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Review

Achieving transparency in carbon labelling for construction materials – Lessons from current assessment standards and carbon labels

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ABSTRACT

The construction industry is one of the largest sources of carbon emissions. Manufacturing of raw materials, such as cement, steel and aluminium, is energy intensive and has considerable impact on carbon emissions level. Due to the rising recognition of global climate change, the industry is under pressure to reduce carbon emissions. Carbon labelling schemes are therefore developed as meaningful yardsticks to measure and compare carbon emissions. Carbon labelling schemes can help switch consumer-purchasing habits to low-carbon alternatives. However, such switch is dependent on a transparent scheme. The principle of transparency is highlighted in all international greenhouse gas (GHG) standards, including the newly published ISO 14067: *Carbon footprint of products – requirements and guidelines for quantification and communication*. However, there are few studies which systematically investigate the transparency requirements in carbon labelling schemes. A comparison of five established carbon labelling schemes, namely the Singapore Green Labelling Scheme, the CarbonFree (the U.S.), the CO_2 Measured Label and the Reducing CO_2 Label (UK), the CarbonCounted (Canada), and the Hong Kong Carbon Labelling Scheme is therefore conducted to identify and investigate the transparency requirements. The results suggest that the design of current carbon labels have transparency issues relating but not limited to the use of a single sign to represent the comprehensiveness of the carbon footprint. These transparency issues are partially caused by the flexibility given to select system boundary in the life cycle assessment (LCA) methodology to measure GHG emissions. The primary contribution of this study to the construction industry is to reveal the transparency requirements from international GHG standards and carbon labels for construction products. The findings also offer five key strategies as practical implications for the global community to improve the performance of current carbon labelling schemes on transparency.

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1. Introduction

The building and construction sector is one of the largest sources of carbon emissions. According to the US Environmental Protection Agency (2012), buildings consume 39% of the total energy used, 68% of total electricity consumption, 12% of potable water consumed and 38 percent of the carbon dioxide emissions in the U.S. The manufacturing process of building materials (e.g. cement and steel) and chemicals have considerable impact on CO_2 emissions level (Worrell et al., 2001a). For example, the cement sector alone accounts for 5% of global man-made CO_2 emissions (Worrell et al., 2001b). Transportation of raw materials is also energy intensive, especially for countries which relies heavily on import of raw materials (Wu and Low, 2011). On-site construction of building is not always effective and may generate unnecessary carbon emissions (Wu and Low, 2012; Wu et al., 2013). Due to the rising recognition of global climate change, many sectors, including the building and construction sector, are under pressure to reduce carbon emissions. A central issue in striving towards reduced carbon emissions is the need for a practicable and meaningful yardstick for measuring and comparing carbon emissions (Crawley and Aho, 1999).

Life Cycle Assessment (LCA) has been widely adopted to evaluate environmental impacts, including evaluating global climate change in terms of measuring global warming potential, in both manufacturing and construction sectors (Petersen and Solberg, 2002). It assigns elementary flow and potential environmental impacts to a specific product system (Wu and Low, 2011). Various carbon labelling schemes have been developed based on LCA, including the Singapore Green Labelling Scheme (Singapore), the CarbonFree (The U.S.), the Carbon Label (UK), the CarbonCounted (Canada) and the Hong Kong Carbon Labelling Scheme (CLS). According to Erskine and Collins (1997), the greatest challenge to LCA in environmental labelling is its credibility, which requires transparency in system boundary definition, the availability of data, data quality and the methods used. Without transparency, comparing the carbon emissions level of different products will be extremely difficult and unrealistic. Consumers, who usually do not have access to the full embodied carbon data of the product and make the buying decision solely based on the information presented on the label, cannot truly identify and select low-carbon products. This paper therefore aims to: (1) compare globally recognized GHG standards and carbon labels to investigate the transparency requirements in the carbon labels for construction materials; and (2) identify key factors that should be addressed for future international GHG standards and carbon labels to improve on these transparency requirements.

2. Transparency in carbon labelling schemes

Driven by the pressing pressure of environmental challenges, there have been a number of attempts to initiate environmental labelling or eco-labelling schemes (Ball, 2002). Environmental labelling programmes may provide one or several pieces of environment-related information, such as modelling of energy consumption, water consumption, carbon emissions and wastes. These pieces of information are aggregated into a single score for making informed decisions when selecting environmentally friendly materials.

The assessment of environmental information in environmental labelling schemes is based on life cycle assessment method, including ISO 14040 (2006) and ISO 14044 (2006). Trusty (2001) divided the life cycle assessment tools into three levels: which are:

- Level 1: Product comparison tools (e.g. UK Ecopoints, Blue Angel, NF Environment Mark)
- Level 2: Whole building design or decision support tools (e.g. Whole Life Cycle Costing, Multi-Criteria Decision Making)
- Level 3: Whole building assessment frameworks (BREEAM, LEED, Green Globes)

For example, LEED (the Leadership in Energy and Environmental Design) is a voluntary consensus standard developed by the U.S. Green Building Council (USGBC) for developing sustainable buildings that have superior performance in the areas of sustainable site development, water savings, energy efficiency, materials selection and indoor air environmental quality (Vijayan and Kumar, 2005). Green Globes offer a simpler methodology and employ a user-friendly interactive guide for assessing and integrating green design principles for buildings (Smith et al., 2006). Both labelling programmes are known as the whole building performance assessment tools. On the other hand, the Building Research Establishment (BRE) methodology for environmental profiles for construction materials, components and buildings offers a standardized method to identify and assess the environmental effects associated with building materials over their life cycles – that is the extraction, processing, use, maintenance and eventual disposal (Building Research Establishment, 2010). Based on the methodology, the UK Ecopoints was initiated by BRE to measure the total environmental impacts of a particular product or process (Huovila and Curwell, 2007). Environmental labelling programmes of construction materials should be developed in close cooperation with manufacturers, as information related to inputs of raw materials, energy as well as the detailed design is mostly provided by manufacturers. The Whole Life Cycle Costing approach is a technique which enables comparative cost assessments to be made over a specified period of time, taking into account all relevant economic factors both in terms of initial costs and future operational costs (Gluch and Baumann, 2004). According to Balcomb and Curtner (2000), the Multi-Criteria Decision-Making (MCDM) technique is designed to guide design teams in a way that makes sustainable building design easy and inexpensive. Both approaches belong to the Level 2 assessment (i.e. whole building design or decision support tool) category and can offer the design team a good evaluation of the proposed building to achieve ultimate building sustainability.

However, since the establishment of the first eco-labelling scheme, i.e. the Blue Angel, in 1978, eco-labelling schemes have been challenged for not providing credible and transparent environmental information. For example, a comparison of five eco-labels in the Netherlands shows that eco-labels fail to