have fallen in 2008 and will continue to decline in 2009.

The Renewables Obligation, the Renewables Obligation Scotland and the Northern Ireland Renewables Obligation are designed to incentivise renewable generation into the electricity generation market. There is considerable uncertainty about how the reforms will impact electricity generators use of wood waste. Given the time it takes to obtain planning permission and build an electricity generating plant, perhaps the best indication of how demand for wood waste as a fuel will change is the amount of extra electricity generating capacity coming on stream. Unfortunately, this is somewhat of an imprecise indicator as some generating plants can switch between feedstocks. However, it is estimated that electricity generating capacity that is likely to use wood waste will increase by 1½ times current capacity by 2011.

Combined together (using usage of wood waste as the weights) the main user industries of wood waste output is forecast to fall in 2009. The fall is predicted to be smaller than the decline in wood waste generating industries' output. The loss in user industries output will be recovered in 2010. Thereafter, the additional electricity generating capacity is likely to lead to a sharp rise in the demand for wood waste.

The analysis suggests the demand for wood waste is likely to outstrip the quantities arising over the next few years. If the price mechanism is working efficiently, the price of wood waste should rise to choke-off the additional demand. If not, shortages of wood waste are likely to occur.

Contents

1.0 Introduction

The purpose of this project was to undertake both market and economic assessments for wood waste in the UK.

The market assessment analyses the current market for waste wood. The key elements of this part of the assignment were to undertake a gap analysis on the current understanding of the UK waste wood market. This was followed with primary research where top-down and bottom-up analysis of wood waste demand was undertaken throughout the entire supply chain - segmented by wood type, source and geography. The ultimate objective was to redefine the market size and main end-users of the waste wood market in the UK. The market assessment was undertaken by Pöyry Forest Industry Consulting

The economic assessment provides an analysis of current and likely future economic trends in the recovered wood markets in the UK, and how those will relate to demand in the short-to-medium term. This part of the report was undertaken by Oxford Economics.

2.0 Wood waste market assessment

2.1 Methodology & Gap Analysis

The study focused on sources that generate the majority of wood waste from municipal waste, construction, demolition and remodelling activities, and from manufacturing of packaging, furniture, joinery and fencing. This study did not specifically focus on an assessment of wood waste arising from railway sleepers, utility poles and cooling tower packing timbers. The hazardous wood waste arising from railway sleepers and utility poles is small (approx. 60,000 tonnes/year), and previous studies conducted by WRAP (WRAP, 2004) suggest that little enters the waste stream. In addition, data on availability of cooling tower packing timber are considered commercially sensitive, and this timber is expected to last the lifetime of a cooling tower.

Packaging waste is considered to be the cleanest source of wood waste and all sources include a lower or higher share of contaminated wood such as painted, coated or laminated wood as well as preservative treated wood.

Figure 1 Sources of post-consumer wood waste.

Wood waste arising was analysed on a regional level across the entire UK (England, Scotland, Wales, and Northern Ireland). English regions were defined based on Government Office Regions.

The desk based gap analysis investigated public information currently available on the wood waste in the UK. In recent years a number of studies have attempted to assess the available amount of wood waste in the UK. Some studies (WRAP&MEL, 2005) are based on desk research and analysis of previous work, while others (WRAP, BFM&BRE, 2004; WRAP&TRADA, 2003) are based on market research and supported by their own and public data collection systems. Understanding of the wood waste arising, as well as data gathering within some sectors i.e. municipal waste, packaging industry is improving.

There seems to be limited reference to the total consumption of wood and wood products in the UK that can be used as an indication/reality check for reasonable wood waste levels generated. TRADA (2003) indicates the

annual consumption of sawnwood and wood-based panels around 9.6 million tonnes in 2001, while WRAP&MEL (2005) states the total use of wood products just over 9 million tonnes for all uses.

On the other hand, in some studies (TRADA, 2002; BRE, 2004) it has been presumed that consumption of wood and wood products reaches 48 million tonnes in UK, therefore large amounts of post-consumer wood waste may seem reasonable. These 48 million tonnes of wood and wood products consumed in the UK are WRME (Wood Raw Material Equivalent, underbark), not tonnes or actual cubic metres. WRME is the volume of trees required to produce a wood product and the above mentioned volume also includes wood for pulp, paper and board consumed in the UK although produced outside the UK. Over 90% of this volume is imports, and only 46% is sawnwood or panels. The corresponding figure for 2007 is 54 million tonnes (FC, 2008).

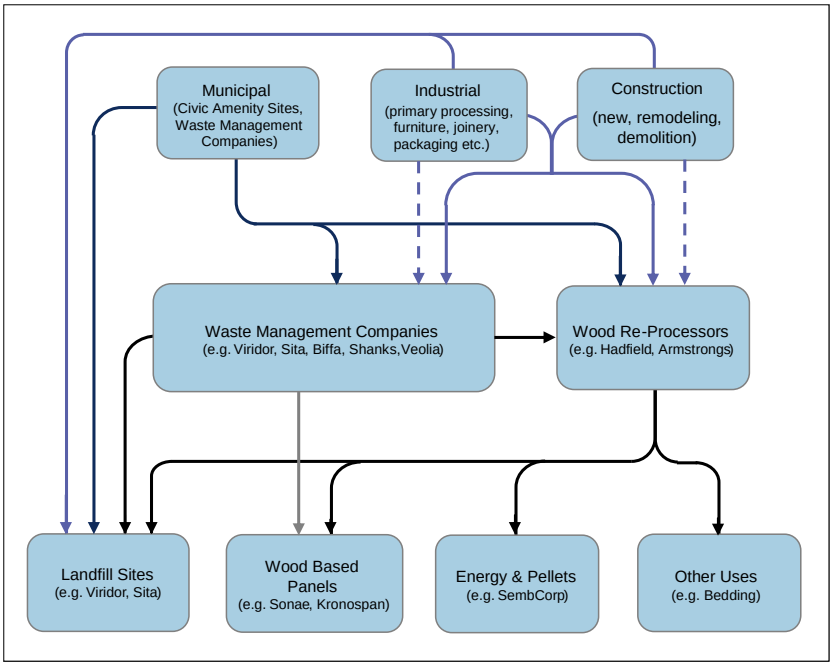
Publicly available data for wood waste arising in the UK are based on surveys and various assumptions, and results vary greatly. Selected studies shown below are the most comprehensive covering all streams of wood waste. The literature review covered key public information, identified the best data and addresses the gaps.

Table 1 Range of estimates in most comprehensive studies published[1] on wood waste in the UK, all numbers in million tonnes.

Stream	ERM/DTI (2006/2007)	WRAP&MEL (2005)	TRADA (2002)	BRE/Hurley (2004)
Municipal	1.1	1.1	2.5	0.8
Industrial/Commercial	3.5	4.5	1.8	3.3
Construction/Demolition/Remodelling	2.9	5.0	0.9	3.3
Total	7.5	10.6	5.2	7.4

The literature review identified the construction and demolition streams as having the greatest range of estimates on wood waste arisings. The market analysis work therefore focussed on these areas for both the top down and bottom up methodology.

Figure 2 Wood waste supply chain and focus areas of the study.



In the research for the 'Gap Closure' element three approaches were used to address the data gaps identified during the desk study:

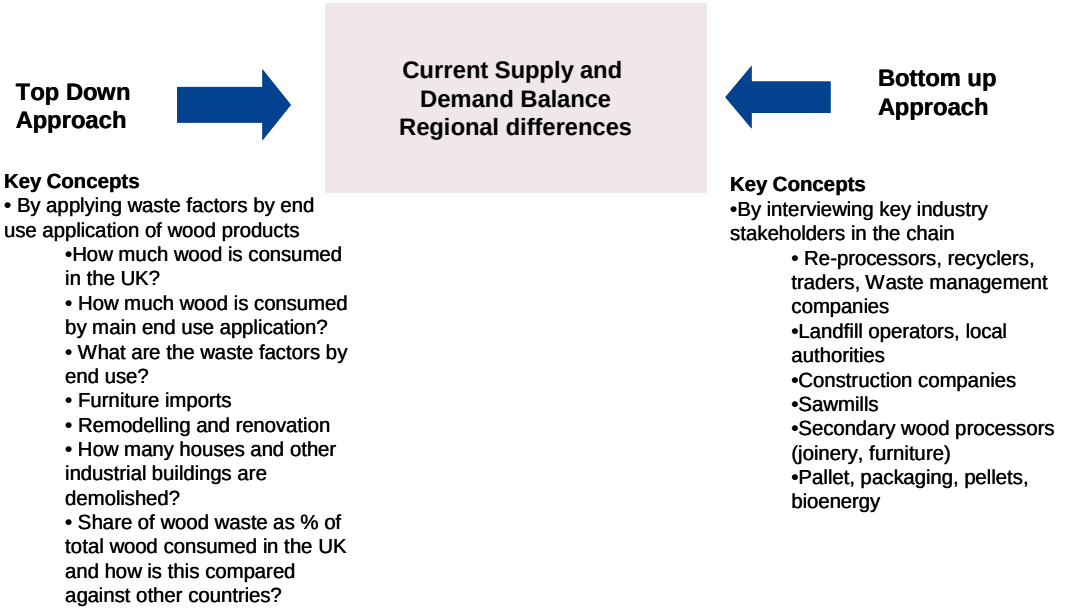
- Bottom up approach.

[1] *Year refers to publication date not the estimate for the year*

- Top down approach.
- Update of existing sources.

The questions were different for each approach. The top down approach verified wastage factors while the bottom up approach builds volumes based on market share or a statistical sampling approach.

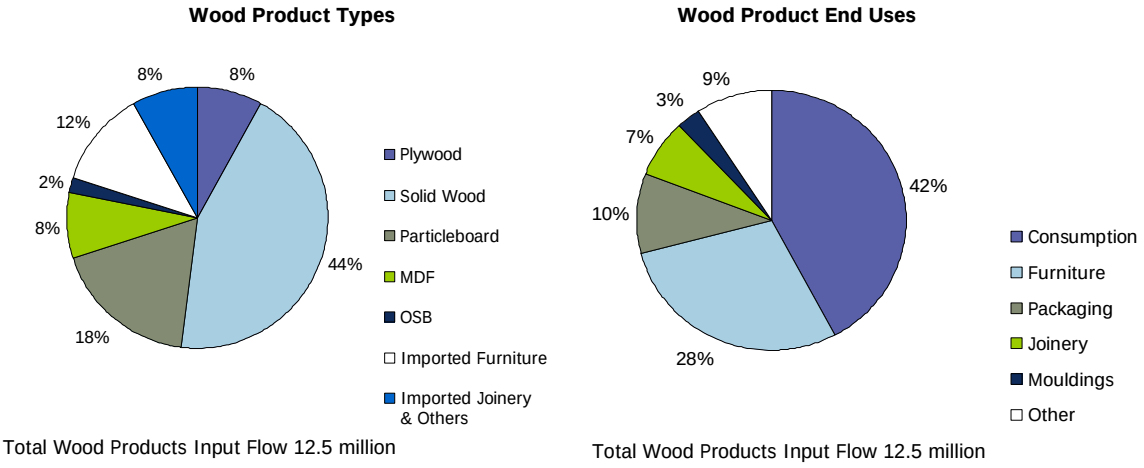
Figure 3 Approaches used in the market analysis.



The bottom up approach focuses on interviewing as many market participants as possible in order to build up the total volume of wood waste. This approach was selected for the analysis of construction, demolition and secondary processing (furniture and joinery) sectors.

The top down approach focuses on the fact that the total wood waste arising in the UK cannot be greater than the total volume of wood intake in construction, furniture, and other key end-uses. Wood waste from demolition activities is considered less than construction activity as most demolition work is preparatory to construction work. The total UK wood products input flow was 12.5 million tonnes in 2007 (Source: Poyry Forest Industry Consulting).

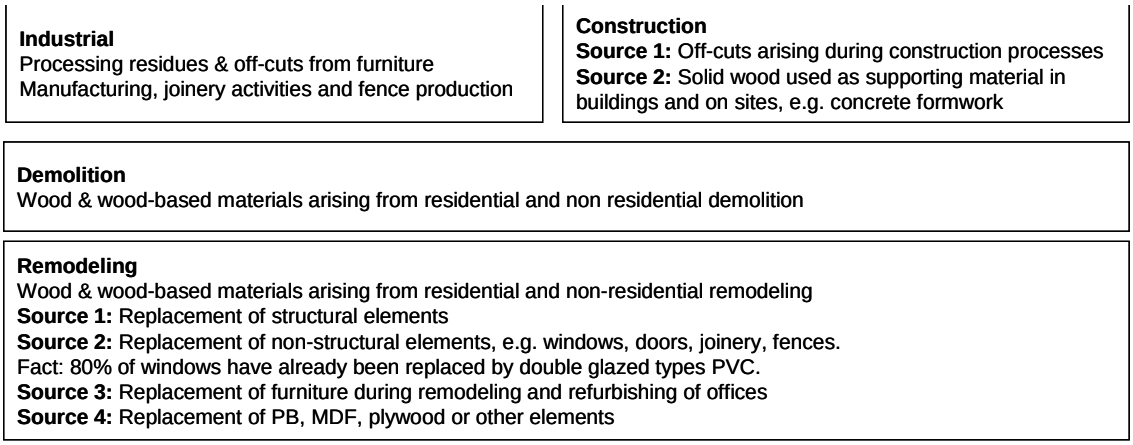
Figure 4 Market segmentation of wood product types and end-uses



The top down approach is based on the market segmentation and the end-use of wood products in the UK. A waste factor is applied to wood consumed by each segment in order to estimate the wood waste volume arising from each segment. These waste factors were verified during an interview process with the relevant industry players.

Wood arising from industrial, construction, demolition and remodelling activities as well as all potential wood sources from each activity were taken into account. A waste factor was applied for each of the end uses of wood in figure 5.

Figure 5 Wood waste streams analysed.



2.2 Research

The survey took place between November 2008 and January 2009. The primary focus of the survey was bottom up market analysis to assess the wood waste arising from construction, demolition and secondary processing segments, in addition wood wastage factors used in top down analysis were also verified. These segments combined consist of 69,630 companies (40,000 construction; 1,096 demolition; 21,009 joineries and 7,525 furniture manufacturers).

In the market survey two different approaches where chosen:

1 Interviews based on the market share of each player with an aim to cover as much of the segment as possible i.e. wood re-processors, panel manufacturers, bioenergy producers etc.

2 Using stratified random sampling for sectors with a very large number of companies i.e. construction companies, demolition contractors, secondary processors – furniture and joinery.

Stratified random sampling:

Stratified random sampling involves dividing the sample into subgroups based on a specified characteristic for this survey, the variable of interest is the quantity and quality of wood waste generated, and the stratification factor is the size of the company based on its turnover. Turnover was chosen because it seems reasonable to assume that there are similar waste generating patterns depending on the size of the company. Random samples were selected within each subgroup to have a proportionate survey sample.

The table below summarises the project interview programme.

Table 2 Summary of survey.

Industry Group	Companies contacted	Successful interviews	Market share covered
Wood re-processors, recyclers and traders	76	24	70%
Waste management companies	14	5	50%
Construction companies	300+	101	<10%
Demolition contractors	~150	35	<10%
Panel manufacturers	4	4	100%
Sawmills	9	8	70%
Secondary processors – joineries	~120	40	<10%
Secondary processors – furniture	~200	48	<10%
Pallet and packaging manufacturers	25	10	<10%
Pellet producers	17	15	90%
Bioenergy and energy producers	22	19	90%

2.3 Results and discussion

2.3.1 Construction sector

Bottom up

There are around 40,000 construction companies contributing to wood waste generation in the UK and during the interviewing process over 300 companies were contacted. While some companies were able to supply exact wood waste records, the majority of the small and medium companies were supplying estimates.

Table 3 Summary of interview findings from the construction sector.

Group	No. of Companies	Turnover £m	Average Wood Waste t/a	Min/Max Range t/a	No. of Interviews	Estimated wood waste arising
Small	37,635	<1	5	1-45	45	188,500
Medium	2,200	1-100	190	50-460	29	418,000
Large	150	101-800	1,800	400-4,000	21	270,000
Very Large	15	>800	15,000	2,800-25,000	6	225,500

The interviews indicated that records of wood consumption are not easily available from construction companies. This is believed to be due to complex purchasing procedures. Only estimates for the typical waste factor in the industry could be provided; approximately 10-15% of the consumed timber (excluding ready-made elements) is believed to be wasted.

Subcontractors are often used in purchasing and disposing of wood, however the disposal is managed by the main contractor or jointly managed by both. This leads to a complex system for sourcing and disposing of wood and often the actual amounts are not sufficiently monitored between the various parties involved.

A common trend is that the waste management companies collect the waste from the construction sites and when required, report the waste quantities back to the construction companies. Several companies indicated that they have only recently started monitoring the waste amounts and the data will be available during 2009.

If the wood is not segregated on the construction site, the waste management company will segregate it in their depots. Most of the large companies target a 75-80% recycling rate (75-80% of total waste is recycled).

The amount of segregation of construction waste is highly variable. Collection of a skip that contains only wood is typically half the price of one containing mixed waste and hence segregation is preferred. However, often the amount of available space and accessibility to the site limits segregation. The limited space is the biggest issue and based on the interviews it is more common that the wood is mixed with other waste than segregated.

Based on the interviews the wood wastage in timber frame manufacturing is less than 5% of consumption and in the construction sites it is negligible. Most of the timber frame manufacturer's burn their wood waste in their own burners or give the wood waste to their employees or other private persons, as a result it is not accounted for in the waste statistics.

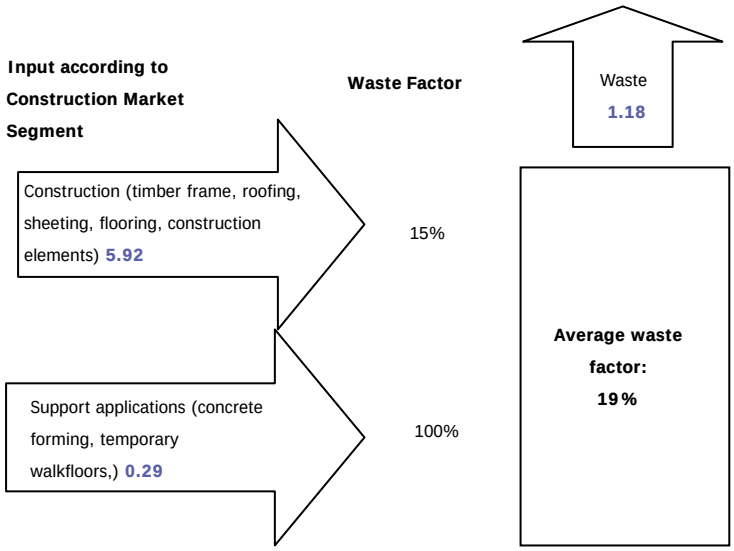
Top down

The construction industry is the largest end user of wood products in the UK. The construction industry alone consumes in excess of 6.2 million tonnes of wood annually (Source: Pöyry Forest Industry Consulting[2]). WRAP & TRADA (2003) concluded that the construction industry consumes over 4.5 million tonnes of wood based panels and sawn wood. Eurostat (accessed January 2009) shows the volume of imported construction elements reaching 0.6 million tonnes in 2007, that would bring the total number to 5.1 million tonnes.

During the interview process it was found that wood waste arising in construction is 10-15% of wood consumed. Based on this a 15% wastage factor was applied to the total volume of all wood based panels as well as imported building products and flooring consumed by the construction sector whether traditional or timber frame. Similarly it was assumed that 15% of all solid wood used directly in the construction industry is wasted as is 100% of all solid wood used in support applications e.g. hoarding, giving an average of 19% wastage rate for wood used in traditional construction activities.

Applying these waste factors to the volume of wood products consumed by the construction industry it was concluded that approximately 1.2 million tonnes of wood waste is generated at construction sites. This includes wood used as supporting material (e.g. formwork) as well as building element off-cuts.

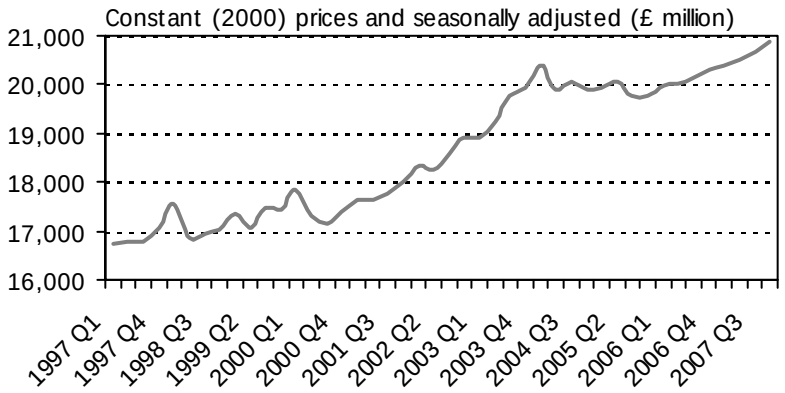
Figure 6 Wood product input and output in construction, all numbers in million tonnes.



It is believed that the wood waste arising from construction industry follows the same pattern as general construction activity – peaking in the beginning of the year and a gradual decrease towards the end of the year.

[2] *Market information is based on years of market research done by Poyry Forest Industry Consulting as there is no official statistics available*

Figure 7 Seasonality of construction output (Source: ONS).



2.3.2 Demolition sector

Bottom up

The demolition sector is a large contributor to total wood waste; however, the bulk of this wood is treated and has few end markets as a result.

During the interviewing process over 150 companies were contacted which lead to 35 successful interviews.

Table 4 Summary of interview findings from demolition sector.

Group	No. of Companies	Turnover £m	Average Wood Waste t/a	Min/Max Range t/a	No. of Interviews	Estimated wood waste arising
Small	756	<0.3	300	50-450	7	226,800
Medium	252	0.3-1	800	300-1,248	10	201,600
Large	71	1-5	3,000	1,200-5,000	12	213,000
Very Large	17	>5	10,000	8,000-15,000	6	170,000

Wood waste arising from demolition sites varies greatly depending on the type of the building demolished. Wood waste typically accounts for 20% of waste by volume and 10% by weight.

Around 80 – 90% of demolition waste is generally recycled with a main focus on aggregates.

Overall reporting is still not great especially for contaminated wood. Members of the National Federation of Demolition Contractors (NFDC) annually account for all demolition waste going to landfill and declare this to the NFDC. Some of the larger companies had their own transfer stations and could provide more accurate information.

Demolition material is sorted either for skipping or into general waste, when contaminated. Material going to transfer or waste management companies often incurs a charge at a lower rate than landfill and so is seen as a saving and often accounted for per job.

New site waste management plans for projects over £300,000 came into force in July 2008 and should allow for more accurate accounting in the future. This legislation applies to England only, but is also encouraged in Wales, Scotland and Northern Ireland.

Top down

The volume of wood waste from demolition activities has been estimated based on the number of demolished dwellings. Statistics on the number of demolished dwellings in the UK is published annually. Based on available

statistics for each region there were around 25,000 residential dwellings demolished[3] in the UK in 2007, which is a decrease from previous years. Based on interviews with industry it was further estimated that around 4,000 commercial buildings are demolished annually bringing the total number to 29,000 buildings.

When calculating the wood waste arising from demolition, based on interview findings it was assumed that each demolished building gives an average 3.6 tonnes of wood waste, which leads to the total wood waste volume just over 100,000 tonnes.

Remodelling activities include both demolition and construction. The total volume of wood consumed for remodelling activities is derived from the volume of wood sold through DIY stores, further a replacement factor[4] is applied and the total volume of wood waste is calculated. Based on these calculations the wood waste arising from remodelling activities is just over 1 million tonnes or 15% of the total wood volume consumed in such activities.

2.3.3 Industrial wood waste

Bottom up

This analysis covered both the furniture and the joinery sectors. The joinery sector consists of over 21,000 companies with 92% being small companies. During the interview process around 150 joineries were contacted leading to 45 successful interviews.

Table 5 Summary of interview findings from the joinery sector.

Group	No. of Companies	Turnover £m	Average Wood Waste t/a	Min/Max Range t/a	No. of Interviews	Estimated wood waste arising
Small	19,349	<0.2	5	3-9	21	96,745
Medium	1,470	0.2-1	30	10-50	8	441,000
Large	180	1-6	300	120-576	12	54,000
Very Large	10	>6	4,000	600-10,000	4	40,000

The joinery sector's main consumption was sawn wood, allowing better recovery and marketability of the waste generated. On average wood waste accounts for around 5-10% of consumption although it is varied depending on the materials used and the speciality of the company.

There seems to be active use of wood waste to several different streams. As sawn wood still makes up a major part of consumption there is greater recovery, adding a value to waste. Typically shavings are used to heat the workshops using wood burners. Some companies pass on collected shavings to employees and small businesses often for little or no cost, also some volumes are sold as animal/equestrian bedding.

In the current economic climate, joineries have seen a reduction in wood waste generated that links to the reduction in orders. Interviewed companies increasingly are purchasing cut-to-size wood that also is contributing to a reduction of wood waste from secondary processing. Primary timber processors are using systems that enable them to increase the volume of usable timber, and the waste generated during primary processing is not considered as post consumer wood waste, hence not covered in the scope of this study. A reduction in waste and an increase in recycling is also seen as beneficial on cost, especially with rising waste disposal costs. On average the wastage from consumption was around the 5-10% level, of which the majority is recycled or consumed.

[3] Source: Web-resources: The Scottish Government - Housing Statistics for Scotland, Welsh Assembly Government - Housing Statistics, Northern Ireland Housing Statistics, National Housing and Planning Advice Unit - Housing Statistics for England.

[4] Replacement factor – what share of existing structural and non-structural elements (including furniture) are replaced?: 100% for structural elements, 50% for OSB, plywood and furniture, 20% for PB and MDF. Sources for these assumptions are interviews and Pöyry Forest Industry Consulting in-house data.

Table 6 Summary of interview findings from the furniture sector.

Group	No. of Companies	Turnover £m	Average Wood Waste t/a	Min/Max Range t/a	No. of Interviews	Estimated wood waste arising
Small	6360	<1	9	1-36	29	58,488
Medium	875	1-5	52	6-208	8	45,347
Large	290	>5	1,455	4-34,400	11	419,166

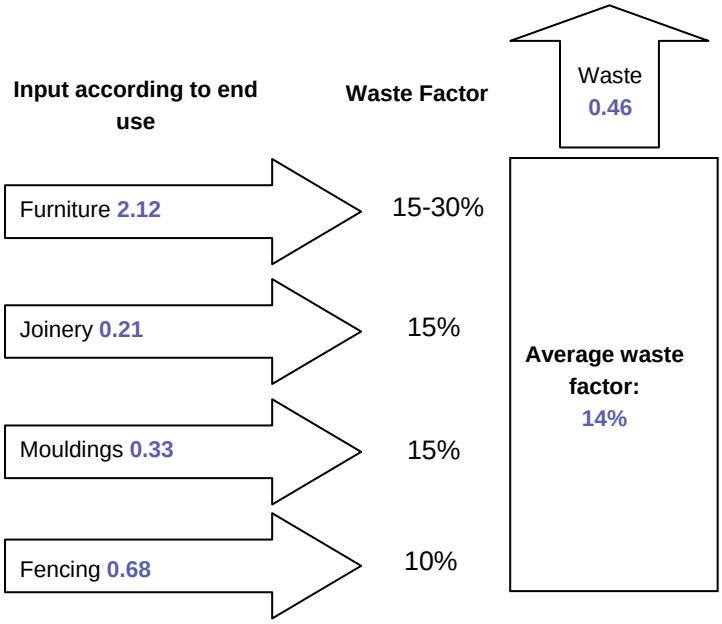
Most of the big furniture producers use particleboard and MDF. The large companies have several methods of recycling their wood waste and much of it is burnt on site. Many of the smallest companies tend to use sawn wood and have a relatively low waste factor and burn all their wood waste on site. Many large furniture manufacturers are looking at alternatives to burning wood waste; and are currently reviewing options of using it in composting or animal bedding. Overall companies first try to reduce the waste generation, secondly to recycle and reuse by burning it for heat generation or selling on to composting and animal bedding. Some companies are trying to achieve 0% landfilling and 100% recycling and reuse.

Some environmental initiatives are currently in the process of being implemented by furniture manufacturers, some examples include: an establishment of a carbon footprint for their products and processes and using more Forestry Stewardship Council certified wood products. More customers are concerned that new processes in furniture manufacturing do not have a negative impact on the environment. Performance improvement is a big issue in the furniture industry.

Top down

Industrial wood waste comes from the manufacture of furniture, joinery products, mouldings and fencing. Wood waste arisings from packaging manufacture is not included within this stream. Almost 5 million tonnes of wood is consumed for the production of above mentioned products and approximately 15% of total wood input is arising as waste. This leads to 0.46 million tonnes of wood waste generated by industrial sector.

Figure 8 Wood product input and output in manufacturing, all numbers in million of tonnes.



The furniture industry has the highest waste factor at 15-30% whilst the average waste factor in manufacturing is 14%[5]. The majority of the wood waste from the industrial sector is formed of panel products that have limited potential for further end uses.

2.3.4 Municipal wood waste

The wood waste arising from municipal stream has been estimated using data from http://wastedataflow.org. It has been assumed that all local authorities reported their volumes in 2007.

The highest wood waste arising is the North West of England, followed by Yorkshire and Humber and South West. The regional volumes of wood waste recovered seem reasonable. Northern areas of England have higher concentration of wood recyclers. Municipal wood waste volumes in London are low partially because there are a limited number of civic amenity sites for wood collection.

The wood waste arising in Scotland may be an underestimate, taking into account that the population is larger than in Wales or Northern Ireland.

Table 7 Municipal wood waste arising by region in thousands tonnes.

Region	Wood waste arising	Wood waste arising tonnes/capita
East Midlands	36.1	0.008
Eastern	46.1	0.008
London	23.4	0.003
North East	26.9	0.011
North West	123	0.018
South East	57.6	0.007
South West	69.1	0.013
West Midlands	54.8	0.010
Yorkshire and Humber	69.3	0.013
England	506.3	0.010
Wales	55.4	0.019
Scotland	28.3	0.006
Northern Ireland	28.6	0.016
United Kingdom	**618.7**	**0.010**

It is believed that low wood waste arising per capita is linked to high density of population and low number of civic amenity sites accepting wood waste. It is likely that many repair and maintenance activities are carried out by contractor's as a result wood waste not entering the municipal waste stream.

There is a clear seasonal pattern in wood waste arisings from municipal waste, with the highest arisings during the warmer times of the year. The seasonality of municipal wood waste arisings closely correlates with new housing starts. Similar to overall construction, DIY activities peak during the warmer times of the year, hence more wood waste arising in the municipal waste stream.

Wood entering municipal waste streams is mostly from DIY and private remodelling activities. The overall quality of wood is low as it includes all types of wood – sawn wood off-cuts, wood based panels, treated wood, painted wood, surfaced wood and is also generated commingled with furniture. The largest potential end market for municipal wood waste is energy generation and to a lesser extent panel board manufacturing.

2.3.5 Packaging wood waste

Data on the volume of packaging wood waste was taken from the National Packaging Waste Database (NPWD) published by the Environmental Agency, as it is widely accepted source for packaging waste. Based on this information the wood waste from packaging industry was 1,047,260 tonnes in 2007; however this number only

[5] Different waste factors have been applied to calculate wood waste arising in each manufacturing industry. In the furniture sector wastage of 15% was applied to all panel material consumed and 30% wastage for all sawn wood material. The average waste factor for all manufacturing industries is 14%

includes recovered and recycled packaging. Additionally, the wood waste arising from packaging manufacturing in the UK was calculated based on a top down approach with the waste factor being verified during market survey.

Packaging manufacturing in the UK consumes just over 1.2 million tonnes of wood of which around 10% is wasted, giving around 120,000 tonnes of wood waste from domestic packaging manufacturing. Combining the figures from the NPWD and estimated wood waste from domestic manufacturing, the total volume of wood waste from packaging industry is 1,169,860 tonnes. This figure does not include single use wooden packaging that is imported i.e. fruit boxes. Such packaging is likely being disposed of by waste management companies or ending up in landfill. There are no statistics accounting for this type of packaging being imported and disposal is not monitored either.

Packaging wood waste is considered clean wood and is used predominantly in panel board manufacture and also animal/equestrian bedding. There is great demand for this type of wood waste and very little is available for energy generation or composting where lower quality could be used.

2.3.6 Conclusions

The advantage of the bottom up approach is that the volume of wood waste generated is built up by talking to industry players and recording the volumes wasted. The disadvantages are that majority of the volumes are estimates since there is no official requirement to record the amount of wood waste generated by most of the industries.

New legislation for waste management plans in the construction and demolition industries came into force during 2008. This legislation requires waste management plans for all projects above £300,000. This should allow better understanding on the actual wood waste volumes generated by the construction and demolition industries in the future.

The advantage of a top down approach is that it takes into account the total volume of wood consumed by construction, remodelling and industrial end users. These volumes are well known by the wood producing industry and this approach also takes into account the volume of imported wood products. By applying the maximum waste factor (confirmed during the market survey) a limit is set to how much wood actually is wasted by each of these industries.

Demolition statistics are reasonable for residential dwellings and absent for any industrial buildings. It was confirmed by the National Federation of Demolition Contractors[6] that there are no reliable statistics available for the total number of demolished buildings. The best estimate of demolished buildings is given in the previous section and a higher wood waste volume per building is used, to account for the demolition of industrial buildings.

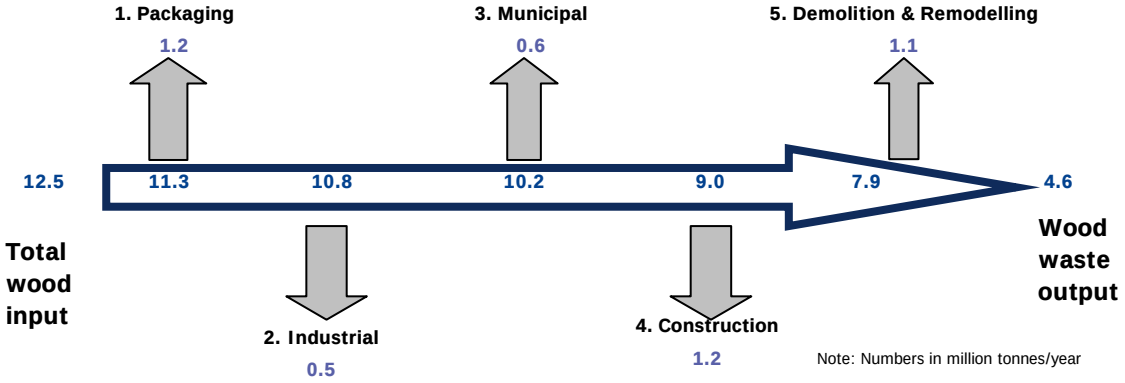
The accountability of wood waste arising from municipal streams and the packaging industry is significantly better than for other industries. For the packaging industry this is driven by a number of packaging regulations; and for local authorities there are a number of regulations on the overall waste reduction and land filling that have lead to better accountability of municipal waste.

2.3.7 Summary of wood waste volumes and regional analysis

A combination of approaches was chosen to derive the total volume of wood waste in the UK. The figure below shows that main sources of wood waste are packaging, construction, demolition and remodelling.

[6] *Personal communication*

Figure 9 Wood waste flow in 2007 (arrows indicate the volume of wood waste from each stream)



The majority of the wood waste is generated in the South East, North West and London. These are areas with high population density, significant construction activities and a concentration of manufacturing enterprises.

The regional supply of municipal wood waste was extracted from http://wastedataflow.org. The regional split for construction, demolition and remodelling waste is distributed based on construction activity. Waste arisings from packaging and industrial manufacturing segments are distributed based on the presence of manufacturing companies.

Table 8 Regional analysis by wood waste stream, in thousand tonnes.

	Packaging	Industrial	Construction	Demolition	Municipal	Total waste
East Midlands	101.8	40.3	80.8	73.9	36.1	**332.9**
Eastern	121.8	48.1	96.1	135.1	46.1	**447.2**
London	123.4	48.8	180.9	158.3	23.4	**534.8**
North East	36.7	14.5	50.4	45.6	26.9	**174.1**
North West	125.3	49.5	134.2	110.9	123	**542.9**
South East	162.7	64.3	150.8	190.7	57.6	**626**
South West	106	41.9	96.4	101.2	69.1	**414.6**
West Midlands	126.6	50	95.1	92.8	54.8	**419.4**
Yorkshire and Humber	103.3	40.8	108.7	91.9	69.4	**414.1**
England	1,007.6	398.4	993.4	1,000.3	506.3	**3,906**
Wales	49.6	19.6	45.1	35	55.4	**204.7**
Scotland	76.3	30.2	107.4	87.9	28.3	**330.1**
Northern Ireland	36.4	14.4	38.6	14.2	28.6	**132.2**
United Kingdom	**1,169.9**	**462.5**	**1,184.5**	**1,137.4**	**618.7**	**4,572.9**

These figures are substantially less than figures presented in previous studies and this is thought to be due mainly to a lack of data for the construction sector. This situation is improving and with the advent of Site Waste Management Plans, estimates for this sector should become increasingly accurate. The current economic climate may also have affected the estimate of wood waste arisings from the Construction and Demolition sectors.

Wood waste qualities have been estimated based on top down analysis for construction, demolition and remodelling, packaging, furniture and joinery manufacturing. Distribution of wood waste qualities within municipal stream has been assumed the same as in construction since the majority of the wood is likely to be used in DIY activities, with a higher proportion of treated solid wood (95% in DIY vs. 70% in construction).

Solid wood constitutes 72% of total wood waste. Treated solid wood includes preservative treated wood, painted, lacquered and similar wood.

Solid wood from packaging is considered as clean wood and it forms over 70% of clean solid wood with the remaining coming from other activities.

Although there is increasing demand for recycled wood fibre and recovery of some types of treated solid wood, i.e. painted and panels is growing, the overall utilisation remains low. The main alternative market for treated solid wood and panels would be energy generation, as the quality requirements are not as strict as for panel board manufacturing or animal bedding.

Table 9 Estimate of wood waste composition in thousand tonnes.

Wood waste type	Volume
Clean solid wood	1,426.6
Treated solid wood	1,903.4
Particleboard	568.3
MDF	261.9
Plywood	303.8
OSB	117.2

2.3.8 Cross check of top down vs. bottom up analysis

Both bottom up and top down analysis gave remarkably close results. The differences in results are primarily due to different approaches used. Estimates derived using a bottom up approach are seen as less reliable, since the majority of the responses are estimates/guesses on which further analysis is based.

The top down approach is believed to be more accurate as it links to the volumes of wood consumed by various industries.

There are uncertainties with regard to wood waste from the packaging industry as single use wood packaging remains unaccounted and this stream is not monitored.

Table 10 Cross check of top down and bottom up market analysis in million tonnes.

Wood waste source	Bottom-up analysis	Top-down analysis
Construction	1.1	1.2
Demolition/Remodelling	0.8	1.1
Furniture	0.5	0.3
Joinery	0.2	0.1
Other industrial	0.1	0.1
Municipal	0.6	
Packaging	1.2	
Total	**4.5**	**4.6**

2.3.9 International comparison

The results of the market research were compared to the data from other countries. Germany was chosen as a comparison as both countries have large population and similar trends in wood consumption, e.g. the share of timber frame construction in both countries is just over 20% of total residential construction. Similar to UK German wood manufacturing industry widely uses machinery equipped with computer programmes to maximise productivity and minimise waste generation. Also Germany is a good example since landfilling of wood waste has been prohibited since March 2003, thus waste streams are relatively well known.

Table 11 International comparison of wood waste in Germany and the UK.

Country	Population	Wood Consumption	Waste Wood Arising	Waste Factor	Source
Germany	82M	~21M tonnes	8.8M tonnes	42%	Mantau (2005)
UK	61M	12.5M tonnes	4.6M tonnes	37%	Pöyry

3.0 Future trends in wood waste arising

Wood waste is generated as part of the manufacturing process or when a wood product is disposed of at end life (EOL). Section 5 evaluates how wood waste generating industries' output is expected to change over the next five years. Output levels are an important and timely indicator of how the quantity of wood waste generated as part of the production process is likely to change. As EOL products are usually replaced, output is also a reasonable indicator of the rate of disposal of existing wood products.

3.1 Construction

The analysis in the market survey shows the construction sector is the largest producer of wood waste (Table 9). But the sector's importance in determining the quantity of wood waste arising is greater than its' share of tonnage, as most of the other wood waste generating industries are in its' supply chain. The level of construction output therefore influences demand for the other industries' products. Trada (2005b) and (2005a) shows 67% of joinery output and 26% of wooden packaging output are sold to the construction sector, respectively. In the case of demolition, most demolition activity is undertaken to make way for new construction and is discussed separately in section 5.2.

The immediate outlook for the quantity of wood waste arising from the construction sector is dominated by the impact of the recession. Historically, the construction sector has been very sensitive to the business cycle, expanding more rapidly than the whole economy in booms and contracting more sharply in recessions. It is possible to assess how much construction output (and therefore the quantity of wood waste the sector generates) will fall in the recession and for how long in three ways.

Leading indicator and forward looking survey evidence has been used to form a view of the outlook for construction output will fall in the short-term. New orders are generally thought of as a leading indicator of output as they precede the start of the building activity. In 2008, total orders for new construction fell by 19% (Table 11). In 2009Q1, new orders for all work fell by 7% on their level in 2008Q4. Survey evidence also points to a sharp contraction in construction output. The Royal Institute of Chartered Surveyors (RICS) Construction Survey in 2008Q4 shows builders' output expectations over the next twelve months at their lowest ever level.[7] Both pieces of evidence suggest the quantity of wood waste arising from the construction sector will decline in the near term.

Table 11: Percentage change in the volume of construction orders for new work

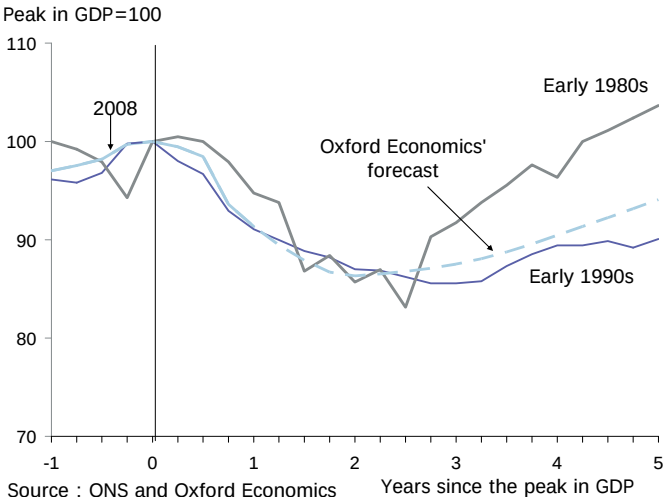
	Total	Of which:				
		Housing	Infrastructure	Public	Industrial	Commercial
Annual (percentage change on previous year)						
2007	2%	-4%	27%	8%	-11%	2%
2008	-19%	-38%	17%	26%	-27%	-28%
Quarterly (percentage change on previous quarter)						
2008Q3	-8%	-29%	-29%	21%	29%	-4%
2008Q4	-20%	-16%	-16%	-16%	-18%	-29%
2009Q1	-7%	14%	14%	-26%	-50%	-26%

Source: ONS and Oxford Economics

[7] *RICS Economics (2009).*

Another way to judge how far construction output and therefore the quantity of wood waste arising will fall in this recession is by examining previous ones. From the peak in GDP in 1979Q2, construction output fell by 17% over 2½ years in the early 1980s recession. Five years after the start of the recession, construction output was 4% higher. From the peak in GDP in 1990Q2, construction output fell by 14% over 2¾ years in the early 1990s recession (Figure 12). Five years after the start of the recession, construction output was 10% lower. Both suggest the quantity of wood waste will fall sharply and will recover to broadly its pre-recession level five years after the start of the recession.

Figure 12: Construction output in three recessions



Source : ONS and Oxford Economics

The third way to assess how construction output and therefore the quantity of wood waste arising will develop is to use a forecast from an econometric model. An econometric model is a complex interaction of statistical equations that aims to mimic behaviour in the economy and industries within it. Oxford Economics runs an industry model which produces forecasts of about 65 industries in 60 countries.[8] According to the latest set of ONS GDP figures, GDP began to fall in the UK in 2008Q1. Between 2008Q1 and 2009Q1, construction output is currently estimated to have declined by 9%. The model forecasts it will decline a further 5 percentage points over the next year. After five years, output is forecast to be 6% below its pre-recession level. This suggests wood waste arising from construction will fall over the next year and be slightly below its pre-recession level in five years time.

Looking forward, several factors are likely to affect the quantity of wood waste arising from the construction sector. The growth in the market share of timber frame houses will lower wood waste arising in construction.[9] It is a relatively small factor as ONS (2009) shows new house building only comprises 16% of total construction output in 2008. Two regulatory developments may also impact recycling rates. First, since 6th April 2008 it is a legal requirement that all construction projects worth over £300,000 have a Site Waste Management Plan (SWMPs).[10] These require construction companies to plan, monitor and measure the waste they generate on site. It is unclear what, if any, affect this will have on the quantity of wood waste generated. To the extent SWMPs improve construction companies planning of inputs usage, they will lower the quantity of wood waste arising. If however SWMPs focus companies' minds on the cost of waste disposal and encourage delivery to wood recyclers, the initiative may increase the quantity of wood waste arising. Alternatively, SWMPs may just force construction firms to count the waste generated. Second, the Department of Communities and Local Government's (2008) Code for Sustainable Homes reinforce SWMPs.

3.2 Demolition

In the market survey analysis, the demolition sector was found to produce 1.0 million tonnes of wood waste arising (or about a fifth of total). This makes it the third largest sector. It is closely linked to the construction sector, as most demolition takes place to make way for new construction.

[8] A lengthy description of the industry model used to generate the forecasts is available from www.oxfordeconomics.com.
[9] Statistics released by The UK Timber Frame Association (UKTFA) show timber frame's share has increased in each of the previous nine years (1998-2007), standing at just over 22% of all new housing in 2007.
[10] See Office of Public Sector Information (2008).

In the absence of adequate data on which to form a judgement about how the quantity of wood waste arising from demolition is likely to change, it is assumed it follows the construction sector's output forecasts. This is because most demolition takes place to make way for new build. The approach is given further legitimacy as ONS data from the Annual Business Inquiry (ABI) shows demolition's output is a stable proportion of construction output (at about 1.5%) between 1997 and 2007. No current or future legislation or regulatory developments are expected to materially affect the quantity of wood waste arising from demolition.

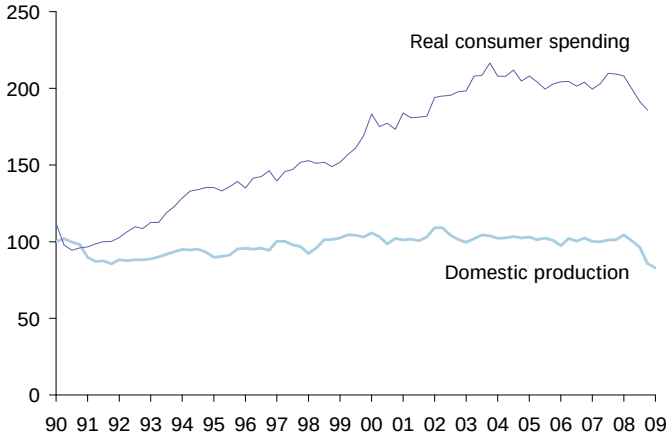
3.3 Furniture

Furniture generates wood waste through the manufacturing process and at end of life. The latter includes imported products. The analysis in this section focuses on the wood waste produced in the manufacturing process, as most EOL furniture is captured in the municipal route (through household disposals).

The domestic furniture manufacturing industry hasn't fared very well over the last decade. Output levels have been broadly constant since the early 1990s recession (Figure 13). Over the same time period, real consumer expenditure on furniture nearly doubled. Imports share of the UK market expanded to 41% by 2007. The growth in import penetration reflects the larger furniture retailers move towards global sourcing. This is usually attributed to domestic manufacturers lack of price competitiveness at the low quality end of the market and the switch in consumer tastes away from pine furniture.

Figure 13: Real consumer spending and domestic production of furniture

1990=100



Source : ONS and Oxford Economics

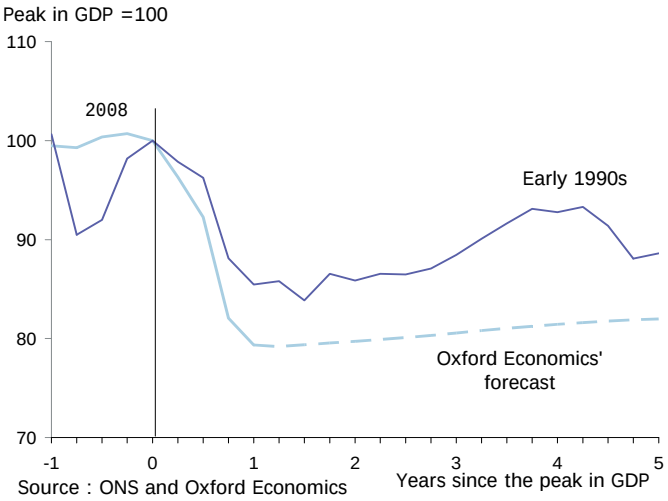
The quantity of wood waste generated by the furniture manufacturing sector is expected to decline in the immediate future. This is because consumer spending on furniture (and therefore production) is sensitive to the business cycle and the level of activity in the housing market.[11] At a time when real household disposable income is expected to grow very slowly for the population as a whole and decline markedly for those who lose their jobs, replacing a piece of furniture is a spending decision that can be deferred to a later date. Spending on larger pieces of furniture (which tend to be bought on credit) will also be restricted by the credit crunch and lenders' efforts to rebuild their balance sheets.

It is possible to judge how far furniture output and therefore the quantity of wood waste arising as a by product will fall in the near future by examining the previous recession (the data do not extend back to the 1980s). In the early 1990s recession, furniture output fell by 16% over 1½ years (Figure 14). After five years output stood 11% below. It has never recovered its pre-recession level.

Since the start of the recession and 2009Q1, furniture output has declined by 21% (Figure 14). The forecast predicts little in the way of recovery. This mirrors the relatively flat profile of output since the early 1990s (Figure 13). The forecast builds in a small stimulus from the exchange rate depreciation in 2008, which makes domestic import substitutes more price competitive.

[11] Benito and Wood (2005) argue the level of activity in the housing market is an important driver of spending on consumer durables because existing ones may not fit the rooms in a new house, moving is a cheap way of extracting equity to fund purchases an d purchasing more than one durable at the same time can lower delivery costs.

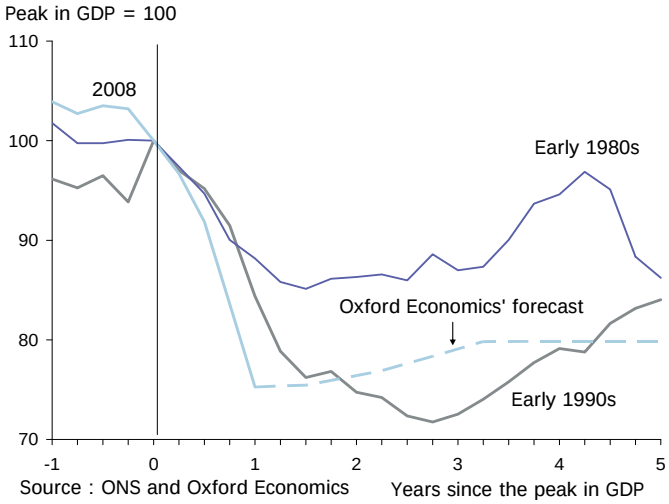
Figure 14: Output of the furniture production sector in recessions



3.4 Joinery

It is possible to see how much the joinery sector's output (and therefore the wood waste it generates as part of the manufacturing process) may behave in this recession and recovery by looking at the previous ones.[12] In the recession of the early 1980s joinery output fell by 28% over a 2½ year period (Figure 15). In the recession of the early 1990s the proxy for joinery output fell by 15% over 1½ years. In this recession, joinery output had fallen by 25% by 2009Q1 from the peak in GDP. Forecasts from Oxford Economics' industry model predict it will shortly begin to recover some of the lost output. After the impacts of the recession and eventual recovery, the sector's output returns to its trend of being broadly constant which it has exhibited for the last fifteen years.

Figure 15: Output of the joinery industry in recessions



3.5 Municipal

Municipal wood waste is that which comes under the control of the local authority. It originates from households disposal of EOL consumer goods containing wood, typically furniture, garden equipment and DIY goods. The remainder originates from municipal parks and gardens, beach cleansing waste, commercial or industrial waste, and waste resulting from the clearance of fly-tipped materials.

It is possible to assess how municipal wood waste is likely to behave over the next five years using two techniques. The first is to look at how consumer spending on goods categories that contain considerable quantities of wood (furniture; tools and equipment for the house and garden) behaved in previous recessions. As

[12] *Joinery output is measured by the ONS monthly Index of Production series. The ONS ABI survey shows the joinery sector contributed 56% of the wood and wood products industry's output in 2007.*

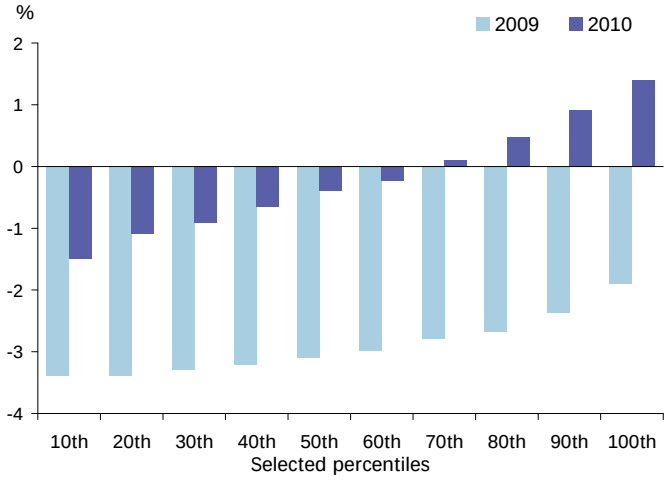
a significant proportion of the expenditure on these products is likely to be replacement spending, there is a high probability a new purchase will result in an existing item being disposed of in the municipal waste stream. The second is to look at how other bodies forecasts the growth in municipal waste.

Consumer spending on the two product groups containing wood differed markedly in the early 1980s and early 1990s recessions. In the early 1980s recession real consumer spending on two categories spiked up in the quarter before the recession, but is otherwise broadly constant over time, exhibiting little if any cyclical pattern. In contrast, during the early 1990s real consumer spending on the two wood categories fell very slightly and remained subdued for a year. Thereafter, spending grew strongly, largely reflecting increased furniture imports. The disparate experience is not particularly helpful as a guide to how the quantity of municipal wood waste arising may change in this recession and recovery.

The European Environment Agency (EEA) publishes forecasts of the amount of municipal waste arising in each EU member state out to 2030. Skovgaard, Hedal, Villanueva, Andersen and Larsen (2008) on whose work the EEA forecasts are based, find the quantity of municipal waste generated in the UK rises by 0.393% for every 1% increase in real consumer spending.

HM Treasury (2009) collates forecasts for consumer spending growth by the private sector from a panel of 39 independent forecasters for 2009 and 2010 each month. Looking at the distribution of these forecasts, all the forecasters expect UK private consumption to decline in 2009 (Figure 16). This reflects the deterioration in labour market conditions, falling consumer confidence and steep falls in households' wealth. The median forecast (50th percentile) is for private consumption to fall by 3.1% in 2009. The distribution of forecasts for private consumption in 2010 is more diverse. The median forecast is for private consumption growth to decline again in 2010 (albeit by a modest 0.4%). This leads to the expectation that the quantity of wood waste arising from the municipal waste stream will decline, but not to the extent the quantities arising from other sectors are likely to fall.

Figure 16: Distribution of independent forecasters' predictions for real private consumption growth in 2009 and 2010 as at July 2009



Source : HM Treasury (2009) and Oxford Economics

While the future quantity of wood waste arriving at municipal sites is likely to determined by households disposals, the quantity recycled is likely to be influenced by the UK's implementaion of the EU Landfill Directive 1999. This sets targets for the quantity of biodegradable municipal waste (BMW) each EU Member State can send to landfill. The UK is required to reduce the amount of BMW sent to landfill to below 75% of its 1995 level by 2010. Then 50% and 35% of its 1995 level by 2013 and 2020, respectively. Failure to meet the targets incurs a fine.

To meet the EU BMW targets landfill allowance trading schemes for local authorities have been introduced in each of the countries in the UK. Under the scheme, each waste disposal authority (WDA) is given an allocation of landfill allowances. These give the WDA the right to landfill a certain amount of BMW in a particular scheme year. The WDA can use these allowances to landfill BMW, or trade, borrow and bank them (subject to certain limits and in non-target years). The total amount of allowances allocated each year declines over time consistent with the UK meeting the Directive's targets. In each scheme year, a WDA must hold sufficient allowances for the

amount of BMW it sends to landfill. Any WDA sending more BMW to landfill than it has allowances for incurs a £150 penalty per tonne of BMW sent in normal years. In EU target years (namely, 2010, 2013 and 2020), the Government reserves the right to pass on some or all of the fine imposed by the European Court of Justice, if the UK as a whole is non-compliant.[13]

The Landfill Directive and its UK implementation through the local authority trading schemes aim to minimise waste generation and increase levels of recycling and recovery. In the short-term, it should increase the quantity of wood waste that is diverted from landfill and therefore available for recycling. Unfortunately, it will still require sorting and maybe contaminated by paints and varnishes which impact quality.

3.6 Packaging

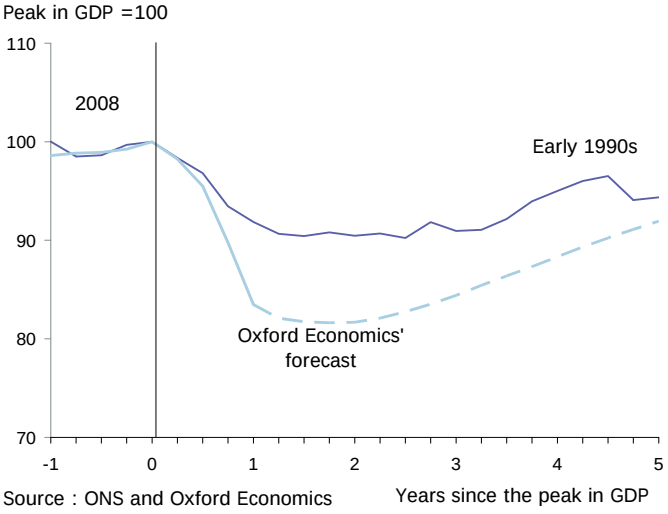
According to the market survey (Table 10), packaging is the second largest source of wood waste arising.

No timely data are available on the quantity of wood packaging manufactured. It is possible to construct an indicator for the amount of packaging needed. TRADA (2005a) shows the industries that purchase wood packaging are: construction (26% of total); wood packaging (18%); furniture (6%); wood pulp (3%) and other (47%).[14] Monthly output series for these industries are available from the ONS' Index of Production.[15] Combining the two generates the indicator for the quantity of wood packaging required and therefore how much EOL wood waste will subsequently be generated.

Insight can be gained into how the quantity of wood packaging used may change in the current recession and eventual recovery by looking at the previous recession. In the early 1990s, the output of industries that use wood packaging fell by 10% (Figure 17). Output fell for 2½ years, although most of the loss occurred in the first year. Five years after the start of the recession, output remained 6% lower than at the peak in GDP. This suggests the quantity of wood waste arising from EOL packaging is liable to fall.

The dashed line shows Oxford Economics' industry models forecast for the individual industries' output weighted by TRADA (2005a)'s wood packaging use weights. From the peak in GDP, the quantity of wood packaging in use is predicted to fall 17% from the beginning of the recession. The trough in output is expected to be reached in late 2009. Output then remains broadly constant for a year, before beginning to pick up. Five years after the start of the recession, the output of the sectors using wood packaging is 6% below its level at the start of the recession in 2008Q1.

Figure 17: Output of industries using wood packaging in recessions



Source : ONS and Oxford Economics

The Packaging and Packaging Waste Directive 1994 and the Producer Responsibility Obligations (Packaging Waste) Regulations impose specific recovery and recycling obligations on all UK businesses which 'handle' more than 50 tonnes of packaging waste a year and have a turnover of over £2 million. Each firm is set a target for the

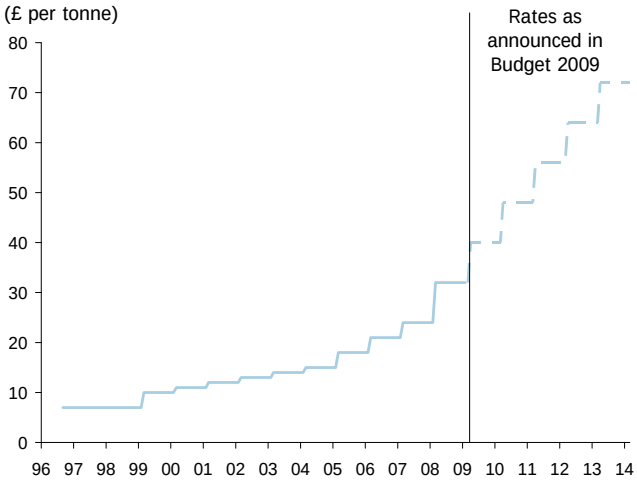
[13] The operation of the LATS schemes are reviewed periodically. See Boys (2008) for the review of the scheme in England.
[14] TRADA (2005a) explain the 18% of sales to firms within the wood packaging sector maybe explained by "companies selling to each other, for example, where a company needs a size or specification of packaging that it does not produce, it buys in."
[15] As the Index of Production contains no series for 'other' and wood packaging, the series for manufacturing and wood and wood products are used as the closest alternative, respectively.

quantity of packaging it must recover and recycle. On 29 January 2009, the DEFRA Advisory Committee on Packaging met to review evidence on the amount of packaging placed on the market in 2008 and the amount which will become waste in 2009. According to the DEFRA website "The Committee felt that the available information was inconclusive and recommended to Ministers that there is no compelling evidence to justify a change to the published recovery and recycling targets for 2009. Based on the analysis of available information and the recommendation of the Committee, Ministers have agreed the Committee's recommendation to maintain the existing targets." The targets increase from 20.5% in 2008 to 21% and 22% in 2009 and 2010, respectively.

3.7 Landfill tax and VAT

In the Budget 2009, HM Treasury announced a continuation of its policy to increase the standard rate of landfill tax by £8 per tonne on 1 April each year for a further three years (2011 to 2013 (Figure 18)). Assuming the announced policy does not change, increases in Landfill tax increase the price all wood waste generating industries and sources have to pay to dispose of wood to landfill. In the short-term, the rise in the cost will increase the incentive to dispose of wood waste via other methods. Hence recycling rates should increase, raising the quantity of wood available for recycling. In the longer-term, the impact is less clear cut as more effort will be made to minimise waste, including wood.

Figure 18: Standard rate of landfill tax



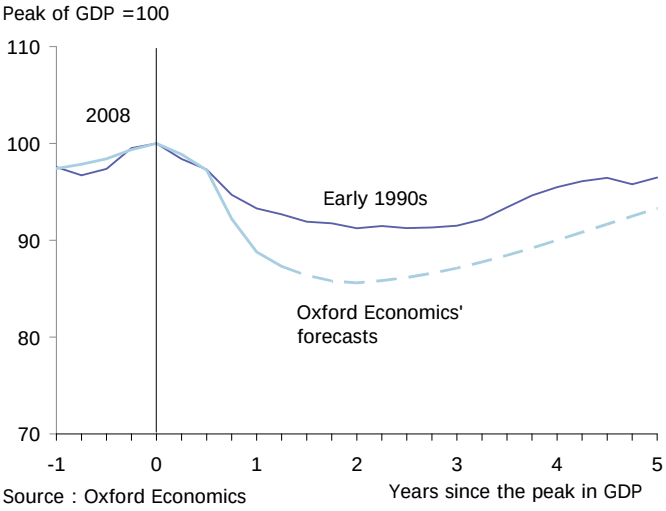
Source : HMRC and Oxford Economics

Value Added Tax (VAT) is also charged on the price of waste disposal to landfill. Any future change in VAT rates (including the planned return to 17.5% at the end of December 2009) will impact incentives.

3.8 Summary of wood waste supply

Using the market survey analysis of the quantity of wood waste arising from each source and Oxford Economics' industry model forecasts, it is possible to predict how the output of the wood waste generating sectors is likely to behave over the next five years. This should be a good guide as to how the quantity of wood waste arising through the manufacturing process and at end of life will change in future. The output of the wood waste generating sectors is forecast to fall 14% from its pre-recession level (Figure 19). This decline is 5 percentage points greater than occurred in the recession of the early 1990s. The sectors' output (and therefore the quantity of wood waste arising) is forecast to begin to recover two years after the start of the recession. Five years after the recession began output levels are 6% below their pre-recession level. This is 3 percentage points below the comparable point in the cycle in the early 1990s.

Figure 19: Output of wood waste generating industries

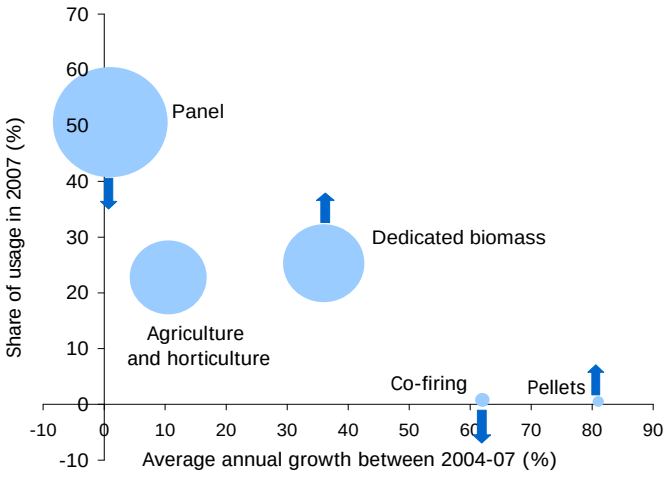


Source : Oxford Economics

4.0 Demand for of wood waste

Wood waste is currently used as an input by a number of industries. In 2007, just over half of wood waste was used by panel manufacturers (vertical scale in Figure 20). Dedicated biomass energy generators used a quarter; agricultural or horticulture product manufacturers used a fifth; and pellet producers and co-firing energy generators the remainder.

Figure 20: Use of recovered wood by various industries[1,2]



Source : Pöyry Forestry Industry Consulting

[1] Arrows indicate expected direction of movement in share of usage.

[2] Bubble size reflects usage in million tonnes.

The rate of growth of the different industries' usage of wood waste varies significantly. Of the three major user industries, dedicated biomass energy plants usage has increased the most rapidly over the last three years (2004 to 2007) in Figure 20 (horizontal scale). Wood panel manufacturers usage has remained virtually unchanged.

The following analysis looks at how demand is likely to change from the three major user industries over the next five years.

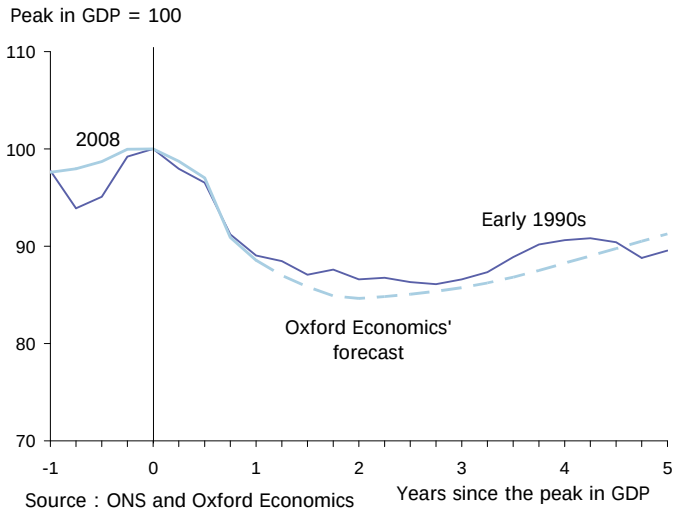
4.1 Wood panel manufacturing

The latest data (2007) show wood panel board manufacturers are the largest users of wood waste (58% of total). It is likely their usage as fallen significantly since, as the industry's output has fallen sharply. This reflects the implementation of production stoppages and short-time working as demand from the industry two main customers (construction and furniture) has fallen.

It is possible to estimate how the wood panels industry's future output levels (and therefore its demand for inputs of wood waste) will change by looking at customer industries' output. Weighting together the construction and furniture manufacture Index of Production output indices by their share of purchases of intermediate products from the wood and wood products industry (sourced from ONS input output tables), it is possible to see how demand for panel board may evolve.

In the recession of the early 1990s, the end user industries of panel board output fell by 14% (Figure 21). From the start of the recession, the proxy for the demand for panel board (and therefore inputs) declined for two years, and then remained broadly flat for another year. Five years after the early 1990s recession began end users of panel board output was still 10% below its pre-recession level. This points to a fall in demand for wood waste inputs.

Figure 21: Proxy for demand for wood panel



Source : ONS and Oxford Economics

Forecasts of end user industries of panel board suggest demand for panel will fall by 15% to a trough in 2010Q1. Five years after the start of the recession, demand for panel board is forecast to be 9% below its pre-recession level. This suggests the demand for wood waste inputs from panel manufacturers is likely to decline from its pre-recession level in the next few years.

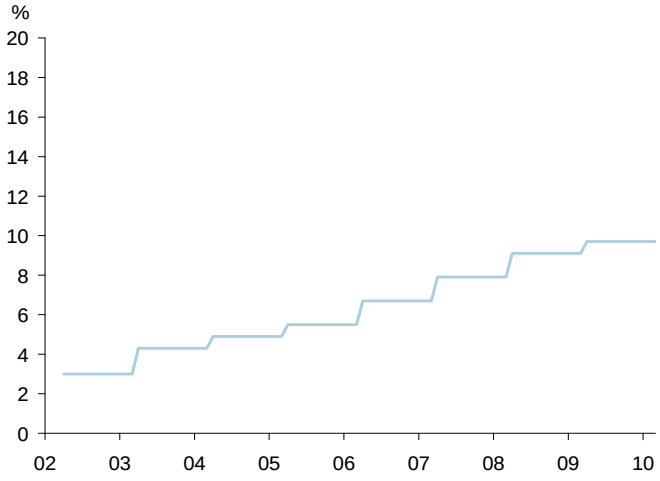
The panel board industry will benefit from the depreciation of Sterling. The Sterling broad effective exchange rate index fell by 12% in 2008.[16] This will enhance the price competitiveness of domestic panel products against foreign competitors in both the UK and other markets.

4.2 Biomass energy generation

To meet the EU Renewable Energy Directive targets and as part of its own energy strategy, the Government has sought to foster electricity generation from renewables by the Renewable Obligation. Since April 2002, electricity suppliers have been required to source a specified proportion of their electricity from renewable generators. As set out in the Renewable Obligation Orders, this proportion increases each year (Figure 22). In 2007/8 the required proportion was 7.9% in Great Britain. In 2008/9 the obligation is 9.1% and it is expected to be 9.7% in 2009/10. Suppliers can meet their obligations by presenting evidence of sourcing from renewable generators (known as Renewable Obligation Certificates) or making a buy-out payment to meet any shortfall.[17]

[16] *An effective exchange rate is a measure of the value of that currency against a basket of other currencies.*
[17] *Ofgem (2009) shows electricity suppliers in Great Britain and Northern Ireland met 65% and 17% of their obligations by sourcing from renewable generators in 2007/8, respectively. The remainder was bought out. Changes to the obligation may not necessarily be a good guide to the actual quantity of renewables consumed by electricity generators.*

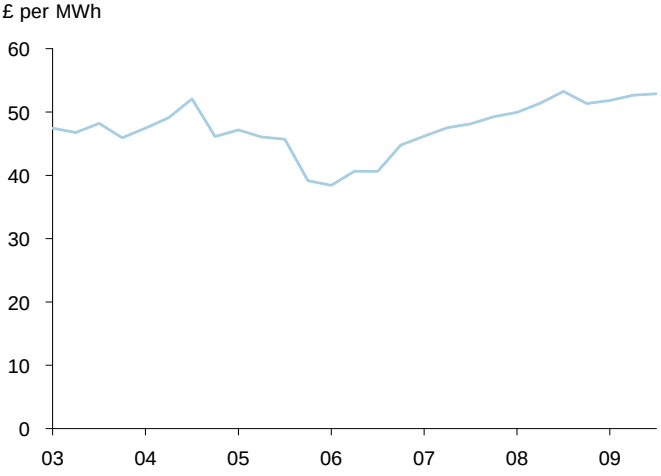
Figure 22: Proportion of electricity suppliers in Great Britain must source from eligible renewable sources



Source : Ofgem and Oxford Economics

Ofgem issues generators with Renewables Obligation Certificates (ROCs) for their qualifying output. Up to March 2009, each ROC represents one megawatt hour (MWh) of electricity regardless of the type of renewables technology used. The renewable generator can sell ROCs either with or separately from the electricity generated. The average price of a ROC in early July 2009 was £52.90 (Figure 23).

Figure 23: Average ROC prices



Source : eROC

To foster less well developed renewable electricity generation technologies the Government put forward proposals to reform the ROC regime in the Energy White Paper 2007. The changes which come into effect in April 2009 band the value of a ROC dependent on the generation technology. The bands applying to wood are shown in Table 12. The intervention provides an incentive to some electricity generators' purchases of wood waste more than others dependent on the technology type used. Providing an incentive to electricity generators use of wood waste increases their ability to pay for the material relative to other end users.

Table 12: Wood using technologies and ROC bands

ROCs per MWh	Renewables electricity generation technology
0.5	Co-firing of biomass
1.0	Co-firing of biomass with CHP
1.5	Dedicated biomass
2.0	Dedicated biomass with CHP

Source: BERR (2008)

The likely impact of the ROC rebanding on the demand for wood waste for electricity generation over the next five years is difficult to estimate. In the short-term, it will depend on the rate at which generating capacity is

added to the system. The Renewable Energy STATisticS (Restats) database monitors the progress of renewable energy projects which have applied for planning permission according to funding source, technology type and location.[18] Unfortunately, some of the entries in the database are out of date and it only disaggregates plants by fuel input type down to biomass (including both animal and all types of plant). In updating and splitting the dedicated biomass plants in the Restats database by technology type, there are a number of issues. The most important is that it not clear-cut how to categorize the type of biomass fuel each plant uses. This is because some generating plants can use a variety of biomass fuels.

The split suggests dedicated-biomass plants which can use wood waste have a maximum generating capacity of 112MW of electricity (Table 13). A further 14 MW of capacity (or additional 13%) is currently under construction. A 100MW of capacity (or 89% of that operational) has received planning permission and is awaiting construction. Planning applications have been made for an additional 70MW.

Table 13: Dedicated biomass electricity generation capacity (MW) as at November 2008

	Operational	Under Construction	With planning consent awaiting construction	Planning application being considered
Exclusively virgin wood	5	4	357	410
Wood waste plus	112	14	100	70
Exclusively other types of biomass	119	0	43	106
Unknown	82	0	5	0
Total	318	19	505	586

Source: Oxford Economics and Restats

There is even less information about co-firing electricity generators than dedicated biomass. The Restats database suggests current operational generating capacity is 248MW from co-firing all renewables (including plant biomass, animal biomass and waste).[19] As of November 2008, it shows no planning applications were being considered for co-firing plants and no project had planning consent and were awaiting or being constructed.

There is little information on what biomass is currently being co-fired with fossil fuels. However, most of the plants undertaking co-firing have a total generating capacity (including fossil fuels) of in excess of 1,000MW. Given these are the largest plants, it is likely they will have a preference for bulk and reliability of biomass supply. They are therefore unlikely to be using much, if any, wood waste. The analysis proceeds on the assumption co-firing of wood waste is currently very limited and will not alter in scale.

There is also considerable uncertainty about how existing electricity generating plants co-firing will change in the future. Up until the introduction of the ROC scheme in 2002, no electricity generating plants were co-firing renewables with fossil fuels in the UK. The ROC incentive has been halved on biomass which will reduce the financial motivation. However, the quantitative limits (known as 'caps') on the number of co-firing ROCs have also been removed.[20]

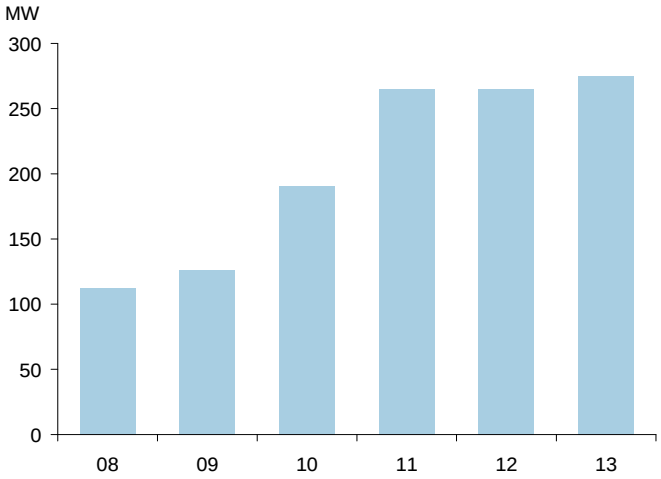
On this basis, it is assumed the demand for wood waste for electricity generation will increase in line with changes in the generating capacity of dedicated biomass plants which can use wood waste. This is shown in the wood waste plus line in Table 13. Additional research has been undertaken to discover the year in which the plants are to be commissioned and start requiring fuel. Where no information is forthcoming the plants currently under construction are assumed to be completed within a year and the plants with planning permission awaiting construction are assumed to be completed in five years. This suggests the demand for wood waste for electricity generation will increase from its 2008 level by 1½ times by 2011 (Figure 24).

Figure 24: Capacity of electricity generating plants using wood waste

[18] The Restats database does not cover proposed generating plants which have yet to apply for planning permission. There are excluded from the analysis as there is far greater uncertainty over whether these plants will be built and over what time frame. To the extent proposed plants which have yet to apply for planning permission are built and become operational, they will positively impact demand for wood waste in future years.

[19] The capacity figures refer to the proportion due to renewables.

[20] There was a limit on the number of co-fired ROCs using non-energy crop biomass a supplier can present to Ofgem when demonstrating that it has met its obligation. This was designed to reduce the risk of flooding the ROC market with co-fired ROCs, thereby affecting ROC prices and investor confidence adversely. The cap was 10 per cent from 1 April 2006.



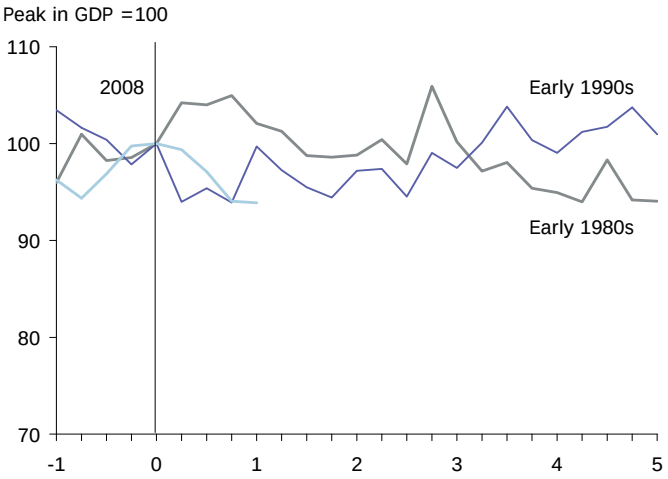
Source : Oxford Economics and Restats

Further stimulus to the demand for wood waste may come from the introduction of the Renewable Heat Incentive (RHI). BERR will initially be consulting on this in summer 2009. The broad aim is to expand the use of renewable heat sources with some form of financial incentive. The details and timetable to introduction of the potential RHI are still be determined.

4.3 Animal bedding manufacturing

The third most important end user industry of recycled wood is the production of animal bedding and equine surfaces. Bedding made from wood waste is mostly used to keep chickens and other poultry.[21] It is possible to gauge how the demand for poultry bedding may change in the near future by looking at consumer spending on meat. This shows little, if any, sensitivity to the business cycle (Figure 25). There is no discernible cyclical pattern in the recession of the early 1980s. Similarly, it is difficult to make a strong case for there being a recession impact in the early 1990s. This is likely to reflect the low income elasticity of meat. It is therefore unlikely poultry numbers will change much as a result of the recession.

Figure 25: Real consumer spending on meat in recessions



Source : ONS and Oxford Economics

Demand for animal bedding (and therefore wood waste inputs) will be buoyed by two factors. First, the recent depreciation of sterling in 2008 has boosted farmer incomes. Real farm incomes rose 36% in 2008. This is because the Common Agricultural Policy's price support mechanisms are all set in Euro. Second, the price of alternative types of animal bedding has increased. In recent years, the price of hay and straw has been on an upward trend, albeit with a seasonal pattern.

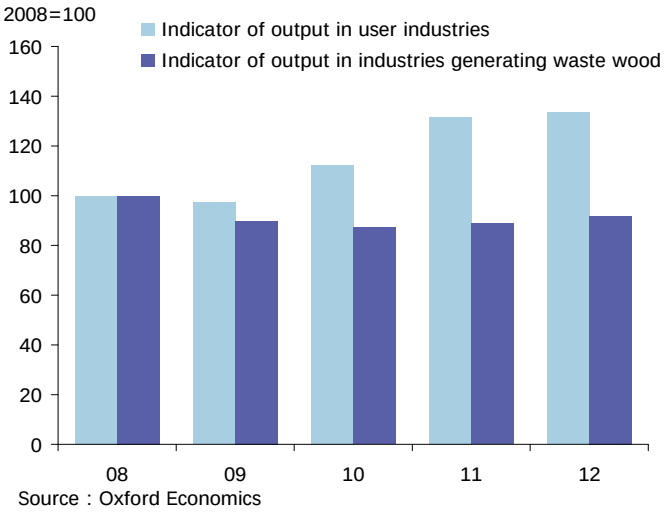
[21] This section does not discuss equine bedding or surfaces due to the lack of data on horses. DEFRA's website comments "there are no accurate figures for numbers of horses and ponies present in the UK. It has been estimated as lying between 600,000 and 1.2 million." No time series data are available.

Overall, therefore it is expected the demand for animal bedding made from wood waste is liable to remain fairly constant. It is difficult to see a lot of growth in this market unless animal numbers increase sharply, the relative price or availability of other bedding products alters or farming practices change markedly. Typically, animal numbers only change substantially if there is an outbreak of a major disease.

4.4 Summary of wood waste demand

It is possible to get an idea of how the demand for wood waste is likely to change in the future by weighting together the three user industries' (wood panel, animal bedding and electricity generation) output forecasts. The analysis uses each industry's consumption of wood waste in 2007 as the weights. User industries output is expected to fall by 3% in 2009 (Figure 26). Generating industries output is predicted to decline by 10%. The increase in capacity from electricity generators which can use wood waste increases the output of wood waste using industries in 2010 to above its level in 2008. It increases further in 2011 and 2012. The output of wood waste generating industries does not regain its 2008 level by 2012.

Figure 26: Indicators of the output of wood waste generating and using industries



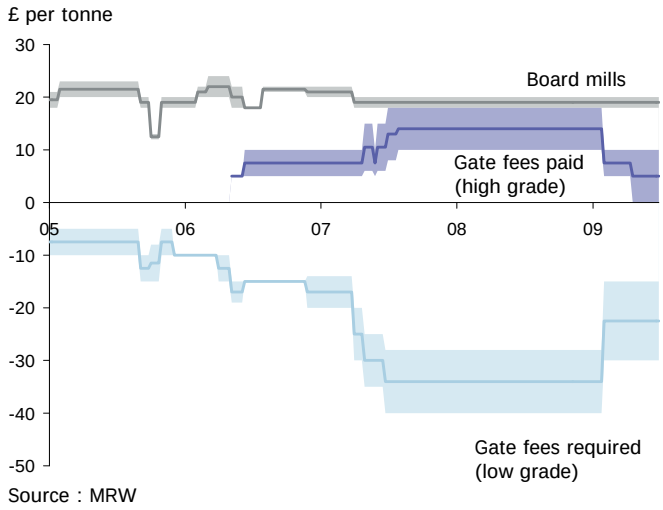
Source : Oxford Economics

5.0 Price of wood waste

Materials Recycling Week (MRW) collects weekly prices on the gate fees panel board manufacturers and other firms pay for high quality wood waste. They also collect data on how much it costs to dispose of low quality wood waste. For each series, MRW publish low, mid and high point data. Across the three types of wood waste, it is evident that prices change infrequently (Figure 27). This is likely to be because it is costly for wood recyclers to review whether their prices are consistent with current demand and supply conditions. As a result, pricing is only reviewed after a particular period of time or in response to particular events.

Looking at the three types of wood waste for which MRW collect prices, the mid price paid by panel board mills is the most expensive at £19 per tonne. There is little disparity in the price panel board manufacturers pay for wood waste (the difference between the high and low price is just £2 per tonne). The mid point of the gate prices for high grade wood waste has fallen twice in 2009. At end June 2009 it stood at £5 per tonne. There is some benefit from shopping around, as the highest price is £10 per tonne above the lowest price. Since February 2009, the mid price owners of low grade wood waste have to pay for disposal is £22.50 per tonne. Again, the range is quite large at £15 per tonne (Figure 27).

Figure 27: MRW's data on the price of wood waste



Source : MRW

The analysis of the quantity of wood waste arising and demand from user industries suggests there is likely to be considerable upward pressure on the price of wood waste in future years. Figure 26 shows that the indicator of the wood waste using industries' output falls slightly in 2009 and then increases markedly. In contrast, the output of the wood waste generating industries falls much more sharply in 2009 and does not recover its 2008 level. If the price mechanism is working, prices of wood waste should rise to bring the two forces into balance. A rise in prices may have distributional effects: the ROC incentive means electricity generators are likely to have a greater ability to pay than the other user industries. If the wood waste market is not sufficiently developed or subject to too much government intervention, the price mechanism will not work efficiently to choke-off the additional demand. Shortages of wood waste are then likely to occur. These will have to be met by virgin wood generation.

6.0 Sustainability of the wood waste market

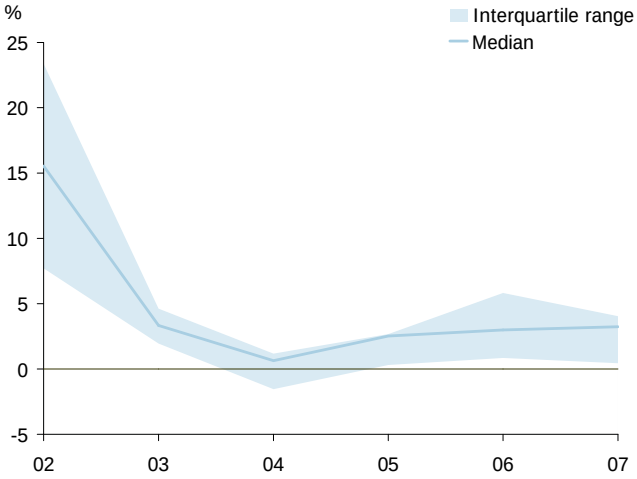
Any private sector company will only survive in the long run if it makes sufficient profits to meet its shareholders desired rate of return. If alternative investments offer higher returns, shareholders will switch their funding to better remunerated projects and close the company.

The profitability of the companies operating in the wood recycling industry is therefore the most important measure of the sustainability of the wood waste market. A standard measure of profitability is return on assets (RoA).[22] This has been compiled for UK wood reprocessing firms using accounting data sourced from Companies House. The wood reprocessors' median return on assets (RoA) in 2007 is 3% (Figure 28). The median has been at or below this level since 2003. This is a low rate of return when the economy was growing at or above five of the eight estimates of trend growth for the UK economy cited in HM Treasury (2002) analysis of the 'usual' rate at which the economy grows. Moreover, the firms in the bottom quartile are highly likely to be making losses.

Wood processors profits are determined by the quantity of wood waste sold and the margin made on each tonne. The analysis in Section 5 suggests the quantity of wood waste arising is likely to decline by 10% in 2009 because of the current recession. The central forecast is that wood waste arising will remain below its pre-recession level after five years. The outlook for volume of wood arising for reprocessors to work with is therefore not very optimistic.

[22] *Return on assets is defined as pre-tax profits expressed as a percentage of total assets.*

Figure 28: Wood reprocessors' RoA



Source : Company accounts and Oxford Economics

Profit margins on each tonne of wood waste sold would normally be expected to decline in a recession. However, the upward pressure on wood waste prices caused by ROCs is likely to give some scope for reprocessors to widen margins. In the short term, the volume effect will dominate. In the longer term, the margin effect may become more important. This leads to a relatively pessimistic view of wood reprocessors' profitability over the next couple of years, but those dealing with the electricity generators may fare better further into the future. This suggests there may be some change in the structure of the market.

7.0 Conclusion to economic trend analysis

The UK economy is in a deep recession. Most forecasts suggest whole economy output will be around 4% smaller in 2009 than in 2008 and the subsequent recovery will be slow. The analysis investigates how the output of wood waste generating industries behaved in past recessions as a guide to what may happen in the future. It then deploys output forecasts from Oxford Economics' industry and macroeconomic models to predict how the output of the wood waste generating sectors is likely to behave over the next five years. The forecast predicts the output of the wood waste generating sectors will fall 14% from its pre-recession level. This decline is greater than occurred in the recession of the early 1990s. The sectors' output (and therefore the quantity of wood waste arising) is forecast to begin to recover after two year of the recession. Five years after the recession began output levels are 6% below their pre-recession level. This too is worse than what happened in the early 1990s.

It is possible to get an idea of how demand for wood waste will evolve in the future by weighting together the three main user industries' (wood panel, animal bedding and electricity generation) output. User industries output is expected to fall by 3% in 2009. The increase in capacity from electricity generators which can use wood waste increases the output of wood waste using industries in 2010 to above its level in 2008. It is predicted to increase markedly in 2011 and 2012.

The sharp increase in demand for wood waste over the next five years is in contrast with the fall in the quantities arising. This will put upward pressure on wood waste prices. If the markets are not sufficiently developed or there is too much government intervention, which prevent prices from rising to choke off additional demand, shortages are liable to occur.

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7.2 Abbreviations

BERR	Department of Business, Enterprise and Regulatory Reform
BFM	British Furniture Manufacturers
BRE	Building Research Establishment
CA	Civic Amenities
CO2	Carbon Dioxide
COST	European Cooperation in the field of Scientific and Technical Research
DEFRA	Department for the Environment, Food and Rural Affairs
DTI	Department of Trade and Industry
EOL	End of life
ERM	Environmental Resources Management
FC	Forestry Commission
MDF	Medium Density Fibreboard
Odt	Oven dry tonnes
ONS	Office for National Statistics
OSB	Oriented Strand Board
PB	Particleboard/Chipboard
PRN	Packaging Waste Recovery Note
PVC	Polyvinyl chloride
RMI	Renovation, Maintenance, Improvement
UK	United Kingdom
US	United States
TRADA	Timber Research and Development Association
WRAP	Waste & Resources Action Programme

Waste & Resources Action Programme

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