

1.3.3. CARBON FOOTPRINT ASSESSMENT STUDY IN CONSTRUCTION IN PORTUGAL

OERCO2
ONLINE EDUCATIONAL RESOURCE FOR INNOVATIVE STUDY OF CONSTRUCTION
MATERIALS LIFE CYCLE

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1. Introduction

Climate change resulting from anthropogenic activity has been identified as one of the greatest challenges for today's society, with major implications for human and natural systems. In response, many initiatives are being developed and implemented to limit concentrations of greenhouse gases (GHG) in the Earth's atmosphere.

In Portugal, the construction sector is a significant contributor to the impact of the built environment. At the environmental level, this sector is directly and indirectly linked to the consumption of a great quantity of natural resources (energy, water, minerals, etc.) and the significant production of waste. The proper use of building materials, products and technologies can contribute considerably to a better environmental performance of a building's life cycle and therefore to its sustainability.

Many of the initiatives for the growth of sustainable construction have resulted in the development of different types of methods and methodologies for calculating the carbon footprint of products/services (CFP), some of which allow us to evaluate the carbon footprint of building materials.

2. Related research

The most common methodologies for calculating Carbon Footprint (PC) are: ISO/TS 14067, GHG Standard Product Protocol, PAS 2050 and the Climate Declaration. These may all be applicable in Portugal. The first three follow specific standards or specifications for calculating PC products, while the Climate Declaration is a subset of an Environmental Product Declaration, which focuses only on the parameter Carbon Dioxide (Climate Change).

ISO/TS 14067:2013 specifies principles, requirements and guidelines for the quantification and communication of the CFP, based on International Standards on life cycle assessment (LCA) (ISO 14040 and ISO 14044) for quantification purposes and on environmental labels and declarations (ISO 14020, ISO 14024 and ISO 14025) for communication. Requirements and guidelines for the quantification and communication of a partial CFP are also provided. This standard addresses only one impact category: climate change.

The GHG Protocol is one of the most widely used international accounting tools for the measurement and management of greenhouse gas (GHG) emissions, developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), providing requirements to quantify the GHG inventories of products and also requirements for public reporting. It is based on a LC and attributional approach, through the ISO standards for

LCA and the first version of PAS 2050. In order to enable meaningful comparisons between products, the development and use of sector specific rules, termed 'product rules', is promoted.

The Publicly Available Specification 2050 (PAS 2050) has been prepared by British Standards Institution (BSI) to specify requirements for assessing the life cycle GHG emissions of goods and services, through BS EN ISO 14040 and BS EN ISO 14044. It was first introduced in 2008 (BSI, 2008) and was revised in 2011 (BSI, 2011), in alignment with the GHG Protocol Product Standard (WRI and WBCSD, 2011) regarding key topics. PAS 2050 does not give specific guidelines for products or sectors. Instead, similarly to the GHG Protocol, it recommends the use and development of sector specific rules known as 'supplementary requirements'.

A Climate Declaration is a single-issue environmental product declaration (EPD) focused on GHG emissions. This concept was first introduced by the International EPD system. The Climate Declaration builds on the same standards as a full EPD, namely ISO 14040 and 14044 standards for LCA methodology and ISO 14025 standards for environmental declarations. The assessment is based on specific guidelines, termed Product Category Rules (PCR), developed for each product category.

There are also other methodologies developed to determine the environmental impacts of products and services, but encompassing several categories of environmental impact, not just the carbon footprint, such as PEF (Product Environmental Footprint), according to Commission Recommendation 2013/179/EU on the use of common methods for the measurement and reporting of environmental performance throughout the life cycle of products and organizations.

The guide to this methodology was developed in the context of the Europe 2020 Strategy initiative "A Resource Efficient Europe". One of its objectives is to "Establish a common methodological approach to enable Member States and the private sector to assess, present and evaluate the environmental performance of products, services and enterprises based on an overall assessment of environmental impacts throughout the life-cycle " ('environmental footprint')".

In research studies regarding the CF analysis in construction materials, Garcia et al. (2013) analysed several CF methodologies, studying the environmental performance of a particleboard produced in Portugal throughout its life cycle (LC). Using 1 m³ as their functional unit, the analysis provided with the major different methodological issues between ISO/TS 14067, GHG Protocol Product Standard, PAS 2050 and Climate Declaration for wood-based panels.

These reference methodologies are all applicable in Portugal. The first three are specific standards or specifications to calculate the CF of products, while the Climate Declaration is a subset of an Environmental Product Declaration, which focuses only on CF.

Thus, the OEF (Product and Organization Environmental Footprint) project was launched by the European Commission to develop a harmonized European methodology for Environmental Footprint studies that can accommodate a broader set of relevant environmental performance criteria using a life-cycle approach.

PEF is a set of multicriteria methods of calculating the environmental performance of a product or service throughout its life cycle. The results of the PEF are calculated with the aim of reducing the environmental impacts of the product/service, considering their life cycle.

CFP assessment studies are being used to declare the GHG emissions related to products/services worldwide, in order to demonstrate the environmental responsibility, stand out from the competition and to show third parties their carbon performance. These studies are also used to assist in the decision process for the selection of materials, processes and technologies to be used in a construction project.

In Portugal, there is a set of construction materials that have an environmental product declaration, with global warming (expressed in CO₂ eq) being one of the used indicators that sustains the carbon footprint. These declarations include other performance indicators such as those in the DAP Habitat system.

The carbon footprint of ceramic materials used in construction in Portugal, such as bricks, tiles, flooring and coating used in construction was quantified by Almeida et al (2012, 2014, 2016). Bragança & Mateus (2011) developed a Life Cycle Assessment (LCA) study on existing constructive solutions in Portugal, from internal walls, exterior walls, roofs, glazing, pavements, using existing information in the Ecoinvent database. This study analyzed several categories of environmental impacts, one of them being climate change or global warming, quantified through equivalent CO₂ emissions.

In many innovative conferences on sustainable building (CINCO's), since 2008 there are a series of life cycle evaluation studies, including the global warming parameter, which quantifies the carbon footprint in many construction materials used in Portugal.

In research studies on PC analysis in building materials, Garcia et al. (2013) analyzed several PC methodologies, studying the environmental performance of a particleboard produced in Portugal throughout its life cycle. Using 1 m³ as a functional unit, the analysis provided the key methodological issues between ISO/TS 14067, the GHG Standard Product Protocol, PAS 2050 and the Wood-based Panel Climate Declaration.

In terms of wall-building materials used in Europe, Silvestre (2012) performed LCA studies, which quantified the CO₂ emissions generated during the life cycle of external wall materials such as building materials, insulation materials, wall constituents and wall coverings.

Effectively, and as already mentioned, the carbon footprint is related to the calculation of CO₂ eq emissions and is included in the various parameters or categories of environmental impact, for example used in EPDs. Therefore, for further or complementary information on the subject, namely the calculation of carbon dioxide, consult document A.3.2. Report On Methodologies For Calculation Of CO₂ Emissions In Construction Processes.

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