Caledonian Environment Centre

# Recycling Reconstituted Wood


SUSTAINABLE SOLUTIONS

## Remade Scotland - Scottish Government

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GLASGOW CALEDONIAN UNIVERSITY

Remade Scotland

# Recycling Reconstituted Wood

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The Caledonian Environment Centre is part of the School of the Built and Natural Environment, Glasgow Caledonian University and is supporting environmental research and policy development in Scotland.



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# Executive Summary

The Scottish Government has made a commitment to Zero Waste and has set ambitious recycling and composting targets of 70% by 2025. To achieve this level of performance, Local Authorities are likely to require to not only to improve the performance of existing schemes, but also increase the range of materials they collect from and are likely to include niche materials, such as waste reconstituted wood.

This Report reviews current arisings and explores the potential contribution that segregating waste reconstituted wood can make towards Zero Waste in general and national recycling and landfill diversion targets in particular.

**Reconstituted Wood**

Reconstituted wood is a timber substitute (mainly as boards/panels) manufactured under controlled conditions using a variety of timber products, bonding agents, resins and preservatives. Reconstituted wood can be categorised into blockboard, plywood, orientated strand board (OSB), chipboard, medium density fibreboard (MDF) and hardboard. Compared to timber in a variety of applications, reconstituted wood products offer a wide range of benefits in weight, strength, flexibility, durability and value. However, whilst its chemical characteristics confer benefits during use, these pose a range of challenges when considering alternatives to landfill once the product becomes waste.

**Arisings**

Previous research found that waste reconstituted wood products enter the municipal solid waste (MSW) stream through residual waste collections, special uplifts/bulky collections and through residual waste deposited at recycling centres. Using data from these sources, it was estimated that 71,855 tonnes of waste reconstituted wood arose in Scotland as MSW, a figure equivalent to 2.1% of total MSW arisings.

An estimated 6,591 tonnes of reconstituted wood waste is potentially available from collected residual waste; 26,000 tonnes from bulky waste collections; and 39,102 tonnes from residual waste deposited at recycling centres. In terms of total MSW arising in Scotland, these tonnages represent 0.19%, 0.77% and 1.15% of total MSW arisings.

**Collection Approaches**

Due to the disperse nature of residual waste collections it may be difficult finding cost effective or environmentally justifiable approaches for collecting from this source. Instead it may be more effective to encourage householders to use bulky waste collections or recycling centres.

The potential for diverting reconstituted wood waste from the bulky waste/special uplifts is high, as the nature of collections offer scope for segregation either during collection or prior to disposal. Local Authorities have indicated that it is feasible to divert nearly 75% of reconstituted wood from bulky waste/special uplifts collections.

Waste reconstituted wood in residual waste brought to recycling centres also offers great potential for segregation, either through up-front segregation, e.g. by allocating dedicated skips for the public to use, or by screening residual waste at a dedicated facility prior to disposal. Both these approaches are taken in Scotland, although not necessarily for targeting the recovery of reconstituted wood. Typical recovery rates at recycling centres have been reported as being around 50%, although Remade Scotland is aware that actively managed sites can achieve much higher rates.

**Contribution to Recycling Rates**

Based on this data it has been estimated that segregated reconstituted wood from both bulky waste collections/special uplifts and recycling centres could contribute almost an additional 40,000 tonnes to recycling and almost 35,000 tonnes to landfill diversion efforts in Scotland. The contribution to landfill diversion is potentially lower because it was assumed that only the softwood and water content in reconstituted wood, 82% and 7% respectively, will count towards the diversion targets.

At individual Local Authority level these values equate to a maximum increase in recycling rate between 0.49% and 1.78%, although actual contribution will depend on the effectiveness of the different segregation strategies.

**Markets & Outlets**

Although Local Authorities in Scotland are responsible for managing waste wood from households, and sometimes local businesses, they work closely with waste wood merchants to find suitable outlets for any segregated waste wood. To inform this Report, Remade Scotland interviewed a selection of waste wood merchants.

The majority of merchants are interested in helping Local Authorities divert reconstituted wood away from landfill, but scarcity of outlets, high gate fees, haulage costs and spare capacity in their yards were identified as influencing their ability to help. Notwithstanding this, a few merchants are already supplying waste reconstituted wood into existing alternatives and are keen to actively develop this element of their business.

Whilst segregation strategies may be effective, the full contribution to recycling and landfill diversion targets can only be realised if alternatives to landfill are available and cost effective. A brief review of the process potentially available to recycle or divert waste reconstituted wood arising in Scotland is also provided. Technologies/processes are classified as either recycling or energy recovery.

Having evaluated the opportunities for waste reconstituted wood to contribute towards national recycling and landfill diversion targets, this research also considers a range of issues that need to be addressed to explore these opportunities in an effective manner.

The Report concludes that although there are a number of factors which may limit Councils' ability to use segregated waste reconstituted wood to contribute to their waste management targets, the option remains a viable proposition for many.

# Contents

# 1. Introduction & Background

The Scottish Government has made a commitment to Zero Waste by 2025 and has set ambitious recycling and composting targets of 70% by 2025. To achieve this level of performance, Local Authorities are likely not only to improve the performance of existing schemes, but also increase the range of materials they collect from households including niche materials.

One such niche material which could be considered is waste reconstituted wood, which although cannot be quantified using Scottish waste composition analysis is frequently reported by Scottish Local Authority Waste Managers as a significant component of bulky/special uplifts and residual waste at recycling centres.

This Report reviews current arisings and explores the potential contribution that segregating waste reconstituted wood can make towards Zero Waste in general and national recycling and landfill diversion targets in particular.

## 1.1. What is Reconstituted Wood?

In previous guidance[1] promoting source-segregation of waste wood, WRAP categorised reconstituted wood products into

- Blockboard,
- Plywood,
- Orientated strand board (OSB),
- Chipboard,
- Medium density fibreboard (MDF) and
- Hardboard.

Reconstituted wood is a timber substitute (mainly as boards/panels) manufactured under controlled conditions using a variety of timber products, bonding agents, resins and preservatives. As an example, in its fact sheet on MDF recycling, Remade Scotland, noted that MDF is composed of 82% softwood fibre, 10% synthetic resin binder, 7% water, >1% paraffin wax solids, >0.05% total extractable formaldehyde, and >0.05 % silica[2].

Compared to timber in a variety of applications, reconstituted wood products offer a wide range of benefits in terms of weight, strength, flexibility, durability and value.

However, whilst its chemical characteristics confer benefits during use, these pose a range of challenges when considering alternatives to landfill once the product becomes waste.

[1] WRAP: Guidance on Separating Wood for Recycling at Source. www.wrap.org.uk
[2] Remade Scotland (February 2006) Fact Sheet: Recycling of Medium Density Fibreboard. www.remade.org.uk

### 1.2. Aims & Objectives

This Report aims to evaluate the potential, opportunities and barriers for waste reconstituted wood to contribute to national recycling and landfill diversion targets.

These will be met through:

- Quantifying the potential amount of waste reconstituted wood arising in Scottish municipal solid waste by reviewing publicly available data and composition analysis.
- Reviewing different approaches for segregating waste reconstituted wood.
- Estimating the potential contribution from segregated waste reconstituted wood to national recycling and landfill diversion targets.
- Reviewing technologies, processes and outlets for recycling/diverting waste reconstituted wood from landfill in Scotland.
- Identifying potential barriers that may influence the potential contribution to national recycling and landfill diversion targets from segregating waste reconstituted wood.

## 2. Waste Reconstituted Wood Arisings in Scotland

Previous research by MEL Research for WRAP[3] found that waste reconstituted wood products enter the MSW stream through residual waste collections, special uplifts/bulky collections and through residual waste deposited at recycling centres.

However, although several attempts have been made to quantify the amount of reconstituted wood products made available for consumption in the UK[4], information on the quantities of waste reconstituted wood entering the MSW stream was limited and not readily available.

To address this, and to explore the potential for diverting/recycling waste reconstituted wood products, the following sources of data were used to estimate arising in MSW in Scotland:

- Waste Data Flow
- Published waste composition surveys
- Local Authority Waste Management Officers

[3] MEL Research (2005) Reference document on the status of wood waste arisings and management in the UK. WRAP, Banbury

[4] TRADA Technology Ltd. (2003) Wood market study - UK wood flows and recycled wood markets. WRAP, Banbury.

- Waste wood merchants
- Internet and peer reviewed journals

Using data from these sources, it was estimated that 71,855 tonnes of waste reconstituted wood arose in Scotland as MSW. This figure is equivalent to 2.1% of total MSW arisings. What was the result of the survey of waste wood merchants?

The approach used to formulate this estimate is described in Appendix A, whilst an estimated breakdown by Local Authority, including the proportion of reconstituted wood in the three waste streams, is provided in Table 1.

**Table 1 Estimate of reconstituted wood arisings (in tonnes) by Local Authority during 2007-08**

| Local Authority | Residual Waste Collection (0.4%) | Bulky Waste Collections (23.87%) | Residual Waste at Recycling Centres (13.44%) | Estimated Total Potential |
|---|---|---|---|---|
| **Aberdeen City** | 344 | 598 | 1,878 | 2,821 |
| **Aberdeenshire** | 432 | 154 | 2,113 | 2,699 |
| **Angus** | 107 | 416 | 1,959 | 2,483 |
| **Argyll & Bute** | 143 | 185 | 716 | 1,044 |
| **Clackmannanshire** | 61 | 106 | 608 | 775 |
| **Dumfries & Galloway** | 225 | 150 | 2,321 | 2,696 |
| **Dundee City** | 167 | 671 | 1,197 | 2,036 |
| **E. Ayrshire** | 126 | 447 | 1,394 | 1,967 |
| **E. Dunbartonshire** | 202 | 1,280 | 729 | 2,211 |
| **E. Lothian** | 146 | 581 | 661 | 1,387 |
| **E. Renfrewshire** | 102 | 326 | 535 | 963 |
| **Edinburgh, City of** | 513 | 932 | 1,592 | 3,037 |
| **Eilean Siar** | 19 | 136 | 144 | 299 |
| **Falkirk** | 191 | 1,887 | 1,092 | 3,169 |
| **Fife** | 393 | 2,257 | 3,362 | 6,012 |
| **Glasgow City** | 773 | 5,633 | 1,285 | 7,691 |
| **Highland** | 281 | 767 | 1,263 | 2,310 |
| **Inverclyde** | 73 | 60 | 1,199 | 1,331 |
| **Midlothian** | 78 | 285 | 1,036 | 1,399 |
| **Moray** | 95 | 328 | 620 | 1,043 |
| **N. Ayrshire** | 169 | 859 | 559 | 1,588 |
| **N. Lanarkshire** | 433 | 5,108 | 2,382 | 7,924 |
| **Orkney Islands** | 15 | 15 | 318 | 348 |
| **Perth & Kinross** | 201 | 59 | 1,290 | 1,551 |
| **Renfrewshire** | 216 | 477 | 2,188 | 2,881 |
| **Scottish Borders** | 99 | 64 | 1,073 | 1,236 |
| **Shetland Islands** | 47 | 75 | 200 | 322 |
| **S. Ayrshire** | 152 | 428 | 1,418 | 1,998 |
| **S. Lanarkshire** | 435 | 1,143 | 1,630 | 3,208 |
| **Stirling** | 77 | 323 | 605 | 1,005 |
| **W. Dunbartonshire** | 113 | 157 | 646 | 915 |
| **W. Lothian** | 162 | 256 | 1,089 | 1,507 |
| **Total** | **6,591** | **26,162** | **39,102** | **71,855** |

# 3. Opportunities for Diversion

Understanding the quantities and sources of reconstituted wood waste available in Scottish MSW (Table 1) allows the evaluation of opportunities and strategies for diverting this waste stream away from landfill from the three main sources.

## 3.1. Residual Waste Collections

Although an estimated 6,591 tonnes of reconstituted wood waste are potentially available for diversion from collected residual waste at a national level, it is such a small amount (approximately 0.19% of total MSW) that finding cost-effective or environmentally justifiable solutions may be difficult.

This is particularly the case when the available quantities are considered at individual Local Authority level, as shown by the data in Table 1.

The most effective approach may therefore be for Local Authorities to capture this material by encouraging householders to use bulky waste collections or recycling centres.

## 3.2. Bulky Waste Collections

Significantly greater amounts of waste reconstituted wood arise through bulky waste collections. At a national level, in 2007-08 arisings were estimated at around 26,000 tonnes (approximately 0.77% of total MSW).

The potential for diverting reconstituted wood waste from this source is high, as the nature of collections offer scope for either segregation during collection or prior to disposal.

As a result of various conversations with Local Authorities, this evaluation has assumed that it is possible to divert from landfill at least 75% of reconstituted wood collected through bulky collections/special uplifts.

## 3.3. Residual Waste at Recycling Centres

Residual waste at recycling centres includes an estimated 39,102 tonnes of reconstituted wood waste, (approximately 1.15% of total MSW), which could be diverted away from landfill.

This waste stream could be segregated up-front, using dedicated skips, or by screening residual waste at a dedicated facility prior to disposal. Both these approaches are in place in Scotland, although not necessarily targeting the recovery of reconstituted wood.

Remade Scotland's review of Local Authority services suggests that recovery rates of 50% at recycling centres are typical, although in actively managed sites it can be much higher.

## 4. Contribution to Recycling & Landfill Diversion Rates

Although in 2007-08 Scotland recycled and composted 31.7% of its MSW[5], the Government's Zero Waste aspiration to recycling and composting 70% of arisings by 2025[6] is likely to require that Local Authorities consider options further up the waste hierarchy for a wider range of materials.

Table 2 considers the contribution that diverting reconstituted wood through initiatives detailed in Sections 3 could make to recycling and landfill diversion rates. For landfill diversion it was assumed that only the wood fibres (82%) and water content (7%) in reconstituted wood contribute to landfill diversion, although it was recognised that this will ultimately depend on specific treatment options.

This analysis suggests that segregated waste reconstituted wood from both bulky waste collections and recycling centres could contribute an additional 39,102 tonnes to recycling and 34,867 tonnes to landfill diversion efforts in Scotland.

Considering these values within the context of individual Local Authorities, this contribution to recycling could equate to a maximum increase in recycling of between 0.59% and 2.11%.

However, the actual contribution to local and national recycling rates and landfill diversion targets would depend on the effectiveness of segregation strategies adopted by individual Local Authorities.

## 5. Private Sector Interest

Although Local Authorities in Scotland are responsible for managing waste wood from households and sometimes local businesses, they work closely with waste wood merchants to find suitable outlets for any segregated waste wood.

As part of this investigation Remade Scotland interviewed a selection of these merchants (18) to capture their overall views on the potential for diverting reconstituted wood from landfill.

The list of merchants interviewed and selection criteria is provided in Appendix B.

The majority of merchants were interested in helping Local Authorities divert reconstituted wood away from landfill, but scarcity of outlets, high gate fees (which, coupled with haulage costs did not compare favourably with local disposal) and spare capacity in their yards were listed as limiting factors on their ability to help.

[5] SEPA Landfill Allowance Reports (accessed in 27th March 2009)
[6] Scottish Government News Release (24th January 2008)

Notwithstanding this, a small handful of merchants are already supplying waste reconstituted wood into existing alternatives and are keen to actively develop this element of their business.

## Table 2 Estimate additional contribution from reconstituted wood to recycling and landfill diversion rates

| Local Authority | Total MSW (Tonnes) | Total Recycling (Tonnes) | Recycling % | Bulky Collections (Tonnes) | | Recycling Centres (Tonnes) | | Contribution to Recycling | | Contribution to Landfill Diversion (tonnes) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total | @ 75% Diversion | Total | @ 50% Diversion | Tonnes | % | |
| **Aberdeen City** | 138,459 | 30,801 | 22.2 | 598 | 448 | 1,878 | 939 | 1,388 | 1.00 | 1,235 |
| **Aberdeenshire** | 153,731 | 47,982 | 31.2 | 154 | 115 | 2,113 | 1,056 | 1,172 | 0.76 | 1,043 |
| **Angus** | 78,185 | 27,112 | 34.7 | 416 | 312 | 1,959 | 980 | 1,292 | 1.65 | 1,150 |
| **Argyll & Bute** | 62,309 | 21,698 | 34.8 | 185 | 139 | 716 | 358 | 497 | 0.80 | 442 |
| **Clackmannanshire** | 35,578 | 15,015 | 42.2 | 106 | 79 | 608 | 304 | 383 | 1.08 | 341 |
| **Dumfries & Galloway** | 100,349 | 31,245 | 31.1 | 150 | 113 | 2,321 | 1,160 | 1,273 | 1.27 | 1,133 |
| **Dundee City** | 95,351 | 31,480 | 33 | 671 | 503 | 1,197 | 599 | 1,102 | 1.16 | 981 |
| **E. Ayrshire** | 73,808 | 30,819 | 41.8 | 447 | 335 | 1,394 | 697 | 1,032 | 1.40 | 919 |
| **E. Dunbartonshire** | 74,941 | 24,111 | 32.2 | 1,280 | 960 | 729 | 365 | 1,325 | 1.77 | 1,179 |
| **E. Lothian** | 69,978 | 24,802 | 35.4 | 581 | 436 | 661 | 330 | 766 | 1.09 | 682 |
| **E. Renfrewshire** | 55,883 | 19,582 | 35 | 326 | 244 | 535 | 267 | 512 | 0.92 | 455 |
| **Edinburgh, City of** | 252,078 | 68,331 | 27.1 | 932 | 699 | 1,592 | 796 | 1,495 | 0.59 | 1,331 |
| **Eilean Siar** | 19,355 | 4,032 | 20.8 | 136 | 102 | 144 | 72 | 174 | 0.90 | 155 |
| **Falkirk** | 102,264 | 36,788 | 36 | 1,887 | 1,415 | 1,092 | 546 | 1,961 | 1.92 | 1,745 |
| **Fife** | 252,077 | 98,491 | 39.1 | 2,257 | 1,693 | 3,362 | 1,681 | 3,374 | 1.34 | 3,003 |
| **Glasgow City** | 363,041 | 65,637 | 18.1 | 5,633 | 4,225 | 1,285 | 642 | 4,867 | 1.34 | 4,332 |
| **Highland** | 164,315 | 50,406 | 30.7 | 767 | 575 | 1,263 | 631 | 1,207 | 0.73 | 1,074 |
| **Inverclyde** | 51,871 | 11,346 | 21.9 | 60 | 45 | 1,199 | 599 | 644 | 1.24 | 573 |
| **Midlothian** | 52,271 | 18,695 | 35.8 | 285 | 214 | 1,036 | 518 | 732 | 1.40 | 651 |
| **Moray** | 64,332 | 28,289 | 44 | 328 | 246 | 620 | 310 | 556 | 0.86 | 495 |
| **N. Ayrshire** | 90,444 | 28,131 | 31.1 | 859 | 644 | 559 | 280 | 924 | 1.02 | 822 |
| **N. Lanarkshire** | 238,209 | 75,816 | 31.8 | 5,108 | 3,831 | 2,382 | 1,191 | 5,022 | 2.11 | 4,470 |
| **Orkney Islands** | 14,883 | 4,274 | 28.7 | 15 | 11 | 318 | 159 | 170 | 1.14 | 151 |
| **Perth & Kinross** | 105,910 | 38,042 | 35.9 | 59 | 45 | 1,290 | 645 | 690 | 0.65 | 614 |
| **Renfrewshire** | 97,805 | 29,441 | 30.1 | 477 | 358 | 2,188 | 1,094 | 1,452 | 1.48 | 1,292 |
| **Scottish Borders** | 76,914 | 25,791 | 33.5 | 64 | 48 | 1,073 | 536 | 585 | 0.76 | 520 |
| **Shetland Islands** | 11,790 | 2,266 | 19.2 | 75 | 56 | 200 | 100 | 156 | 1.32 | 139 |
| **S. Ayrshire** | 88,593 | 38,222 | 43.1 | 428 | 321 | 1,418 | 709 | 1,030 | 1.16 | 917 |
| **S. Lanarkshire** | 204,490 | 75,611 | 37 | 1,143 | 857 | 1,630 | 815 | 1,672 | 0.82 | 1,488 |
| **Stirling** | 54,858 | 21,222 | 38.7 | 323 | 242 | 605 | 303 | 545 | 0.99 | 485 |
| **W. Dunbartonshire** | 59,995 | 19,422 | 32.4 | 157 | 117 | 646 | 323 | 440 | 0.73 | 392 |
| **W. Lothian** | 109,635 | 37,543 | 34.2 | 256 | 192 | 1,089 | 544 | 736 | 0.67 | 655 |
| **TOTAL** | **3,413,702** | **1,082,443** | | **26,162** | **19,622** | **39,102** | **19,551** | **39,173** | | **34,864** |

# 6. Outlets in Scotland

Whilst segregation strategies may be effective, the full contribution to recycling and landfill diversion targets from segregated reconstituted wood can only be realised if alternatives to landfill are available and cost-effective.

This section provides an insight into the types of process potentially available to recycle or divert waste reconstituted wood arising in Scotland. The technologies/processes are classified as either recycling or energy recovery and are the result of a combination of internet searches, literature reviews and stakeholder interviews.

## 6.1. Recycling

Originally identified in a Remade Scotland report[7] in 2006, Microrelease uses microwaves and moisture to breakdown MDF to its constituent parts and produces a wood fibre that can be re-used to manufacture new MDF[8]. The technology is being commercialised by Nviro Cleantech[9], but there are still no commercial facilities in operation, although field trials appear to have been successful[10].

Another technology also identified in the above Remade Scotland report is FibreSolve, an autoclave based process that also produces a clean fibre material with potential for inclusion in the manufacture of MDF, paper and cardboard. Although the technology developer notes[11] the success of several prototype trials, no information was found regarding the commercialisation or full-scale deployment of this technology.

One waste wood merchant manufactures and uses a landfill engineering material from waste reconstituted wood.

Composting of reconstituted wood waste may also be a possibility[12], although Remade Scotland is not aware of this happening in Scotland at present.

Although these technologies and re-use application have the potential to contribute to local and national recycling performance, their early stage of development or niche applications means that, in reality, their contribution is currently limited.

[7] Remade Scotland - Factsheet on Recycling of MDF – February 2006
[8] Article on letsrecycle.com (August 2007)
[9] www.nvirocleantech.com
[10] Article on Bloomberg.com (October 2008): http://tinyurl.com/aslhfe
[11] www.envirofibre.co.uk
[12] WasteNot reuse and recycling ltd. (April 2009): http://tinyurl.com/cwgjrf

### 6.2. Energy Recovery

Whilst the contribution to recycling and landfill diversion targets arising from recycling and re-use of reconstituted wood waste is limited, the potential is greater from energy recovery, which uses more established technologies.

Through the stakeholder interviews three energy recovery options were identified as currently or imminently available outlets for waste reconstituted wood arising in Scotland.

Steven's Croft is E.On's 44 MW biomass power station in Lockerbie[13]. It is currently using waste reconstituted and contaminated wood as part of its fuel mix. Several wood merchants in Scotland supply this facility.

The other biomass option imminently available in Scotland, which Scottish waste wood merchants expressed an interest in supplying fuel to, will be the 50 MW[14] biomass heat and power boiler at UPM's Caledonian Paper Mill in Irvine[15-16].

The third option identified during the stakeholder interviews was a biomass plant in Hexham, although limited information was disclosed or learned about this outlet.

A fourth energy recovery option, identified through an internet search, potentially available for waste reconstituted wood arising in Scotland is RWE npower Cogen and papermakers Tullis Russell's 45 MW biomass plant in Markinch[17-18].

The contribution that any of these outlets can make to Scottish recycling or landfill diversion rates will not only depend on the availability of these, and similar outlets, but also on their proximity to the waste producers/waste wood merchants (transportation costs), gate fee (disposal cost) and current landfill gate fee and tax (status quo option).

## 7. Potential Barriers to Enhance Diversion

Through the background research and data gathering for this Report, several issues were identified that contribute to the low recovery/recycling levels of reconstituted wood in Scotland and possibly elsewhere.

The first issue that comes to prominence is the general understanding of the quantities of reconstituted wood in MSW and the fact that very few waste composition analysis are sufficiently detailed to estimate quantities. Possible explanations for this are the fact that recycling targets could have been achieved by

[13] http://www.eon-uk.com/generation/stevenscroft.aspx
[14] UNCECE Timber Committee (Sept 2008) – UK Timber Market Statement: http://tinyurl.com/cds4ze
[15] UPM Interim Report, April 2008: http://tinyurl.com/dgxq9p
[16] Metso Power - biomass plant suppliers - newsletter (V.9, Issue3, 2007): http://tinyurl.com/cexvck
[17] Glasgow Herald Article "Burning Question"( July 2008) http://tinyurl.com/c3bbxk
[18] Glasgow Herald Article "Salmon announces £100m biomass energy site" July 2008: http://tinyurl.com/c4danr

initiatives targeting the bigger waste constituents (e.g. paper, glass, garden waste, cans and plastic bottles) and that traditionally reconstituted wood has either been landfilled or incinerated and these did not require any more detailed information.

Where composition information is available it becomes apparent that arisings are small and that it may be difficult to justify investment in segregation for waste reconstituted wood. The exception might be where waste reconstituted wood is collected through bulky collections/special uplifts or from recycling centres.

Where quantities may justify investment in segregation infrastructure, e.g. additional skips for bulky collections/special uplifts or at recycling centres, there may not be sufficient space at Local Authority depots, recycling centres or waste wood merchant yards. This is an issue that only individual organisations can address within the context of their own circumstances.

The limited availability of outlets is another restricting factor discouraging the segregation of reconstituted wood away from landfill disposal. Until recently, treatment options were constrained primarily to landfill and energy recovery in mass burn energy from waste facilities. This was possibly a result of the chemical properties of reconstituted wood, but as this Report demonstrates, there are now a number of technologies potentially available that could widen the opportunities for diverting this waste stream from landfill.

Notwithstanding this, although technologies and processes are available, their contribution to national recycling and landfill diversion targets will depend on haulage costs and gate fees. For some Local Authorities and waste wood merchants these may be more expensive than local landfill options.

## 8. Conclusion & Recommendations

There are an estimated 71,855 tonnes of reconstituted wood in Scottish MSW, a figure equivalent to 2.1% of total MSW arisings, with the main sources being domestic residual waste, bulky uplifts/special collections and material delivered to recycling centres.

For individual Local Authorities these figures may equate to small tonnages. It is possible, however, that in a number of cases there is scope for segregated reconstituted wood to make a contribution to local and national recycling and landfill diversion targets.

This is particularly the case where Local Authorities or waste wood merchants have access to alternatives to conventional landfill, or energy from waste facilities and can deliver the material for less that the cost of local landfill.

Considering available tonnages, segregation efforts and investment, the most effective means of segregating waste reconstituted wood is likely to target material collected through bulky collections/bulky uplifts or delivered to recycling centres. In

these circumstances, storage space may be the limiting factor affecting the ability to benefit from this potential.

Although not all Local Authorities can participate fully in recycling waste reconstituted wood, the opportunity is available to a significant number as an additional option to increase their current waste recycling, composting or landfill diversion performance.

# 9. Appendix A: Quantifying Arisings

Previous research by MEL Research for WRAP[19] found that waste reconstituted wood products enter the MSW stream through residual waste collections, special uplifts/bulky collections and through residual waste at recycling centres.

Reconstituted wood waste arisings in Scottish municipal solid waste (MSW) were determined using total arisings from residual waste collections, special uplifts/bulky collections and recycling centres and composition analysis.

The approach to quantifying arisings was split into three distinct stages: quantification of waste arisings; collection of waste composition data, and estimating waste reconstituted wood arisings, which are described in detail in the following sections of this appendix.

## 9.1. Quantification of Waste Arisings

Data for total arisings for residual waste collections, special uplifts/bulky collections and recycling centres was obtained from 2007-08 WasteDataFlow[20]. Data on population size and household numbers was also obtained from the 2007-08 WasteDataFlow as relationships between this information and waste arisings could be useful in helping fill data gaps. WasteDataFlow data is provided as Table 3.

[19] MEL Research (2005) Reference document on the status of wood waste arisings and management in the UK. WRAP, Banbury

[20] www.wastedataflow.org

**Table 3 2007-08 WasteDataFlow returns for Scottish Local Authorities (NB. blanks indicate missing data).**

| Local Authority | Residual Waste Collection | Residual Waste at Recycling Centres | Bulky Waste Collections | Population Size | Number of Households |
|---|---|---|---|---|---|
| **Aberdeen City** | 86050 | 13976 | | 99269 | 202370 |
| **Aberdeenshire** | 108023 | | | 97401 | 235440 |
| **Angus** | 26868 | 14578 | | 48625 | 109170 |
| **Argyll & Bute** | 35747 | 5324 | | 40769 | 90870 |
| **Clackmannanshire** | 15252 | 4527 | | 21610 | 48630 |
| **Dumfries & Galloway** | 56261 | 17269 | 629 | 66465 | 148340 |
| **Dundee City** | 41790 | 8908.5 | 2812.2 | 67747 | 142170 |
| **E. Ayrshire** | 31494.4 | 10369 | | 51459 | 119400 |
| **E. Dunbartonshire** | 50458 | | | 42592 | 105960 |
| **E. Lothian** | 36447 | 4917.4 | | 39749 | 91800 |
| **E. Renfrewshire** | 25586 | 3979.1 | 1364.9 | 35512 | 89600 |
| **Edinburgh, City of** | 128184 | 11842 | 3906 | 211731 | 457830 |
| **Eilean Siar** | 4870 | 1070 | 569 | 11486 | 26370 |
| **Falkirk** | 47638 | 8123 | | 65879 | 149150 |
| **Fife** | 98223 | 25017.3 | | 155890 | 356740 |
| **Glasgow City** | 193278 | 9558 | 23598 | 274678 | 578790 |
| **Highland** | 70195 | 9395 | 3213 | 94941 | 213590 |
| **Inverclyde** | 18257 | 8919 | 250.1 | 36692 | 82130 |
| **Midlothian** | 19491.9 | 7712 | 1194.3 | 33422 | 79190 |
| **Moray** | 23736 | 4616.7 | | 37484 | 88120 |
| **N. Ayrshire** | 42340 | 4162 | | 60321 | 135830 |
| **N. Lanarkshire** | 108355 | 17724 | 21401 | 139343 | 323420 |
| **Orkney Islands** | 3682.8 | 2364.4 | 62.5 | 8790 | 19590 |
| **Perth & Kinross** | 50295 | 9598 | 248.86 | 61613 | 138400 |
| **Renfrewshire** | 53960 | 16283 | 1997.7 | 77012 | 170000 |
| **Scottish Borders** | 24710 | 7981 | 270.1 | 49534 | 109730 |
| **Shetland Islands** | 11787 | | | 9376 | 22000 |
| **S. Ayrshire** | 38052 | 10547 | | 50311 | 111780 |
| **S. Lanarkshire** | 108713 | 12129 | | 131065 | 306280 |
| **Stirling** | 19195.3 | 4504.1 | | 36958 | 86930 |
| **W. Dunbartonshire** | 28205 | 4806 | 655.5 | 40835 | 91400 |
| **W. Lothian** | 40541 | 8099 | 1073 | 69309 | 163780 |

Where data was missing, per capita estimates derived from existing data were used to fill gaps. However, as it was felt that residual waste arising at recycling centres and bulky waste are likely to be influenced by the geographical nature of the Authority, the frequency of residual waste collections and whether free bulky waste collections are available to householders, it was necessary to produce indicators that reflected these differences. The available data is summarised in Table 4.

**Table 4 Details of Local Authority family grouping and service characteristics.**

| Local Authority | COSLA Family Group[21] | Frequency of Residual Collections[22] | Free Bulky Uplifts[23-24] |
|---|---|---|---|
| **Aberdeen City** | Urban | Weekly | No |
| **Aberdeenshire** | Rural | Fortnightly | No |
| **Angus** | Mixed | Fortnightly | No |
| **Argyll & Bute** | Rural | Weekly | No |
| **Clackmannanshire** | Mixed | Fortnightly | No |
| **Dumfries & Galloway** | Rural | Weekly | Yes |
| **Dundee City** | Urban | Weekly | No |
| **E. Ayrshire** | Mixed | Fortnightly | Yes |
| **E. Dunbartonshire** | Urban | Fortnightly[25] | Yes |
| **E. Lothian** | Mixed | Weekly | Yes |
| **E. Renfrewshire** | Mixed | Weekly | No |
| **Edinburgh, City of** | Urban | Weekly | Yes |
| **Eilean Siar** | Rural | Fortnightly | N/A |
| **Falkirk** | Urban | Weekly | Yes |
| **Fife** | Mixed | Weekly | No |
| **Glasgow City** | Urban | Weekly | Yes |
| **Highland** | Rural | Weekly | No |
| **Inverclyde** | Mixed | Fortnightly | No |
| **Midlothian** | Mixed | Fortnightly | Yes |
| **Moray** | Mixed | Fortnightly | Yes |
| **N. Ayrshire** | Mixed | Weekly | N/A |
| **N. Lanarkshire** | Urban | Weekly | Yes |
| **Orkney Islands** | Rural | Weekly | No |
| **Perth & Kinross** | Rural | Weekly | No |
| **Renfrewshire** | Urban | Weekly | No |
| **Scottish Borders** | Rural | Weekly | No |
| **Shetland Islands** | Rural | Weekly | No |
| **S. Ayrshire** | Mixed | Fortnightly | No |
| **S. Lanarkshire** | Mixed | Fortnightly | Yes |
| **Stirling** | Mixed | Fortnightly | No |
| **W. Dunbartonshire** | Urban | Weekly | No |
| **W. Lothian** | Mixed | Fortnightly | Yes |

The data inTable 3 and Table 4 was used to generate per capita indicators for bulky waste and residual waste from recycling centres, as presented in Table 5, which were subsequently used to fill data gaps identified in Table 3.

[21] Remade Scotland Report (February 2007): Kerbside Collections – Factors for Success
[22] Data from Remade Scotland's forthcoming review of kerbside collection schemes in Scotland
[23] Individual Council websites
[24] For comparison purposes, where Councils offered a limited number of free collections it was assumed that all bulky collections where free.
[25] Although residual waste collection frequencies for this Authority changed during the 2007-08 financial year, for simplicity it was assumed that any impact on the quantity of either bulky waste or residual waste at recycling centres.

### Table 5 Per capita indicators generated from the available data

| COSLA Family Group | Frequency of Residual Collections | Free Bulky Uplifts | Residual at Recycling Centre | | Bulky Waste Collections | |
|---|---|---|---|---|---|---|
| | | | T/Capita | T/Household | T/Capita | T/Household |
| **Urban** | Weekly | No | 0.066 | 0.136 | 0.012 | 0.026 |
| **Urban** | Weekly | Yes | 0.054 | 0.123 | 0.053 | 0.120 |
| **Urban** | Fortnightly | No | | | | |
| **Urban** | Fortnightly | Yes | | | | |
| **Mixed** | Weekly | No | 0.057 | 0.136 | 0.015 | 0.038 |
| **Mixed** | Weekly | Yes | 0.054 | 0.124 | | |
| **Mixed** | Fortnightly | No | 0.094 | 0.210 | | |
| **Mixed** | Fortnightly | Yes | 0.063 | 0.147 | | |
| **Rural** | Weekly | No | 0.069 | 0.156 | 0.003 | 0.006 |
| **Rural** | Weekly | Yes | | | | |
| **Rural** | Fortnightly | No | | | | |
| **Rural** | Fortnightly | Yes | | | | |

The final data set for quantities of waste arising from residual waste collections, bulky waste collections and residual waste at recycling centres is presented in Table 6.

**Table 6 Complete data-set of waste reconstituted wood arisings. Numbers *in red* indicate gaps filled using per the capita indicators.**

| Local Authority | Residual Waste Collection | Residual Waste at Recycling Centres | Bulky Waste Collections |
|---|---|---|---|
| **Aberdeen City** | 86050 | 13976 | *2505* |
| **Aberdeenshire** | 108023 | *15720* | *645* |
| **Angus** | 26868 | 14578 | *1743* |
| **Argyll & Bute** | 35747 | 5324 | *775* |
| **Clackmannanshire** | 15252 | 4527 | *442* |
| **Dumfries & Galloway** | 56261 | 17269 | *629* |
| **Dundee City** | 41790 | 8908.5 | 2812 |
| **E. Ayrshire** | 31494.4 | 10369 | *1873* |
| **E. Dunbartonshire** | 50458 | *5427* | *5363* |
| **E. Lothian** | 36447 | 4917.4 | *2433* |
| **E. Renfrewshire** | 25586 | 3979.1 | 1365 |
| **Edinburgh, City of** | 128184 | 11842 | 3906 |
| **Eilean Siar** | 4870 | 1070 | 569 |
| **Falkirk** | 47638 | 8123 | *7905* |
| **Fife** | 98223 | 25017 | *9454* |
| **Glasgow City** | 193278 | 9558 | 23598 |
| **Highland** | 70195 | 9395 | 3213 |
| **Inverclyde** | 18257 | 8919 | 250 |
| **Midlothian** | 19491.9 | 7712 | 1194 |
| **Moray** | 23736 | 4616.7 | *1373* |
| **N. Ayrshire** | 42340 | 4162 | *3599* |
| **N. Lanarkshire** | 108355 | 17724 | 21401 |
| **Orkney Islands** | 3682.8 | 2364.4 | 63 |
| **Perth & Kinross** | 50295 | 9598 | 249 |
| **Renfrewshire** | 53960 | 16283 | 1998 |
| **Scottish Borders** | 24710 | 7981 | 270 |
| **Shetland Islands** | 11787 | *1490* | *313* |
| **S. Ayrshire** | 38052 | 10547 | *1794* |
| **S. Lanarkshire** | 108713 | 12129 | *4787* |
| **Stirling** | 19195.3 | 4504.1 | *1354* |
| **W. Dunbartonshire** | 28205 | 4806 | 656 |
| **W. Lothian** | 40541 | 8099 | 1073 |

## 9.2. Collection of Waste Composition Data

To help quantify the amount of reconstituted wood waste arising in Scottish MSW, waste composition results were used to determine the proportion of reconstituted wood waste in residual waste collections, bulky waste collections and residual waste at recycling centres.

### *Collected Residual Waste Composition*

Few waste composition analyses that specifically identified reconstituted wood were found for Scotland and therefore the estimates in this Report are derived from data from other regions in the UK.

Although waste composition analysis[26] for collected residual MSW indicates what proportion of the collected waste stream is wood (1.11%), none were found detailing the proportion of reconstituted wood.

However, data from a WRAP study into wood flows and recycled wood markets in the UK[27] found that approximately 36% of wood products placed in the UK market place were reconstituted wood.

Due to limited data, it was assumed that this proportion is maintained throughout the lifecycle of wood products and that waste arises in similar proportions. For this Report it was assumed that 0.4% of collected residual waste is reconstituted wood.

### *Composition of Collected Bulky Waste*

Detailed composition for bulky waste, which facilitated the proportion of reconstituted wood, was also unavailable. The estimates provided in this Report are based on those found during a small scale analysis conducted by North Lanarkshire Council during the summer in 2007[28]. This analysis suggested that reconstituted wood accounts for approximately 23.87 % of bulky waste composition.

### *Composition of Residual Waste at Recycling Centres*

Typical proportions of residual waste at recycling centres that is reconstituted wood are show in Table 7.

**Table 7 Typical proportion of waste reconstituted wood in residual waste at recycling centres**

| Document Title & Date | Material Terminology | % |
|---|---|---|
| **Warwickshire Waste Analysis (May 2007)** | MDF & Chipboard | 3.25 |
| **Household waste composition analysis final report for Merseyside WDA (July 2006)** | Reconstituted wood | 6.4 |
| **DOE – Environment and Heritage Service – Review of Municipal Waste Component Analysis (Feb. 2008)** | Reconstituted wood | 6.76 |
| **SORT IT centre residual waste composition study. South Gloucestershire Council (July 2007)** | Reconstituted Wood | 13.7 |
| **Northamptonshire Joint Municipal Waste Management Strategy – Addendum to Baseline Report (July 2007)** | MDF & Chipboard | 22.7 |
| **Revised Cambridgeshire and Peterborough Joint Municipal Waste Management Strategy (September 2008)** | Woodchip & MDF | 27.8 |

As part of the assessment of which values to use, no relationship was found between the proportion of reconstituted wood waste in residual waste at recycling centres and the amount of waste wood collected separately.

It was therefore decided that, considering the range in the proportion of reconstituted wood in residual waste at recycling centres, an average value (13.44%)

[26] The Welsh Assembly Government (2003) Welsh Waste Composition Analysis Report.
[27] TRADA Technology Ltd. (2003) Wood market study - UK wood flows and recycled wood markets. WRAP, Banbury.
[28] Personal communication: Alex McLaren, 29th October 2008.

would be used. This figure is comparable with those obtained by the City of Edinburgh[29] in a recent composition analysis performed.

### *Reconstituted wood Proportions in Different Waste Stream*

Table 8 summarises the estimated proportions used to quantify waste reconstituted wood in Scottish MSW.

**Table 8 Estimated proportions of reconstituted wood in Scottish MSW**

| Waste Stream | % Reconstituted wood |
|---|---|
| **Collected Residual Waste** | 0.4% |
| **Bulky Waste Collections** | 23.87% |
| **Residual Waste at Recycling Centres** | 13.44% |

## 9.3. Estimating Reconstituted wood Waste

These two data sets were combined to provide an estimate of reconstituted wood arising in Scottish MSW, by Local Authority (Table 9).

**Table 9 Estimated tonnage and potential reconstituted wood by Local Authority.**

| Local Authority | Residual Waste Collection (0.4%) | Bulky Waste Collections (23.87%) | Residual Waste at Recycling Centres (13.44%) | Estimated Total Potential |
|---|---|---|---|---|
| **Aberdeen City** | 344 | 1878 | 598 | 2821 |
| **Aberdeenshire** | 432 | 2113 | 154 | 2699 |
| **Angus** | 107 | 1959 | 416 | 2483 |
| **Argyll & Bute** | 143 | 716 | 185 | 1044 |
| **Clackmannanshire** | 61 | 608 | 106 | 775 |
| **Dumfries & Galloway** | 225 | 2321 | 150 | 2696 |
| **Dundee City** | 167 | 1197 | 671 | 2036 |
| **E. Ayrshire** | 126 | 1394 | 447 | 1967 |
| **E. Dunbartonshire** | 202 | 729 | 1280 | 2211 |
| **E. Lothian** | 146 | 661 | 581 | 1387 |
| **E. Renfrewshire** | 102 | 535 | 326 | 963 |
| **Edinburgh, City of** | 513 | 1592 | 932 | 3037 |
| **Eilean Siar** | 19 | 144 | 136 | 299 |
| **Falkirk** | 191 | 1092 | 1887 | 3169 |
| **Fife** | 393 | 3362 | 2257 | 6012 |
| **Glasgow City** | 773 | 1285 | 5633 | 7691 |
| **Highland** | 281 | 1263 | 767 | 2310 |
| **Inverclyde** | 73 | 1199 | 60 | 1331 |
| **Midlothian** | 78 | 1036 | 285 | 1399 |
| **Moray** | 95 | 620 | 328 | 1043 |
| **N. Ayrshire** | 169 | 559 | 859 | 1588 |
| **N. Lanarkshire** | 433 | 2382 | 5108 | 7924 |
| **Orkney Islands** | 15 | 318 | 15 | 348 |
| **Perth & Kinross** | 201 | 1290 | 59 | 1551 |
| **Renfrewshire** | 216 | 2188 | 477 | 2881 |
| **Scottish Borders** | 99 | 1073 | 64 | 1236 |
| **Shetland Islands** | 47 | 200 | 75 | 322 |
| **S. Ayrshire** | 152 | 1418 | 428 | 1998 |
| **S. Lanarkshire** | 435 | 1630 | 1143 | 3208 |
| **Stirling** | 77 | 605 | 323 | 1005 |
| **W. Dunbartonshire** | 113 | 646 | 157 | 915 |
| **W. Lothian** | 162 | 1089 | 256 | 1507 |
| **Total** | 6591 | 39102 | 26162 | 71855 |

[29] Personal communication: Andy Williams, 4th December 2008.

# 10. Appendix B: Waste Wood Merchants

For expediency, this Report draws on information collected during Remade Scotland's Waste Wood Management Survey 2009, which to avoid double counting classified operators in the waste wood supply chain into one of the following three tiers:

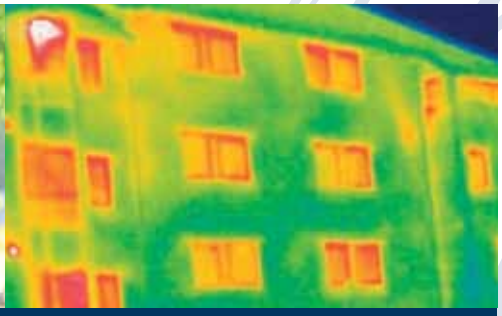
- Tier One: Local Authorities
- Tier Two: Private skip hire and waste management
- Tier Three: Private waste management and wood merchants

For expediency, and to fill data gaps only a selection of operators in these tiers were interviewed. These are listed in Table 10 below and include those handling 50% of the Tier Two tonnage and 100% of Tier Three tonnage. As data for Local Authorities was already available it was not necessary to interview them.

**Table 10 List of waste wood merchants interviewed**

| Company Name | Tier |
|---|---|
| **Armstrong Waste Management** | 2 |
| **Binn Skips** | 3 |
| **Buchanan Skip Hire** | 2 |
| **Central Skips** | 2 |
| **Delson Waste Management** | 2 |
| **DJ Laing** | 3 |
| **Dow Waste Management** | 2 |
| **Enviroco** | 2 |
| **Grays Recycling** | 2 |
| **Henry Waste Management** | 2 |
| **Jenkinson Woodwaste** | 3 |
| **Lowmac Alloys** | 2 |
| **Patersons** | 2 |
| **Ramsay McBain** | 2 |
| **Stevenson Brothers** | 3 |
| **Stewart Melrose** | 2 |
| **Viridor Enviroscot** | 3 |
| **William Tracey** | 3 |
| **Armstrong Waste Management** | 2 |

These companies were interviewed on a broad range of supply chain issues in order to make a comprehensive assessment on the present state of supply of waste wood.

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