STRATEGIC ENVIRONMENTAL COMMUNICATION TOOLS

T. Ros-Dosdá [1], I. Celades [1], V. Sanfelix [1], S. Gomar [1], E. Monfort [1]

[1] Instituto de Tecnología Cerámica (ITC). Asociación de Investigación de las Industrias Cerámicas (AICE)

Universitat Jaume I. Castellón. Spain

ABSTRACT

The Instituto de Tecnología Cerámica (ITC), pursuing its programme of actions aimed at transferring knowledge to the ceramic industry, presents the following work to facilitate the entry of ceramic coverings to markets demanding sustainable or green products and to national and international sustainable building certification programmes.

At present, for the industry in general and for the ceramic industry in particular, companies seeking to respond to green market demands face serious difficulties owing to the vast number of existing certificates, ecolabellings, and eco-features, which adversely affect the decision-taking process in this sense.

In this context, ITC has focused on developing, adapting, and fine-tuning a series of the most demanded eco-features, currently deemed the most complete for ceramic coverings.

All tools have been developed in the frame of the ISO environmental labelling standards. The following briefly cites each of these initiatives:

- Collaboration with the Tile Council of North America (TCNA) to implement in Spain the first sustainability mark for ceramic tiles, glass tiles, and tile installation materials, GREEN SQUARED®.

- Development of the computer tools CoverLEED and CoverBREEAM by ITC, so that companies can automatically generate the requested environmental requirements for LEED® and BREEAM® sustainable construction projects.

- Development and fine-tuning of the DAPCER tool, developed at the request of the Spanish Ceramic Tile Manufacturers' Association (ASCER), which enables Life Cycle Assessment Studies and Environmental Product Declarations to be rapidly and economically obtained.

1. INTRODUCTION

1.1. SUSTAINABLE MARKETING CONTEXT

The environmental upgrading of construction products is a clear priority in European Union policies. This has materialised in the approval of legislation such as the **Construction Products Regulation No. 305/2011** which, in Article 56 and Annex I, introduces a series of changes in this sense, and the establishment of specific objectives and supporting measures to increase the level of **Public Green Procurement** in all Member States with a view to achieving intelligent, sustainable, and integrating growth, including in the construction and related sectors [1] and [2].

In addition, voluntary initiatives under the auspices of the European Commission include the EU Sustainable Development Strategy (EU SDS), the Product Environmental Footprint (PEF), and Environmental Labelling to foster consumption and sustainable production through the Sustainable Consumption and Production and Sustainable Industrial Policy (SCP/SIP) Action Plan, among others.

In parallel fashion, private **voluntary certification schemes** are pursuing their own campaigns to foster sustainable production and consumption, schemes whose green criteria do not always parallel those defined by the European Union. Finally, there are the **standardisation committees** of scientific and business panels for establishing sectoral sustainability criteria for certifications.

The trend is therefore clear: big private organisations, and especially public organisations, prioritise products that present environmental upgrades or that are transparent in regard to the environmental information they provide.

The above has led to the emergence of 439 eco-labels and certificates in 197 countries, corresponding to 25 industrial sectors. This has not only given rise to considerable confusion among manufacturers and consumers, but it also puts obstacles in the path of free trade.

Based on an analysis of the contents of the most widespread environmental labels and certificates, the communication tools presented in this paper may be deemed the most appropriate and versatile for ceramic coverings.

1.2. BACKGROUND

The Spanish Ceramic Tile Manufacturers' Association (hereafter ASCER) seeks to implement strategic plans with rapid, lasting actions, based on the quest for differentiation arguments, not only to foster growth, but also to survive in markets where there are competitive inequalities. Part of these competitiveness arguments must be based on R&D&I advances developed in the cradle of the sector, and they therefore need a high-visibility component, as it has been shown that R&D&I efforts focused on contributing to sustainable development are not directly cost-effective if they are not displayed.

In its approach to this strategy of disseminating and communicating the environmental performance of the ceramic tile sector and of its products, ASCER has promoted several targeted national studies, with the collaboration of panels of experts both in industrial processes and in environmental analysis techniques, such as the Instituto de Tecnología Cerámica, the UNESCO Chair in Life Cycle and Climate Change, and its spin-off Cyclus Vitae Solutions.

The most noteworthy results of this collaboration have been the writing of a Life Cycle Assessment (hereafter LCA) on a sectoral scale [7] and the writing of the Product Category Rules (hereafter PCR) for ceramic coverings in the frame of the DAPc programme [8] and the AENOR GlobalEPD programme [9], as well as the active participation in writing the PCR being developed on a European level, promoted by the European Ceramic Industry Association CERAME-UNIE, so that companies can obtain Environmental Product Declarations (hereafter EPD).

In this line, an important achievement of the above consortium has been the design and development of a computer tool called DAPCER for obtaining the LCA and EPD of ceramic coverings, with a considerable reduction in execution times and costs.

In addition, in view of the growing importance of building certification systems and their role as major drivers of the enhancement of the communication and environmental profile of construction materials, ITC has developed computer tools adaptable to the companies that manufacture construction materials for calculating, quantifying, and communicating environmental aspects in order to demonstrate a company's contribution in LEED® and BREEAM®-certified sustainable buildings. The tools are called **CoverLEED** and **CoverBREEAM by ITC**.

In this same line, ITC has collaborated with the Tile Council of North America (TCNA) to implement in Spain the first sustainability mark exclusively envisaged for ceramic tiles, glass tiles, and tile installation materials, **Green Squared**®. A multi-attribute label is involved that addresses environmental and social requirements, whose objective is to identify the ceramic materials that exhibit a more responsible profile and to make it easier for this type of product to access, simply, sustainable construction certification programmes and green procurement tenders in the USA.

2. OBJETIVES

- The work presented here had the following general objectives:
- To enhance the importance of technical and environmental communication both of the product and the process among the ceramic companies, as sales argument.
- To raise ceramic tile competitiveness with relation to other competing materials and markets.
- To promote improved environmental performance of ceramic tiles based on knowledge of the impacts.
- In addition, the proposed tasks entailed the attainment of the following specific objectives aimed at enabling different eco-features to be efficiently and economically obtained:
- To promote the obtainment of Environmental Product Declarations (EPD) by the ceramic tile manufacturing companies associated in ASCER.
- To expedite the preparation of the documentation required to demonstrate compliance with specific materials requirements included in sustainable construction certificates.
- To facilitate the implementation in Spain of the only sustainability mark for ceramic tiles available in the market.

3. METHODOLOGY

The steps followed in developing and adapting the three tools presented in this document may be summed up as follows:

- **Identification of key parameters**. These parameters were either directly provided by the companies or had a sectoral origin and/or came from commercial LCA databases.
- **Tool design and programming**. The tools DAPCER, CoverLEED, and CoverBREEAM by ITC consist of two types of computer media. One is a macro that operates when specific environmental data of the company and sectoral data are entered, while the second is a calculation engine that obtains the environmental information to be communicated.
- **Development of the documentation**. When the tools had been programmed, they generated valid documentation for the Environmental Product Declaration programmes and for the Sustainable Construction Certificates.
- **Verification of the generated information**. The conformity of the calculation engines and of the documentation with the reference standards was verified in each case, as was the traceability of the information provided by the company.

3.1. DAPCER

At the request of ASCER, ITC, together with the UNESCO Chair in Life Cycle and Climate Change and its spin-off Cyclus Vitae Solutions, has developed a computer tool that is able rapidly and economically to obtain Life Cycle Assessment studies and Environmental Product Declarations for ceramic tiles. This project was developed thanks to funding by IMPIVA through the II Sectoral Competitiveness Plans 2011 Action 4: Development of Markets (European Regional Development Fund, ERDF).

Writing of the Product Category Rules

The EPD are voluntary declarations based on LCA studies, which allow dissemination of quantified environmental information on the life cycle of a product. The Product Category Rules (PCR) are a set of guidelines that steer the development of the EPD and the corresponding LCA for a product category. In addition, the PCR enable the EPD made by different manufacturers to be compared with each other [7].

The development of these PCR was based on the sectoral study of LCA of ceramic tiles ([7] and [11]), and the international requirements set out in standards UNE-EN 15804:2012, UNE EN ISO 14025:2010, and ISO 21930:2010, as well as other existing PCR, were followed.

The PCR for ceramic coverings in this project were approved by the Spanish Association for Standardisation and Certification (AENOR) on 6 September 2013, after submission to public review for 1 month by the manufacturing companies and business associations, and they have a validity of 5 years.

The significant aspects generally subject to debate were as follows: (i) grouping of several products under a single EPD, (ii) definition of the Functional Unit, and (iii) life cycle stages and corresponding information modules to be included.

If a company wished to include several products in the same EPD of the AENOR GlobalEPD programme, in the **group and expression of results**, it was considered that the same classification criteria should be applied as in standard UNE EN 14411:2012 (ISO 13006): that is, type of forming and water absorption. The results should be expressed by means of a production-weighted average, this value being delimited by the environmental data on the products having the greatest and the smallest environmental impact.

With relation to the **life cycle stages and corresponding information modules**, standard UNE EN 15804:2012 on the basic Product Category Rules for construction products [10] establishes that the EPD can be either cradle-to-gate (modules A1–A3) or cradle-to-grave, it being possible optionally to include the remaining life cycle modules.

Module D, stating the benefits and loads beyond the system boundary, can also be included.

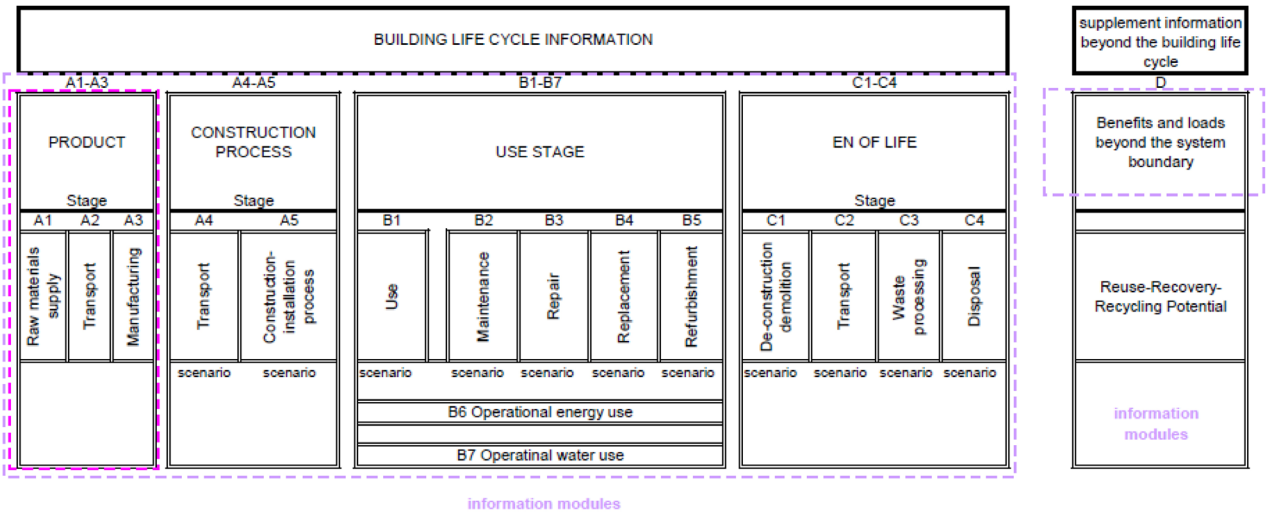

Figure 1. Types of EPD based on the life cycle stages for roofs, and life cycle stages and modules for building assessment [10].

In this case, the sectoral panel decided not to provide the possibility of developing the cradle-to-gate alternative with options to select the modules to be declared, thus avoiding inconsistencies between ASCER associates; the modules of use, repair, replacement, refurbishment, and deconstruction and demolition are not relevant from an environmental viewpoint.

In relation to the definition of the **Functional Unit**, this must be clearly defined and shall be measurable and appropriate for the product(s) at issue and for the product life cycle. In the case of ceramic tiles, this is an issue of debate because the versatility of ceramic tiles allows tiles, particularly those with lower water absorption, to be installed in floors or walls, indoors or outdoors, and in different types of building constructions, such as homes, hospitals, shops, etc.

The Functional Unit must refer to the entire life cycle, specifying the specific function of the product, the surface to be covered, and the service life span. Therefore, a valid example would be: "*1 m² covering of a (floor) surface inside a home for 50 years, considering a geographical and technological context of Spain in the year 2012*".

The sectoral panel, again avoiding inconsistencies among the manufacturers, decided that, when the EPD scope was cradle-to-grave, at least the following maintenance scenario should be declared:

- Tiles for wall covering: internal residential use. Washing frequency twice/year

- Tiles for floor covering: use in residential flooring with moderate pedestrian traffic. Washing frequency once/week.

The manufacturer shall establish one or more scenarios to assess cleaning products, disinfectants and/or water consumption as a function of the washing frequency throughout the tile service life.

Improvement of LCA model representativeness and adaptation to the PCR

On the other hand, the representativeness of the sectoral LCA model made in the LCA software, GaBi, was also improved in order to encompass all types of ceramic coverings and all technological scenarios present in the Spanish ceramic tile sector. In addition, the most significant aspects were identified, a sensitivity and scenarios analysis being performed to define the data that needed to be provided by the companies to obtain the EPD.

The most important changes were the updating and incorporation of certain flows and processes to improve the flexibility of the flow charts developed with the GaBi software and to enhance the model's exhaustiveness by the parameterisation of indicators that had previously been considered fixed.

In addition, it was also necessary to adapt this model to the requirements of the PCR for ceramic coverings in the AENOR GlobalEPD programme.

In regard to the analyses performed to define the significant parameters, the results highlighted the importance of tile mass and energy, as well as the presence or absence of optional processes such as polishing. Consequently, the precision of these parameters was critical to the precision of the results.

Design of the DAPCER tool

Once these tasks had been performed, the computer tool was designed and programmed. Entering the characteristic values of each product and company thus enabled a LCA report and an EPD draft to be simply and efficiently obtained.

The steps were as follows:

a. Preparation of a questionnaire for data collection from the manufacturers and a calculation matrix to be collated using individually drawn up mass and energy balances and to allocate loads.

b. Design of the calculation models in the LCA software as a function of the decision taken by the company regarding the "cradle-to-gate" or "cradle-to-grave" scope, which were then "locked" to assure consistency and compliance with the requirements of the reference standards.

c. Development of LCA and draft EPD types of reports according to the possible production alternatives for ceramic tiles made in Spain.

d. Programming of the tool with the LCA software.

Tool validation and EPD verification

Fourteen companies that manufacture different ceramic tiles, using different process technologies, participated in the tool validation and verification process as pilot trials; 12 of the companies decided to verify the EPD, these being the first in the AENOR GlobalEPD programme.

The pilot trials to validate the EPD tool were aimed at:

- testing the tool.
- obtaining reports on the LCA of the selected products and the EPD.

The verification was carried out by a team of verifiers appointed by the verifying organisation. The steps in the EPD verifications were as follows:

1. Sending the LCA and EPD studies of each company that had chosen to obtain the EPD to the certifying organisation.
2. Verification of conformity of the EPD and the LCA study with the general AENOR PCR and the PCR for ceramic coverings.
3. Verification of the conformity of the LCA study and model with standards UNE EN ISO 14052, UNE EN ISO 14040, and UNE EN ISO 14044.
4. Verification of the acquisition and treatment methodology of all data in the LCA study and the EPD: coverage, precision, integrity, representativeness, consistency, reproducibility, sources, and data uncertainty.

The part of the process corresponding to the verification of the LCA study and the model, as well as the inventory analysis, was conducted by technicians from ITC and Cyclus Vitae Solutions. Verification of primary data acquisition and traceability was performed at the tile manufacturing company facilities.

The verification results were documented in a report that, together with the LCA study and EPD draft, was submitted to a committee for approval and publication of the EPD [9].

3.2. CoverLEED and CoverBREEAM by ITC

CoverLEED and CoverBREEAM are tools that are simple to use, which can be adapted to the company and integrated into the company's management computer system, and that allow appropriate documentation to be generated at any time to respond to demands by clients or other parties interested in sustainable construction.

The purpose of the tools is to calculate and demonstrate compliance with credits/criteria demanded for materials in the LEED® (Leadership in Energy & Environmental Design) and BREEAM® certification systems for sustainable buildings.

Identification of criteria and calculation methodology

The criteria and calculation methodology needed to demonstrate the contribution of coverings to the following building certification systems were identified:

- LEED® v03, for the 9 certification schemes or Ranking Systems recognised by LEED® in the 2009 version.

- LEED® v04 for the 21 certification schemes included in the LEED version approved in the last quarter of 2013.

- UK BREEAM® for the 22 certification schemes that it recognises.

Note that LEED® and BREEAM® are both designed to certify buildings and not products.

The LEED® v4 version introduces new demands for materials and products. The changes are mainly in the Building Product Disclosure and Optimization criteria, which now include the previously individual credits for materials containing recycled and/or regional materials.

Some of the main changes are as follows:

- MR Credit 1 – Building Life-Impact reduction.

- MR Credit 2 - Building Product Disclosure and Optimization – environmental product declarations.

- MR Credit 3 – Building Product Disclosure and Optimization – sourcing of raw materials.

- MR Credit 4 – Building Product Disclosure and Optimization – material ingredients.

Most of these credits can be demonstrated from Life Cycle Assessment studies and Environmental Product Declarations.

Development of the tools CoverLEED and CoverBREEAM by ITC

Once the necessary company information had been compiled, either from the computer management system or manually, the appropriate calculations were made to demonstrate compliance with the criteria identified as applicable.

The results of these calculations were compiled in a dossier of data sheets, each of which corresponded to a criterion identified in the previous section, so that the company could use them in the way that best suited it.

The company could thus decide how to group its products, i.e. perform the calculations for each model or for each series or collection.

Each data sheet also indicated for which certification scheme (or ranking system) the described characteristic was valid and the weight that it had in each requirement in the final building score.

In addition, this tool was accompanied with a practical guide for companies that manufacture construction materials, aimed at explaining how the construction materials work in the certified building, how scoring is performed, and the basic guidelines on environmental communication, standards and regulations, and related legislation.

3.3. GREEN SQUARED®

Another initiative promoted by ITC is the implementation of GREEN SQUARED® in Spain.

This is the first sustainability mark exclusively for ceramic tiles and tile installation materials. The mark enables those products to be identified that have a smaller impact on the environment and on society and that can, therefore, be candidates for sustainable construction projects.

GREEN SQUARED® was developed by the Tile Council of North America (TCNA), in close collaboration with the North American ceramic tile industry, in response to the needs of these products and installation materials to highlight their environmental features compared with those of their immediate competitors (carpets, laminates, etc.) in the green procurement and sustainable construction scenario.

The scope of the mark includes ceramic tiles and glass tiles, as well as cementitious adhesive, grouts, resins, insulation sheets, panel installation materials, etc.

GREEN SQUARED® was developed on a technical level as a Type I eco-label (i.e. with a voluntary, certifiable character (ISO 14024)). Consequently, a specific standard was published compiling all the requirements and specifications that could be demanded of sustainable ceramic tiles. That standard was adopted in 2011 by the American National Standards Institute as an ANSI standard entitled: American National Standard Specifications For Sustainable Ceramic Tiles, Glass Tiles And Tile Installation Materials (ANSI A138.1-2011).

Based on standard ANSI A138.1-2011, manufacturers of products detailed in this standard must demonstrate compliance with the requirements laid down in the standard in order to use the GREEN SQUARED® mark and logos.

The system is administered by TCNA and, in addition, enjoys the collaboration of three of the world's top certifiers of product sustainability: NSF International, SCS Global Services, and UL Environment..

Content of the standard

The standard has a multi-attribute approach: that is, it is not solely focused on one environmental aspect, such as perhaps the use of recycled material or CO_2 emissions, but goes beyond this and seeks to cover all sustainability vectors affected by the fabrication of tiles and tile installation materials. The standard has thus been divided into five different categories (see Figure 2).

The requirements laid down in the standard may be divided into compulsory requirements and voluntary requirements. Depending on the type of product, the number of requirements to be met differs.

Figure 2 shows the breakdown of the sustainability criteria set out in ANSI A138.1 according to the categories into which the credits are divided.

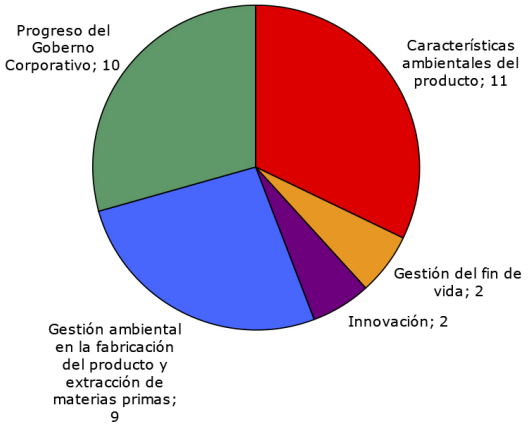

Figure 2. Breakdown of GREEN SQUARED sustainability criteria (ANSI A138.1).

Green Squared in Spain

The Instituto de Tecnología Cerámica has collaborated closely with TCNA to introduce the GREEN SQUARED® mark in Spain. The requirements of ANSI A138.1 have been adapted for this purpose to the European and Spanish context and normative frame.

4. CONCLUSIONS

The main conclusions drawn from the developed methodology and the obtained results are as follows:

- A tool has been developed that allows Environmental Product Declarations of ceramic coverings and Self-declared Environmental Claims for products to be simply and efficiently obtained, decreasing execution times and costs.

- The obtainment of these eco-features will help enhance the competitiveness of ceramic tile and position it with relation to other competing markets and materials that have eco-features, particularly in green procurement and sustainable construction scenarios.

- The methodologies developed in this study could be used in other product categories, this being simpler for sectors that are technologically mature and homogeneous.

- The tools provide valuable information for raising the environmental profile of ceramic tile, more precise information for comparing tiles with alternative products, and useful information for construction projects.

5. ACKNOWLEDGEMENTS

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