Journal of Cleaner Production 109 (2015) 108–117

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Review

A review of benchmarking in carbon labelling schemes for building materials

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ARTICLE INFO

Article history:
Received 15 May 2014
Received in revised form
21 June 2015
Accepted 10 July 2015
Available online 18 July 2015

Keywords:
Carbon labelling
Benchmarking process
Building materials
Benchmarks

ABSTRACT

As one of the largest sources of greenhouse gas (GHG) emissions, the building and construction sector is facing increasing pressure to reduce its life cycle GHG emissions. One central issue in striving towards reduced carbon emissions in the building and construction sector is to develop a practical and meaningful yardstick to assess and communicate GHG results through carbon labelling. The idea of carbon labelling schemes for building materials is to trigger a transition to a low carbon future by switching consumer-purchasing habits to low-carbon alternatives. As such, failing to change purchasing pattern and behaviour can be disastrous to carbon labelling schemes. One useful tool to assist customers to change their purchasing behaviour is benchmarking, which has been very commonly used in ecolabelling schemes.

This paper analyses the definition and scope of benchmarking in the carbon labelling schemes for building materials. The benchmarking process has been examined within the context of carbon labelling. Four practical issues for the successful implementation of benchmarking, including the availability of benchmarks and databases, the usefulness of different types of benchmarks and the selection of labelling practices have also been clarified.

1. Introduction

The impact of climate change can be catastrophic to global environment. Average sea level has risen since 1960 at an average rate of 1.8 mm/year and since 1993 at 3.1 mm/year (Intergovernmental Panel on Climate Change, 2007). The worst-case predictions for rising sea levels in the Thames Estuary would see the level of the river rising by up to 4 m by 2100, which means that eventually large parts of London – one of the world's biggest capitals – would be under water (Tang and Yeoh, 2007). According to the Australian Department of the Environment (2014), human-induced global warming was a key reason why the Australian Drought of 2002 was so severe. In addition, the U.S. Environmental Protection Agency (2014a) reported that global climate change would have a significant impact on crop yields, livestock and fisheries. The adverse impact of global climate change would cost at least 5% of global GDP per year if actions were not taken to reduce GHG emissions (Stern, 2007).

The building and construction industry is one of the largest sources of GHG emissions. According to American Institute of Architects (2007), it is estimated that nearly 50% of all GHG emissions are generated by buildings and their construction (in terms of energy used in the production of materials and transportation of materials form production factories to construction site) and operation (in terms of energy used in heating, cooling, ventilation, air conditioning, lighting, etc.). According to Huntzinger and Eatmon (2009), the cement sector alone accounts for approximately 5% of global CO_2 emissions. The sector is the third largest source of carbon emissions in the United States. Transportation of construction materials is also energy intensive, especially for countries which rely heavily on import of raw materials (Wu and Low, 2011). The transportation sector has been the second largest source of CO_2 emissions in the United States since 2000 (U.S. Environmental Protection Agency, 2014a). On-site construction of buildings is not always effective and may generate unnecessary

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http://dx.doi.org/10.1016/j.jclepro.2015.07.067
0959-6526/

carbon emissions (Wu and Low, 2012, 2013). As one of the largest sources of emissions, the building and construction industry is facing increasing pressure to reduce its life cycle emissions. The life cycle of a construction product, process or system includes:

- the extraction and processing of raw materials;
- manufacturing, transportation and distribution;
- operation (i.e. use and maintenance); and
- end-of-life treatments, such as reuse, recycling and final disposal.

According to Crawley and Aho (1999), one central issue in striving towards reduced carbon emissions in the building and construction sector is to develop a practical and meaningful yardstick to assess and communicate the greenhouse gas (GHG) results. While many internationally recognized carbon labelling schemes, most notably the CO_2 Measured Label and the Reducing CO_2 Label (UK), the CarbonCounted (Canada), the CarbonFree (US) and the Hong Kong Carbon Labelling Scheme (CLS), have been established in recent years, Wu et al. (2014) argued that these labelling schemes may not be useful for consumers to identify and select true low-carbon products because they do not have access to the full set of data and make the buying decision solely based on the information presented on the label, which sometimes can be misleading. D'Souza et al. (2006) also pointed out that there appears to be a proportion of consumers who find environmental labels difficult to understand.

As comparison is one of the most commonly adopted strategies by customers to choose environmentally friendly materials, benchmarking can be appropriately incorporated into the labelling schemes to assist informed purchasing decisions. Such strategy has been adopted in many other environmental labelling schemes. For example, Energy Star, one of the internationally recognized building energy initiatives, uses a score system of 1–100. Buildings with a score less than 50 perform worse than 50 percent of similar buildings. Similarly, Leadership in Energy and Environmental Design (LEED) 2009 has four levels of certification, which are Certified, Silver, Gold and Platinum. Higher levels of certification normally indicate superior environmental performance. The idea of carbon labelling schemes for building materials is to trigger a transition to a low carbon future by switching consumer-purchasing habits to low-carbon alternatives (Gadema and Oglethorpe, 2011). As such, it is important to provide adequate scaffolding system, which is a term widely used to describe effective learning support, to assist the transition (McLoughlin, 2002). This paper therefore aims to analyse the use of benchmarking as the scaffolding system by: (1) defining benchmarking and its scope within the context of carbon labelling; (2) examining the benchmarking process in carbon labelling; and (3) investigating the practical issues relating to the implementation of benchmarking.

2. Definition and scope of carbon labelling schemes for construction materials

2.1. Definition

Environmental labelling or eco-labelling schemes are developed based on growing concerns on environmental protection. According to the U.S. Environmental Protection Agency (1998), in simple terms, environmental labelling is defined as making relevant environmental information available to appropriate consumers. It is the practice of labelling products based on a wide range of environmental considerations (e.g., hazard warnings, certified marketing claims, and information disclosure labels), which will eventually contribute to the decision-making process inherent in product selection and purchasing (U.S. Environmental Protection Agency, 1998). Due to the rising global recognition of environmental issues, environmental labelling has gone through rapid development in recent years.

The world's first environmental labelling scheme, i.e. the Blue Angel, was developed in Germany in 1978 to be used as a market-conform instrument to distinguish the positive environmental features of products and services on a voluntary basis (Blue Angel, 2013). Many other national ecolabel schemes have also been established since the 1990s, such as the ‘White Swan’ in Finland, the ‘NF-Environnement’ in France and the ‘GreenLabel in Singapore. In order to remove the trade barriers caused by using national ecolabel schemes, a few international ecolabel schemes, most notably the EU Ecolabel, have also been established. The EU Ecolabel is a voluntary, third-party ecolabelling scheme that provides information about the environmental superiority of awarded products by a single score and at the point of sale (Karl and Orwat, 1999). It uses life cycle assessment (LCA) tools to evaluate the environmental impacts of different product categories. At the time of the study, the EU Ecolabel has 33 product categories. In each of the product category, comparisons between the environmental performance of different products can therefore be made.

Environmental labelling schemes measure the overall environmental impacts which may include climate change, fossil fuel depletion, ozone depletion, waste disposal, water extraction, acid deposition and mineral extraction. As different environmental impacts are measured using different measurement units (e.g. mineral extraction is measured by tonnes of mineral extracted and global climate change is measured using carbon dioxide equivalent in a specified timeframe, which generally is set at 100 years), the environmental impacts must be normalized into a same scale to allow comparison.

On the other hand, carbon labelling schemes focus on a single category of environmental impact, i.e. global climate change. Carbon labelling schemes, similar to environmental labelling schemes, use LCA tools to analyse the inputs of raw materials and energy and report carbon dioxide emissions or carbon dioxide equivalent over a 100-year period as the outputs. According to Boardman (2008), the aim of carbon labelling schemes are:

- To provide information so as to enable customers to choose a less carbon-intensive product.
- To provide a way for organizations to publicly commit to reducing the embodied carbon of the products.
- To encourage retailers to only put up non carbon-intensive products for sale.

The other commonly used term to replace carbon labelling schemes is carbon footprint of a product (CFP). According to ISO 14067 (2013), CFP is the sum of greenhouse gas emissions and removals in a product system, expressed as CO_2 equivalents and based on a life cycle assessment using the single impact category of climate change. The carbon label or the CFP label is the mark on a product identifying its CFP within a particular product category (ISO 14067, 2013). Higher CFP values usually indicate higher adverse impact on global climate.

2.2. Scope

According to Wu et al. (2014), the International Organization for Standardization established three types of environmental labelling, which are:

- Type I refers ecolabelling schemes which award a mark or logo based on the fulfilment of a set of criteria (ISO 14024, 1999).