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Environmental impact of windows

Owen Abbe

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The Publisher
IHS BRE Press
Garston
Watford
Herts WD25 9XX
Tel: +44 (0) 1923 664761
Email: brepress@ihs.com

Printed using FSC or PEFC material from sustainable forests.

FB 66

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First published 2014

ISBN 978-1-84806-368-6

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Glossary

Allocation: sharing the input or output flows of a unit process to the product system under study. This may need to be done where a manufacturing process results in products and co-products, eg steel and slag.

Ecopoints: (as used in the BRE Environmental Profiles methodology) the normalised profile values are multiplied by weighting factors developed for each impact category and the results summed to give a single figure.

Environmental impact category: environmental issue being examined, eg climate change, acid deposition and human toxicity.

Environmental Profile: the level of impact in each environmental impact category for the functional unit or product being studied.

Functional unit: a qualitative description of function specifically defined for the product/service under study and any alternative products/services to which it is compared. The use of a functional unit means that the alternative designs under study are, in theory, compared fairly. For example, a comparison of external walls may be based on every external wall design in the study achieving a U-value of 0.3 W/m^2K and compliance with building regulations.

Input: material or energy that enters a unit process (can include raw materials and intermediate products).

Intermediate product: material that has already been processed before being used to produce a product.

Life cycle: consecutive and interlinked stages of a product system from raw material acquisition or generation of natural resources to the final disposal.

Life cycle assessment (LCA): compilation and evaluation of the inputs, outputs and potential environmental impacts of a product system throughout its life cycle.

Life cycle inventory (LCI): the product system input and output flow data used in carrying out the LCA.

Normalised profile: the characterised profile is referenced to the environmental impact for each category at the national or global level in one year (usually for one citizen), giving a 'normalised' profile; the values are directly comparable.

Output: material or energy that leaves a unit process (may include raw materials, intermediate products, products, emissions and waste).

Raw material: unprocessed material that is used to produce a product.

Sequestration: (of carbon) the removal and long-term storage of carbon dioxide (CO_2) from the atmosphere in biomaterials such as timber and agricultural products.

1 Introduction

This report provides a review of how windows have been assessed in *The Green Guide to Specification* (fourth edition)[1], including the application of the BRE Environmental Profiles methodology[2], which underlies *The Green Guide*. The way that windows are addressed within building-level environmental assessment schemes such as the BRE Environmental Assessment Method (BREEAM; www.breeam.org) and the Code for Sustainable Homes[3] is also explained.

The report aims to provide manufacturers and specifiers with a general understanding of the approach and decisions that have been made when applying the Environmental Profiles methodology to windows. The benefits and impacts of windows over their whole life cycle (cradle to grave) are discussed and opportunities for improvements within the sector are identified.

This report has been produced as part of a series on the production of *The Green Guide to Specification*. Many of the other reports in the series, eg *Environmental impact of metals*[4] and *Environmental impact of brick, stone and concrete*[5] may also be of value when considering the environmental impact of specific windows and their uses.

1.1 Windows and *The Green Guide*

The main purpose of a window in a building is to contribute to the well-being and comfort of the building occupants through various functions, including but not limited to the following:

- as a source of natural light into the building or room
- enabling ventilation and insulation – heat and air flow
- providing sound and noise filtration
- providing a view to the outside of the building
- as an aesthetic finish to the room or building.

The choice of window type in the building is generally dependent on the design and the intended use of the building and, therefore, the functional and practical requirements of the window. The location is a key input in the decision, as it affects issues such as the durability of the window relative to environmental conditions. The location also influences the planning requirements and may restrict the window design or the materials that can be used. Building orientation may also have some influence over the window design.

The Green Guide to Specification has grouped windows into two main categories of building over the 60-year study periods:

- Non-domestic: commercial (offices), education, health, industrial- and retail-type building applications, high-rise housing (≥ 4 storeys).
- Domestic: low-rise housing (≤ 3 storeys) and domestic-scale construction.

The windows have been assessed under the 13 environmental categories contained in the BRE Environmental Profiles methodology. The thermal performance of windows has a considerable influence on the energy consumed during the life of the building. Consequently, the thermal performance of the window (via its U-value) is a key part of the functional unit – the basis on which comparisons of different windows have been achieved in *The Green Guide*. All windows are modelled to have a U-value of 1.8 W/m^{2}K, giving a constant operational energy use. In addition to the material credits, it should be remembered that there are also credits available in BREEAM and the Code for Sustainable Homes for reducing fabric heat loss and improving operational carbon dioxide (CO_2) emissions.

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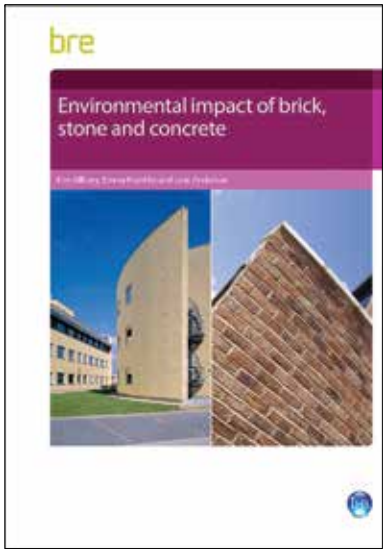

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Understand the significant benefits and impacts of metals over their life cycle and identify opportunities for improvements to their environmental performance. This report reviews how metals have been assessed in *The Green Guide to Specification*.

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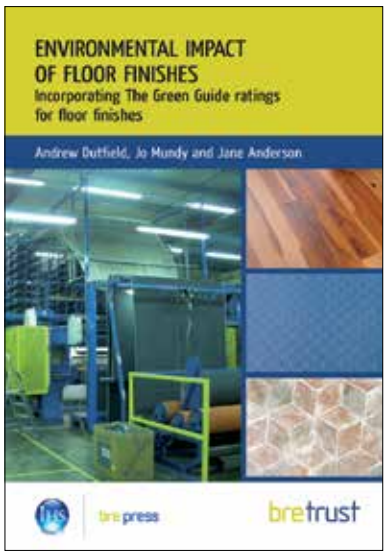

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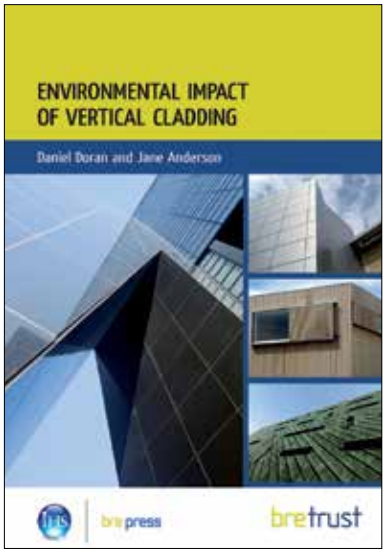

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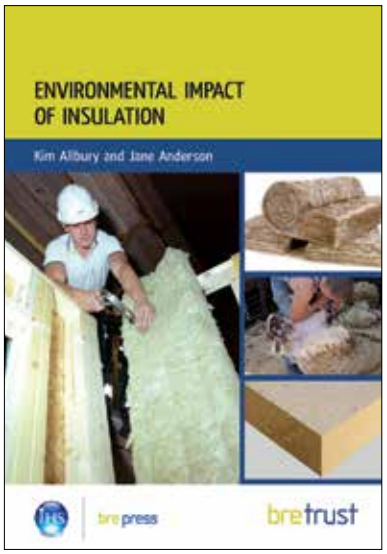

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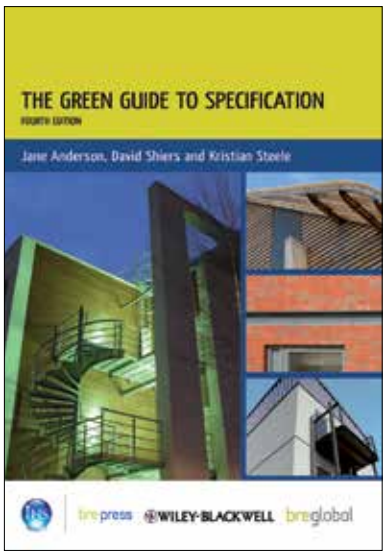

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Environmental impact of windows

This report reviews how window units and frames have been assessed within *The Green Guide to Specification*, including the application of the Environmental Profiles methodology, which underlies Green Guide data. The way in which windows are addressed within building-level environmental assessment schemes such as BREEAM and the Code for Sustainable Homes is also explained.

The report will give manufacturers and specifiers a general understanding of the significant benefits and impacts of windows over their whole life cycle and help to identify opportunities for improvements to their environmental performance. It is part of a series that provides comparable information on cladding, floor finishes, insulation, masonry and concrete, metals, and biomaterials and biomass to assess the environmental impact of specific construction materials.

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