

Eco-labeling

The Use of LCA to Develop Eco-label Criteria for Hard Floor Coverings on Behalf of the European Flower

Gian Luca Baldo^{1*}, Sara Rollino¹, Gerhard Stimmeder² and Maurizio Fieschi³

¹ Life Cycle Engineering, Via Livorno, 60, I-10144 Torino, Italy

² Austrian Ministry of Environment, Unit V/8, Stubenbastei 5, A-1010 Wien, Austria

³ Macroscopio, Via Solferino 2, I-40026 Imola, Italy

* Corresponding author (baldo@studiolce.it; www.studiolce.it)

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Abstract. Thorough environmental observation and a series of life cycle consideration have been performed to underpin the development of the environmental criteria of a new EU Eco-label product group following the voluntary and selective European Environmental Award Scheme based on Regulation EC 1980/2000. Since April 2002, the European Eco-label is available for the Hard Floor Coverings product group, subsequently also called 'HFC'. The Eco-label translates environmental awareness on products for indoor and outdoor covering materials such as ceramic and clay tiles, concrete paving units, terrazzo, agglomerated and natural stones into a new market-based environmental policy tool. As a matter of fact, the HFC ecological criteria development has been positively concluded based on a the study of the Italian National Environment Protection Agency (ANPA, Agenzia Nazionale per la Protezione dell'Ambiente) with the technical support of Life Cycle Engineering (Turin, Italy), that had been entrusted with this task by the European Commission, DG Environment. The stakeholders involved in the 'Ad Hoc Working Group' activities included European Eco-label Competent Bodies, some of the most important manufacturers, consumers and environmental associations at a European level. In December 2001, after eighteen months of concerted work with all the interested parties in the European Union Eco-label Board (EUEB), the final vote of criteria by Member States enabled the publication of the EU-wide valid criteria and the elaboration of an application pack (user manual) in late March 2002.

Keywords: Building materials; EU eco-label; green procurement; hard floor coverings; integrated product policy

Introduction

The active participation in the growing search for eco-sustainable solutions in Europe and abroad is the expression of a stronger awareness of the society for environmental issues. In order to support market-based initiatives that should allow informed choices, the European Commission is developing integrated strategies within the new IPP (integrated product policy). Ecological labels (ISO Type I) are destined to become detectable tools for promoting environmentally correct practices¹.

¹ A Commission Decision (c2001 4395 of 21/12/2001) reports the plan of the next year's activities of the Commission on the Eco-label field.

The ISO 14020 series represents the active answer for producers and consumers sensitive to products and services both competitive on the market and for their environmental performance. The environmental labels and the environmental product declarations (ISO type III) are tools that allow one to detect, through the simple presence of a specific logo or by an LCA-based declaration, those products/services offering the best characteristics in terms of environmental sustainability².

Obviously, these features differ according to the labelling type briefly presented in Fig. 1.

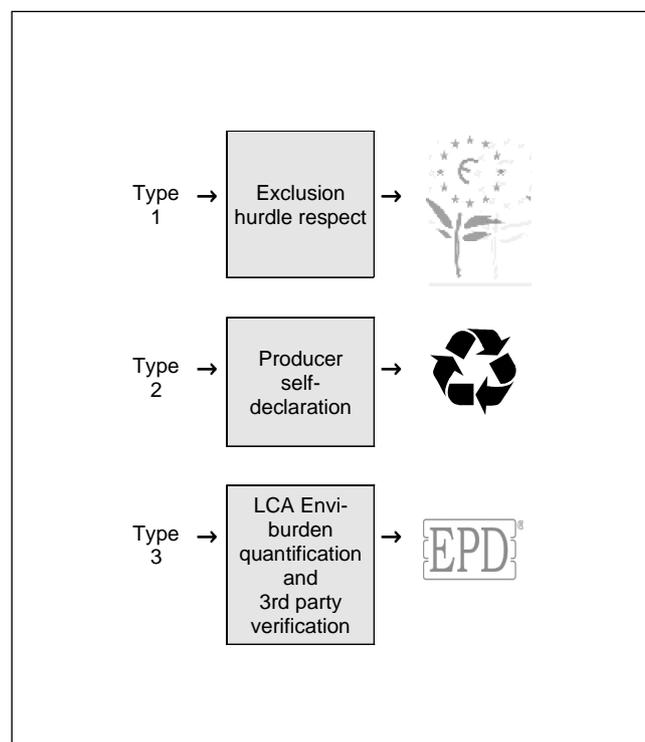


Fig. 1: The three environmental labels according to ISO 14020

² DG Environment is developing a study on Environmental Product Declarations with the support of ERM. The Interim Report is already available on an EU site.

Among type 1 labels, the European Eco-label (Regulation n. 1980/2000) is probably the most widespread label of all 15 EU and 3 EEA countries; other very well known European labels are the Blauer Engel (Germany) and the Nordic Swan (5 Nordic Countries), which are recognised at a national and interregional level.

This paper wishes to describe the work carried out and the results obtained by the 'European Union Eco-label Award Scheme for Hard Floor Coverings (HFC)' project, commissioned by the European Commission to ANPA (Agenzia Nazionale per la Protezione dell'Ambiente – Italian National Environment Protection Agency) and Life Cycle Engineering (Turin, Italy) in September 2000 and concluded in early 2002 with the publication of the criteria in the Official Journal of the EC (n. 2002/272/CE of 25/3/2002)³.

1 The Eco-label Regulation and LCA

The European Eco-label is a voluntary market tool that promotes the environmental excellence of products and services at European level/scale. To be awarded with the EU Eco-label, a product group must fulfil the following main preliminary conditions⁴:

- (a) It shall represent a significant volume of sales and trade in the internal market.
- (b) It shall involve, at one or more stages of the product's life, a significant environmental impact on a global or regional scale and/or of a general nature.
- (c) It shall present a significant potential for effecting environmental improvements through consumers choice as well as an incentive to manufacturers or service providers to seek a competitive advantage by offering products which qualify for the Eco-label.
- (d) A significant part of its sales volume shall be sold for final consumption or use.

It is therefore obvious that environmental impacts shall be identified on the basis of examination of the interactions of products/services with the environment, including the use of energy and natural resources, on a life-cycle perspective. Within the Eco-label Regulation, Life Cycle Assessment considerations play a key role to highlight 'hot spots' in the entire production chain of the considered products/services and help to identify the most appropriate set of ecological criteria available for answering to the above-mentioned, preliminary conditions.

1.1 The Eco-label establishment procedure

After an early attempt already made in 1994, the idea to assign an ecological quality award to the coverings sector started with a new feasibility study. Conclusions were carried out by ANPA during the beginning of 2000 in collaboration with CSERGE (East Anglia University, UK) (ANPA-CSERGE, 2000) highlighting how the floor coverings sector would meet the EC Regulation requirements. On the basis

of these conclusions, the EC decided to develop the ecological criteria for the product group named 'Hard Coverings Products' in September 2000. Very early in the beginning, the EUEB (European Union Eco-label Board) decided that HFC should include, if feasible, all the following materials used for indoor and outdoor spaces: ceramic tiles, natural stones, concrete paving units, terrazzo tiles, agglomerates, stones and clay tiles.

ANPA was designed to lead the EU activities and to choose the most appropriate technical support.

Usually, the open-up activities deal with the necessity to actively involve all potentially interested parties by knowledge diffusion in order to build a sound team of experts, the so-called 'Ad Hoc Working Group' (AHWG).

Therefore, the AHWG is created in order to develop a transparent and wide discussion with reference stakeholders, concerned manufacturers, consumers and environmental associations at a European level, and has the goal of supporting the criteria definition with technical advice to the whole of the EUEB. This is done by giving regular feed-back on work progress to the whole of the EUEB in 3 or 4 of their meetings.

A scheme of all activities from the EC's initial decision of conducting a new award scheme to the final publication of ecological criteria in the Official Journal is given in Fig. 2, from which the roles of all bodies may be summarised as follows:

- 1) the Commission co-ordinates the activities in strict cooperation with the leading Competent Body ('Lead CB'); within the EU, the EUEB works as a main reference and decision-making body⁵ together with the Commission that needs to adopt final criteria;
- 2) the Lead CB nominates technical support and begins with the diffusion of the project among all the interested parties;
- 3) the Commission and the Lead CB individuate an AHWG to contribute during technical activities⁶;
- 4) all CBs in Europe support the activities participating to the AHWG meetings, helping in the diffusion of the project among interested parties in their own countries and providing technical support for the development of the ecological criteria.

Starting from September 2000, the HFC project developed along the following guidelines:

1. Transparent and objective knowledge diffusion of the project to all possible interested parties with the consequent identification of a specific working group (AHWG) representing all interested stakeholders and allowing a sound technical discussion for criteria development.
2. Definitive selection of the product group representing the HFC sector and identification of those features where an environmental improvement is possible. To avoid any misunderstanding in product definition, CEN nomenclature is utilised if feasible. Update of the preliminary market analysis and Life Cycle Assessment of the selected product families.

³ www.europa.eu.int/comm/environment/ecolabel

⁴ EC Regulation 1980/2000

⁵ via its Regulatory Committee that votes on final criteria

⁶ Note that any EU AHWG is nevertheless open to anybody willing to participate

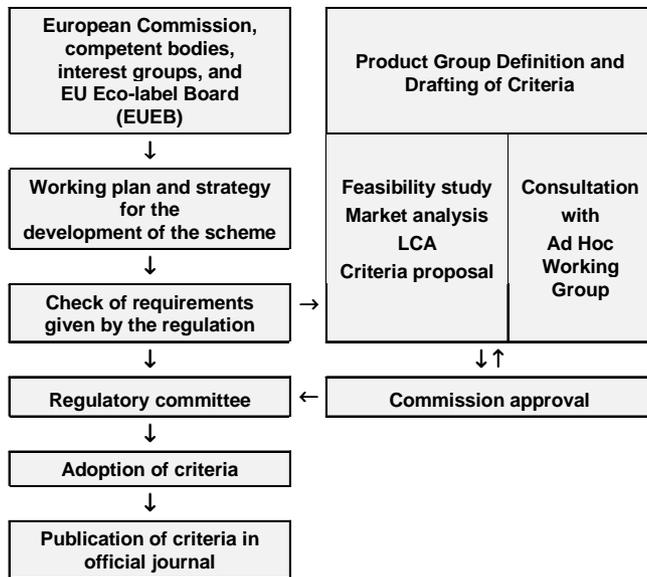


Fig. 2: Main phases of the Eco-label criteria setting

3. Continuous exchange of information among all AHWG members, mainly by mail but also via 3 official meetings to present the activity reports.
4. Progressive definition of a set of parameters able to determine the environmental excellence, among the considered production systems.

In practice, the definition of the AHWG could not be limited only to the first period as the knowledge diffusion process involved progressively new, interested parties. This had the benefit of stimulating discussion with suggestions and critics that were collected and registered during the whole project, and until the final discussion that took place at the beginning of December 2001 during an EUEB meeting.

Four Activity Reports have been published and discussed with the AHWG during three official meetings. Two sessions of the EUEB meetings were dedicated to the HFC criteria development with an open discussion among all the participants (documentation was handed out three weeks in advance of each EUEB meeting in order to allow experts to perform a critical review of the criteria draft proposals).

All the documents concerning the project including activity reports are fully available on the official Ecolabel website of the European Commission:

http://europa.eu.int/comm/environment/ecolabel/producers/pg_hardfloor.htm

As mentioned above, during the 4th December 2001 EUEB meeting held in Brussels, the final criteria were officially presented to all national Competent Bodies and to the representatives of industry, consumers and environmental associations. Consequently, a positive vote by the Regulatory Committee took place the next day. After almost eighteen months of technical research and process analysis, the working group had been able to outline a set of criteria that was positively voted by a majority of the Regulatory Committee in Brussels, on the 5th of December 2001. At an EU level, the HFC criteria were published in the Official Journal in March 2002.

2 The Eco-label Criteria for HFC

Generally speaking, covering products can be grouped into three large 'families': rigid coverings (represented by HFC), coverings derived from wood (parquet and others) and coverings of a resilient type (including linoleum, carpets and others).

Considering the peculiar characteristics of each product family, the project had been conceived to focus in a first phase only on the first family of Hard Floor Coverings and then, in a second or third run and subject to the decision by the EUEB, to complete the Eco-label set of criteria for coverings as a result of the analysis of the other two large families within a separate project.

Nevertheless, the HFC product group itself is already a highly complex family as it contains different products with very specific characteristics: indeed, these products have been classified together because of their equivalent function, but all six of them stem from production systems, making them absolutely incomparable. Therefore, the first challenge was to investigate, with the same degree of depth, six products belonging to different traditions and technological development, with structural differences within each production sector as well.

Taking the product group definition into account, technical characteristics have been privileged above all, suggesting to always keep the ornamental stones separated (**natural products** –CEN TC 246) from those products resulting from an industrial process (**processed products**). Within the second category, following the technical characteristics of the industrial process, two sub-families have been identified: the former composed of hardened products [concrete paving units (CEN TC 178), agglomerated stones (CEN TC 246/229) and terrazzo tiles (CEN TC 229)] and the latter composed of fired products [ceramic tiles (CEN TC 67) and clay tiles⁷], as shown in Table 1.

Table 1: Summarised outline of HFC group with CEN definitions

HARD FLOOR COVERINGS	Natural products	Natural stones (CEN TC 246)	Marble
			Granite
			Other
	Processed Products	A) Hardened products	Agglomerated stones (CEN TC 246/229)
			Concrete paving units (CEN TC 178)
			Terrazzo tiles (CEN TC 229)
		B) Fired products	Ceramic tiles (CEN TC 67)
			Clay tiles (CEN TC 78)

⁷ Clay tiles are units which satisfy certain shape and dimensional requirements, used for the surface course of pavements and manufactured predominantly from clay or other materials, with or without additions as defined by CEN. The specific weight of such tiles shall not exceed 40 kg/m².

2.1 Life cycle assessment

Process description by means of LCA was as complete as possible in order to detect environmental 'hot spots'. The environmental burden of a production process can be outlined from the 'cradle to the grave', but these building materials can only be monitored from the 'cradle to the gate' most of the time, which is the burden of the applied system. Nevertheless, hurdles and requirement involving the use phase and end of life could be included⁸. Here, some information is provided about how the LCA methodology was applied.

Approach. The systematic approach to the project, with an objective involvement of the interested parties and the continuous AHWG collaboration from the very beginning, produced a positive project development, avoiding any interruption in the delicate criteria selection process. The total transparency of the actions developed together with the constant encouragement of the interest parties to bring in any kind of contribution allowed to settle down very useful work relationships, particularly with consultants from other competent bodies and with specialised research centres involved. For instance, the parallel collaboration of the Bologna Ceramic Center (Italy) and of the Institute of Ceramic Technology in Castellon (Spain), two of the main qualified research centres for the ceramic tiles industry in Europe, is only one example of how it is possible to overcome market rivalries between two strong competitors –Spain and Italy together make up nearly the total European market for ceramic tiles –in order to build up credible and suitable environmental criteria.

Data. Data quality requirements are those defined by ISO 14040. Representative and reliable information were to be found with the same degree of depth for each of the six categories of products identified. Data were to be descriptive both for each entire industry sector and at a European level at the same time. Data banks and information gathered by means of questionnaires sent to selected and representative producers, allowed one to overcome the data availability problem, which is rather a typical issue to solve when it comes to LCA methodology. Nevertheless, this data collection caused some unpleasant delays in the time schedule, due to waiting for answers from producers or other institutions which have been contacted. In many cases, even if producers had been contacted all over Europe, the positive collaboration with Italian producers, most of them important producers of the worldwide HFC market, surely stimulated and encouraged the initial analogic model definition of the production system and the progressive implementation of the model with the incoming information.

The analysis of the production of some ancillary materials (glazing for ceramic tiles, additives for concrete paving units, etc.) was included, as well as data on such main raw materials as cement.

About transport, the delivery of raw materials has been considered as a simple average. So far, transport has not been

⁸ It has to be added that the development of an eco-label is an iterative process. Regular revisions of all product groups are foreseen and usually start 2–3 years after publication of criteria.

considered as a full criterion within the existing European Eco-label product group families⁹.

A sensitivity analysis was finally carried out after the inventory phase for each of the six families included in the HFC product group.

Functional Unit. The physical functional unit for the HFC product group is m², which is a common reference in the covering industry. For all families, classes of thickness were also defined to specify the reference flows of the systems under analysis.

System Under Study and System Boundaries. The initial system was considered from cradle-to-gate as the HFC production can be considered from raw material extraction to process and packaging. Once the product is sold out, its use phase and end of life can be modelled including some hurdles in the ecological criteria to avoid the dispersion of unwanted substances during cleaning and dismantling operations.

Impact Assessment. In order to highlight environmental 'hot-spots', a standard impact assessment stage was carried out up to the characterisation of main potential effects such as Photochemical Ozone Creation, Acidification and Global Warming.

3 Results

The LCA results allowed one to figure out an ecological picture of the HFC product group, upon which the environmental excellence has been developed by means of a criteria set. As outlined in Fig. 3, the environmental criteria have been organised into eight main chapters making up the criteria, and some use-

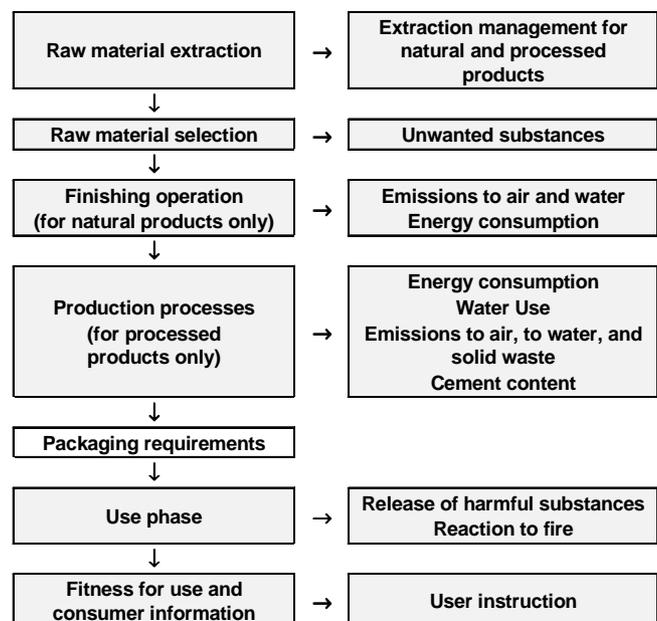


Fig. 3: Outline of criteria with 8 main chapters and an example next to them (beside)

⁹ It will certainly be highly difficult to include transport in future product and service groups. However, looking ahead and particularly at the labelling of services and considering the priorities of the 6th EAP, e.g. climate change and the emission contribution of transport, one may not completely rule out the possibilities for the future in a voluntary and selective scheme. In any case, it would be decisive to set up non-discriminatory solutions based on sufficient data, e.g. via one or more formulas and by exceptions for third countries willing to participate in the EU scheme.

ful examples are given to explain the items examined. These criteria are the genuine result of LCA analyses; different stakeholders' experience, IPPC working group documents on the best available techniques (BAT) and other studies.

Criteria are fully available on the Commission Ecolabel web site as well as in all European CB sites in national languages; hereafter, some numeric references about the imposed limits will be shortly sketched, dividing the discussion by the two main product groups.

3.1 Natural products

Important aspects of the natural stone production for coverings were obviously to be found in the extraction phase and –at a more limited extent –in the subsequent finishing phases. As mentioned above, the critical point which probably marked the analysis of this sector was the urge to implement, within the criteria definition, issues such as the impact to the territory, that since the Roman Age has made the extraction activity a critical point when it comes to environmental evaluation and control. This type of impact has a specific local significance, in terms of noise, visual effect, heavy vehicle traffic and so on.

Furthermore, the criteria to be set up had to keep up with the applicability to different situations in Europe and consequently to take into account that the specific geological structures play an important role in the definition of extraction practices. At the same time, extraction activities are often still characterised by semi-artisanal approaches, an authentic 'quarrying art' which is rather far from an industrial activity where contingencies can be controlled more easily.

Keeping an objective approach and proportionally subdividing the environmental aspects characterising the quarrying activity, a matrix system was finally chosen, with the classification into nine specific indicators resulting to be directly or indirectly significant in order to select the extraction activities worth an environmental award quality label.

These indicators are defined for: water recycle ratio, rehabilitation simultaneity degree, block recovery, natural resource appreciation, working conditions of operating equipment, air quality, water quality, noise, visual impact.

The visual impact hurdle introduction certainly represents a new approach, which had to meet some criticism before being accepted. Referring to the criteria themselves and for a more detailed understanding of this element building steps¹⁰, the adoption of a visual impact hurdle was necessary in order to cope with the following issue: many AHWG members considered absolutely vital to avoid awarding the Eco-label to products whose raw materials could originate in a quarry where, even if all environmental precautions for land protection are adopted, the visual impact on the local context is particularly heavy and incompatible with the idea of a voluntary label for pioneer companies.

¹⁰OJEC n.94/13 of 11/04/2002, Technical Appendix, Figure A.1 explains this geometrical operation aimed at evaluating the outcoming visual dimensions created by the quarrying activity from the point of view of an observer positioned in specific places, such as roads or neighbouring villages.

The indicators are furthermore constrained by a list of weights to be used when specified: e.g. in the case of a quarry area located in sites managed for nature restrictions or protection¹¹, soil protection based upon utility classes, proximity to inhabited centres and interference with water streams and so on a minimum score, equal to 2.5, is required to move towards the evaluation phase of the finishing operations, for which eight parameters have been considered, in order to control the emissions into air and water, as well as the consumption of a precious resource such as water.

The **user manual or application pack**, beside all the reference standards for the required laboratory tests, contains 'check lists' conceived to assist the producer willing to obtain the Eco-label. A preliminary investigation has shown that filling in indicators and weights, together with the required documents (such as area maps, recovery plan, laboratory test results), usually only needs a reasonably short time as the majority of the requested parameters are all normally monitored already by the extraction companies.

Among the entire HFC product group, the case of natural stones is probably the one that was much harder to handle. The greatest difficulties came from the fact that it was not easy to transform the quarry environmentally good practice rules into strict ecological (i.e. numerical) criteria, as in many cases this attempt conflicted with basic environmental issues (land impact, visual impact, etc.) for which the applied LCA approach does not provide a clear answer. On the contrary, in the case of the 'processed products' where the industrial system is well defined, LCA methodology was able to solve similar issues in a clear manner.

3.2 Processed products

Raw materials used in processed HFC products come from quarrying activities too, but seen from a life-cycle perspective their impact is much smaller if compared to their whole industrial process. This is the reason why the requests for the extraction activity, in the case of processed HFC products, are limited to the extraction activity project, to the environmental recovery of the interested area and to the visual impact to be kept below a defined level.

Concerning downstream processes, the following indicators have been taken into account: energy consumption (regarding the entire process or the firing phase only), water consumption, air and water emissions, and solid waste production.

To give a hint of the analysis degree, in the case of ceramic tiles, for instance, the energy consumption hurdle imposed on firing phase takes into account two different classes of mass per surface unit (<19 kg/m² e >19kg/m²), as well as a possible subsequent firing step, the so-called 'third fire', during which decorations are laid on the tiles.

¹¹For instance, if the quarry area is located into a site notified by the Community Directive 92/43/EEC of 21/1/1992 and subsequent amendments, or by the Natura 2000 network areas pursuant to 79/409/EEC of 2/4/1979 and subsequent amendments, or equivalent areas located outside the European Community, then the indicators concerning the rehabilitation simultaneity degree, air quality, water quality, noise, visual impact are considered with a weight penalty of 0.3.

With regard to the case of products containing cement, specific requirements on energy consumption and air emissions are to be respected¹².

Concerning criteria development for processed products, downstream from the extraction, the air emission hurdle reference unit had to be converted from mg/Nm³ to mg/m², which meant that, from a practical point of view, the air monitoring had to move from the chimney sampling to the air emission control based upon emission factor calculation.

In fact, air emission factors do vary according to the type of plant and according to the way the plant runs, but the necessity to refer to one single unit was imposed by a chosen functional unit (m²).

Within the processed HFC products, the case of clay tiles is worth a short examination for the aspects concerning the value of energy consumption required for the firing phase. Clay tiles represent a rather large family of products, whose thickness by surface unit may vary from 30 mm (35 kg/m²) to more than 100 mm, with subsequent expansion of the energy consumption ranges during the firing phase. In Northern Europe, the so-called earthenware tiles are normally used for road paving, but these thick products have nothing to deal with the clay tiles included in the Eco-label HFC product group. Therefore, for instance, a limit to energy requirement for firing of 60 MJ/m², referred to products with a mass per surface unit not above 40 kg/m², has been introduced within the EU Eco-label criteria in order to take into consideration only the characteristic and typical family of clay tiles.

¹²Also cement production shall comply with some specific hurdles that have been set up based on the results of the BAT documents for IPPC.

A complete summary of the criteria is shown in **Table 2**, where it is possible to assess the important efforts made in order to balance the requirements of environmental excellence among the various 'families' of products.

4 Discussion

From a merely scientific point of view, the application of the LCA methodology together with environmental considerations about local issues entirely fulfilled the requirements of Regulation 1980/2000, giving evidence to specific environmental features upon which criteria excellence was built.

This is the reason why it is possible to conclude that the entire process of Eco-label criteria development according to the new award scheme is able to provide an objective approach, allowing one to classify the European ecological award scheme among the most adequate integrated tools in the search of eco-efficiency and integrated product policy.

5 Conclusion and Outlook

The development of ecological criteria for this new group of products has taken approximately two years of work, during which the major part has been dedicated to the technical activities of elaborating the 'hurdles' and organising the agreements with the stakeholders. The activities of the group of expert AHWG proved to be essential in order to obtain the contributions from the European stakeholders, whose agreement was fundamental to determine the final positive vote. The strong attention given to all explanation and investigation requests, plus the careful discussion with all the Competent Bodies of the individual countries, allowed one to keep up with the timetable of criteria elaboration.

Table 2: Hard floor coverings criteria summary

	Natural products			Processed products				
	Marble	Granite	Other	Hardened products			Fired products	
				Agg. stones	Concrete paving units	Terrazzo tiles	Ceramic tiles	Clay pavers
1 Raw material extraction								
1.1 Extraction management (for natural products)	X	X	X					
1.2 Extraction management (for processed products)				X	X	X	X	X
2 Raw material selection	X	X	X	X	X	X	X	X
3 Finishing (for natural products)	X	X	X					
4 Finishing (for processed products)								
4.1 Energy consumption				X		X	X	X
4.2 Water use				X	X	X	X	X
4.3 Emission to air				X		X	X	X
4.4 Emission to water				X	X	X	X	X
4.5 Waste management				X	X	X	X	X
4.6 Cement				X	X	X	not present	not present
5 Packaging requirements	X	X	X	X	X	X	X	X
6 Use phase								
6.1 Release of dangerous substances	X	X	X	X	X	X	X	X

After the publication of criteria and following the strong interest shown by Italian HFC producers during the criteria development, the European Commission has encouraged a diffusion project of the Eco-label within the companies of the sector in Italy.

As a matter of fact, a new project is now aiming to promote the Eco-label system for HFC (preparatory action and development of a marketing strategy for the European Eco-label on hard floor coverings in Italy, financed by the European Commission for 2002) in Italy. It includes the involvement of producer associations and the direct collaboration with the associated companies in order to enhance pioneer applications for the EU Flower.

The documents concerning the new project for the diffusion of the Eco-label in Italy can also be found at the following web site: www.life-cycle-engineering.it.

This project aims to promote a marketing strategy for the European award scheme on HFC in Italy by means of seminars, participation to events and Eco-label promotion by posters and so on, during which the Eco-label criteria will be presented to producers in order to enhance the adhesion of the Italian productive sectors and to promote the commitment of HFC producers to the European Eco-label¹³.

¹³It should be noted that Italy is one of the leading EU Member States with 20 Flower companies and more than one hundred Ecolabel products in July 2002. For the latest information, please either consult the ANPA website <http://www.sinanet.anpa.it/ecolprod/> or look at the European Flower website at <http://europa.eu.int/ecolabel> which is already counting more than 75,000 hits per month.

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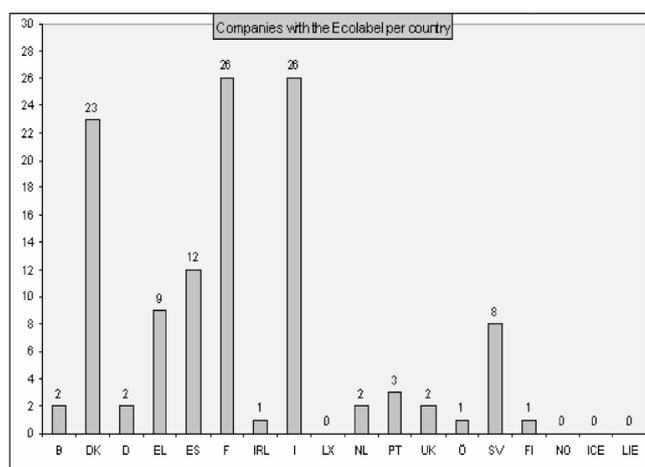
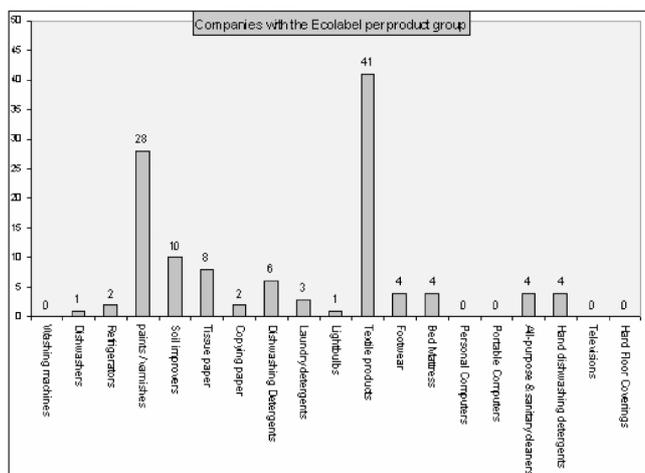
About the Authors

Gian Luca Baldo and **Sara Rollino**, respectively responsible for and junior consultant at Life Cycle Engineering, were in charge to assist the Italian Environment Protection Agency (ANPA) during the project.

Gerhard Stimmeder, now in the Austrian Ministry of Environment, was the responsible desk officer on behalf of the European Commission during the project.

Maurizio Fieschi, now responsible at Macroscopio (Italy), was the responsible head of a unit with ANPA taking the lead on this product group at that time.

The European Eco-label: A brief perspective and a project for the diffusion of HFC criteria in Italy. The European Eco-label is the voluntary ecological quality label stated by the European Union whose aim is to promote products and services with reduced environmental impacts during their whole life-cycle. This label offers detailed, objective and scientifically based information on the key environmental impacts to European and any other private or professional consumer or purchaser. The following pictures show the up-to-date situation of companies with the flower per product group and country (www.europa.eu.int/comm/environment/ecolabel).



Hard Floor Coverings (HFC) is the latest group for which criteria are available. At present, in Italy a project for HFC Eco-label diffusion is going on ('Preparatory action and development of a marketing strategy for the European Eco-label on hard floor coverings in Italy') in order to widely spread out the HFC Eco-label criteria awareness in Italy. More information available on www.studiolce.it