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WRAP: Comprehensive life-cycle analysis of plasterboard

A new study conducted by WRAP (Waste and Resources Action Programme) has assessed the environmental impact of plasterboard, including a detailed evaluation of the CO_2 emissions associated with every stage of the product's life-cycle. Dave Marsh, construction project manager at WRAP, outlines the findings of this new study, the most extensive to be conducted in the UK to date.

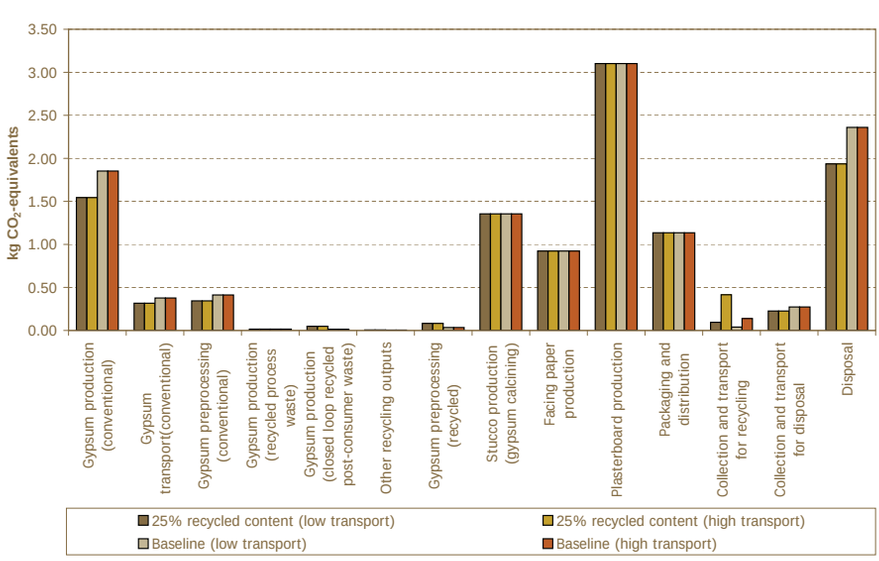
As part of its work to facilitate and encourage greater reduction and recycling of waste plasterboard, WRAP commissioned a comprehensive life-cycle assessment (LCA) which investigated the environmental impact of one standard sheet of Type A plasterboard – the most common plasterboard product used in the UK. The findings of the study now enable the plasterboard manufacturing and recycling sectors to identify where the CO_2 emissions are greatest and therefore where positive interventions could be made to reduce the environmental impact of the product and improve materials resource efficiency.

One of the headline findings reported in the study was that over the entire life-cycle, each sheet of the baseline plasterboard assessed was found to cause the emission of the equivalent of 12kg of CO_2. As shown in Graph 1, the life-cycle stages contributing the highest emissions were production of conventional gypsum (the typical mix of natural and synthetic gypsum used in the UK); plasterboard production; and landfill disposal of waste plasterboard.

The study evaluated three scenarios with different levels of recycled gypsum content in the plasterboard. The baseline scenario was the average mix of gypsum currently used in conventional Type A plasterboard production in the UK, which already includes around 10.5% recycled gypsum from waste plasterboard. A second scenario saw the content of recycled gypsum increased to 15%; and a third scenario involved the content of recycled gypsum increased to 25% – the maximum level of inclusion currently considered to be feasible.

The study showed that using more recycled gypsum from waste plasterboard in the manufacture of the new plasterboard contributed to a small reduction in the associated CO_2 emissions during the course of that product's lifecycle. This results from avoiding the need to produce, transport and pre-process conventional gypsum and avoiding landfill disposal of the waste plasterboard through recycling. While this benefit was only small when compared to the overall CO_2 impacts of plasterboard manufacture, it is significant in that it indicates that increasing the content of recycled gypsum in plasterboard has no negative CO_2 impact.

When considering the waste stage of the plasterboard life-cycle, processing it to produce recycled gypsum was found to have lower global warming potential than disposal of it in mixed waste landfill. This aspect of the study is significant in that it opens up the potential of future work being conducted to quantify the benefits of the open loop recycling of waste plasterboard into products and applications other than plasterboard. This would further support a number of initiatives led by WRAP over the last three years in developing these alternative markets for recycled gypsum; this is already considered important as in the UK more waste plasterboard is currently produced that could be feasibly used back into the manufacture of new plasterboard. Both open and closed loop recycling routes are required to maximise diversion of plasterboard waste from landfill.



Graph 1: Life-cycle stages and their contribution to CO_2 emissions.

Minimising the amount of waste being produced is the most preferable waste option – and sits at the top of the waste hierarchy. The study specifically investigated this scenario and the findings clearly reinforce it by showing that reducing the amount of plasterboard waste being generated on construction sites was a key factor in reducing plasterboard's environmental impact. In global warming terms, the study found that a saving of up to 158t of CO_2 equivalents could be achieved by reducing waste from 15% to 5% on a UK£750,000 example contract. This saving equated to 62kg of CO_2 equivalents per ton of plasterboard used and – even though the size of the contract could be seen as a modest example – has the same effect as removing 50 cars from UK roads for one year.

Crucially, for manufacturers operating take-back schemes for waste plasterboard, the study found that the distance waste plasterboard travels is also extremely relevant in determining the range of the product's environmental impact. The approach taken for this LCA was to model two alternative scenarios representing extremes for the UK for the total transport distance for the plasterboard waste to the recycler and the onward transport of the recycled gypsum to its point of use. With these parameters set at extremes of 50km (shortest distance) and 450km (longest distance), it was determined that transportation was a key contributor to environmental impacts in several key areas, including the emission of greenhouse gases.

The overall environmental impact of waste plasterboard could thus be reduced by decreasing the distances travelled by the waste collected and the recycled gypsum powder that is produced. This suggests that the use of bulking stations would bring about reductions in emissions by enabling larger loads and reducing the number of individual vehicle movements.

Also commonly called 'cradle-to-grave' or 'cradle-to-cradle' assessments, the LCA encompassed all the steps and processes in the product's life, from production and its use of raw materials, through product manufacture, distribution and packaging, installation, use and finally, disposal or recycling. It tested a number of scenarios including waste reduction on site, and increasing the content of recycled gypsum in plasterboard manufacture.

The study incorporated information provided by a number of bodies including the Gypsum Products Development Association (GPDA) which represents the UK's three plasterboard manufacturers: British Gypsum, Knauf Drywall, and Lafarge Plasterboard. It also included input from plasterboard recyclers and waste management companies. The high quality of the information and data provided made the study the most up to date of its type.

The LCA provides UK plasterboard manufacturers with a new evidence base to support their drive towards the 2010 targets set as part of the Ashdown Agreement, a voluntary agreement by the manufacturers to reduce plasterboard going to landfill. These targets include reducing the amount of production waste being sent to landfill to 10,000t/y and increasing takeback and recycling of plasterboard to 50% of new construction waste arisings.

Under the influence of the Ashdown Agreement and other sustainability drivers, manufacturers are already taking significant strides towards establishing methods of minimising the amount of plasterboard waste produced and increasing the amount of plasterboard waste that is recycled.

The environmental benefits of reducing wastage of plasterboard are further enhanced through recycling any plasterboard waste that does arise, and can be maximised by ensuring the distances travelled by both the waste and the recycled materials produced are kept as short as possible.

The full report – Life-cycle Assessment of Plasterboard – can be downloaded as a .pdf document free from the WRAP website – www.wrap.org.uk/plasterboard.