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Background report to the guide for the use of the EU Ecolabel

In the green public procurement of hard covering products (of natural stone, agglomerated stone, ceramic or precast concrete)

Donatello, S., Pérez-Camacho, M.N., Wolf, O.

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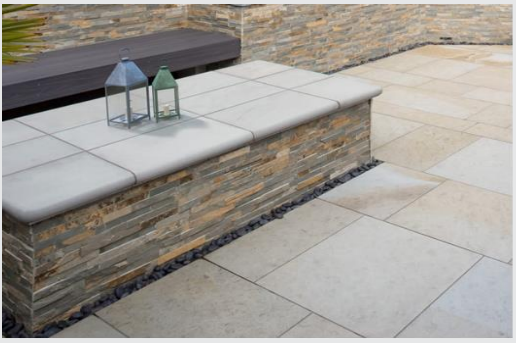

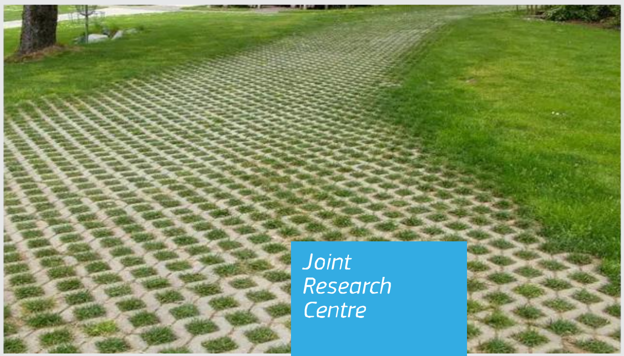

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Abstract

Green public procurement (GPP) is a powerful tool to achieve environmental objectives by means of the incorporation of green requirements into public sector purchasing contracts. Public authorities, by promoting "green" purchases, incentivise environmentally beneficial outcomes and foster market innovation as well as the transformation towards a sustainable economy model.

In order to "green" the market, it is essential for producers to be able to make certifiable and credible green claims about their products and for customers to know what to ask for. While the EU Ecolabel policy can provide environmental references or standards in relation to green claims on products, the EU GPP policy can help customers to know what to ask for.

The EU GPP recommendations placed in this document are based on the EU Ecolabel criteria and intend to provide authorities with guidance on how to use ecolabels, and in particular the EU Ecolabel, in the procurement process. This report aims to bring these two policies together in order to find synergies between the supply-side EU Ecolabel policy and the demand-side EU GPP policy – specifically for the procurement of hard covering products made of natural stone, agglomerated stone, ceramics/fired clay or precast concrete.

In addition to a brief introduction to the EU Ecolabel policy, to the EU GPP policy and to procurement procedures as a whole, research is presented to support JRC recommendations to public procurers about exactly what green criteria to set when trying to procure environmentally friendly hard covering products.

The recommended environmental criteria are split into three themes that focus on: (i) energy consumption and CO_2 emissions (different approaches for sub-products made with and without combustion processes); (ii) emissions to air (dust and, where relevant, SOx, NOx and HF), and (iii) process waste reuse at the production site (different benchmarks for different sub-products).

Where relevant, further information about the why the EU Ecolabel criteria are relevant and what other ISO 14024 type I ecolabels may be considered as equivalent is provided. This builds up upon the work that concluded with the adoption of the EU Ecolabel criteria, project that was also led by the JRC and finalised in 2021.

Acknowledgements

The authors wish to thank corresponding policy officers from DG Environment for their support and feedback during the production of this report. Likewise, the authors wish to thank members of the EU Ecolabelling Board, the GPP Advisory Group and the JRC Editorial Board for their input and comments.

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Executive summary

In line with Article 7(1) point (f) of the EU Ecolabel Regulation (EC) No 66/2010, the aim of this report is to present and justify the selection of certain EU Ecolabel criteria that are considered most relevant and suitable for use by public authorities as green public procurement (GPP) criteria in calls for competition to procure hard covering products with a good environmental performance.

Consequently, this report is primarily targeted at public authorities seeking to procure such products, but is also of interest to suppliers and manufacturers of these same products, since it provides a clear indication of relevant green "demand signals" recommended by the Commission. This report also incentivises peer-to-peer sharing of procurement initiatives by providing practical guidance that can be used as reference on how to formulate and verify green claims under the procurement contracts.

Altogether, the document provides 1) a general guidance on the key environmental considerations that should be incorporated into public purchase (when defining life cycle-based environmental criteria), and 2) ready-to-use EU GPP criteria (and corresponding means of verification).

The report consists of a general introduction to EU GPP and EU Ecolabel policies and how they can and should work together to "green" the market. A brief summary of relevant background research conducted by the JRC is provided, with a focus on the following points:

- The scope and definition of products that criteria apply to, including reference to Common Procurement Vocabulary codes that should be used in calls for competition.
- Market considerations, including real examples of how the procurers purchase these products.
- The main environmental hotspots associated with hard covering products.

The procurement of hard covering products was often (52% of the time on Tenders Electronic Daily) being carried out via much larger works contracts that also involved other materials and labour costs. Most of the remaining contracts were supplies (46%) but often showed hard covering products being just one of many other construction materials being requested in centralised procurement exercises. Only relatively few examples of contracts were focused heavily on hard covering products, and these tended to focus on the procurement of supplies for paving works.

The main environmental hotspots were found to be associated with the upstream processes of making cement or lime for use in precast concrete or the core process firing of ceramic or fired clay products in a kiln. Data could not be found for the upstream production of the resins used in agglomerated stone products. With natural stone production, energy consumption was important and a large improvement potential appears to exist for dust control and reuse of process wastes.

Policy context

The report is primary focused on the development of EU GPP criteria (for hard covering products) as part of the Commission´s vision of public procurement for a better environment (COM(2008) 400). A strong link is established between the recommended EU GPP criteria and already adopted EU Ecolabel criteria for hard covering products under Decision (EU) 2021/476 (established within the framework of Regulation (EC) No 66/2010).

Key conclusions

The following EU Ecolabel criteria are recommended to be used by procurers in calls for competition (always being nuanced to one extent or another for the different hard covering product sub-categories):

- Energy consumption and CO_2 emissions.
- Emissions to air.
- Process waste reuse.

After each suggested criterion (see section 3.4), further information is provided to better inform procurers about why the criterion is relevant, if there are equivalent labels and how they diverge, in case of non-equivalency.

Any hard covering products carrying the EU Ecolabel can be automatically assumed to comply with all of the EU GPP criteria recommended in this report. Other ISO 14024 type I ecolabels may also demonstrate proof of compliance with some or all of the recommended EU GPP criteria, but these need to be carefully checked.

- Annex 1 provides brief justifications of why these EU Ecolabel criteria were considered as relevant and suitable for EU GPP criteria (based on relevance to subject matter, ease of verifiability and environmental relevance) .
- Annex 2 lays out, for each selected criteria area, an equivalency check between the EU Ecolabel and relevant ISO 14024 type I ecolabels.

This background report is complementary to a more concise (12 pages) Science for Policy Brief for the same subject. Readers of the Brief (Practical Guidelines) who wish to find more information are directed to this background report.

1 Introduction

Every year, over 250 000 public authorities in the EU spend around 14% of EU Gross Domestic Product (GDP) on the purchase of services, works and supplies[1], accounting for roughly EUR 1.8 trillion annually (EC, 2016). Across the Organisation for Economic Co-operation and Development (OECD) countries, public procurement purchasing power makes up an average of 12% GDP, and up to 30% in many developing countries, worldwide[2].

Green Public Procurement (GPP) is defined in the European Commission's Communication "Public procurement for a better environment" (COM(2008) 400) as "a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured." Training toolkits[3] for public authorities are available to help understand the strategic thinking, legal aspects and needs assessment associated with procurement as well as how to engage with the market.

The new EU circular economy action plan (CEAP) recognizes public procurement as a driving force, capable of incentivising the demand for sustainable products and of steering the market transition towards circular economy principles. The CEAP also stresses the need to improve the coherence between public procurement and any other complementary regulatory or voluntary approaches of new and existing instruments that regulate products along various phases of their life cycle. In practice, the incorporation of GPP into public purchases can address (or mitigate) environmental concerns, for example, through natural resource preservation, energy efficiency or reductions in greenhouse gas emissions.

GPP is one of the pillars of Sustainable Product Procurement (SPP)[4]. Worldwide, governments (especially those in OECD-countries) initially implemented sustainable procurement by focusing on reducing the environmental impacts of purchasing, but now they are progressively leveraging their procurement in support of social equity and economic development (UNEP, 2022). Indeed, the public sector can use procurement to boost jobs, growth and investment, and to create an economy that is more innovative, more energy efficient[5] and more circular (ICLEI, 2017). Additionally, life cycle thinking may also provide financial savings for public authorities, especially if you consider the full life-cycle costs (LCC) of a contract and not just the purchase price[6].

The aim of the EU Ecolabel, as defined in Regulation (EC) No 66/2010 (EC, 2010), is to promote products (goods and services) with a reduced environmental impact during their entire life cycle via a voluntary ISO 14024 type I ecolabel award scheme. The development of a Manual for authorities awarding public contracts is foreseen in Article 7(1) point (f) of the EU Ecolabel Regulation (EC) No 66/2010 (EC, 2010)

For any given product group or service, EU Ecolabel criteria on the supply side can work in combination with EU GPP criteria on the demand side to drive the market towards better products in terms of environmental performance. As shown in Figure 1 below, the EU Ecolabel enables suppliers to market their products with a simple label that can be used as an accurate, non-deceptive and science-based proof of the excellent environmental performance of their product. The setting of EU Ecolabel criteria aims to target the top 10 to 20% of products on the market within a defined product group (good or service). Public authorities can then directly specify some or all EU Ecolabel criteria in calls for competition, depending on how ambitious they want to be. The combined effect of both supply push with EU Ecolabel and demand pull from EU GPP, is to shift the market distribution towards greener products. With time, a significant enough shift may render the existing EU Ecolabel criteria as unambitious and it would become necessary to revise the criteria, thus beginning the next cycle.

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1 See: https://ec.europa.eu/info/policies/public-procurement_en

2 See: https://www.unep.org/explore-topics/resource-efficiency/what-we-do/sustainable-public-procurement

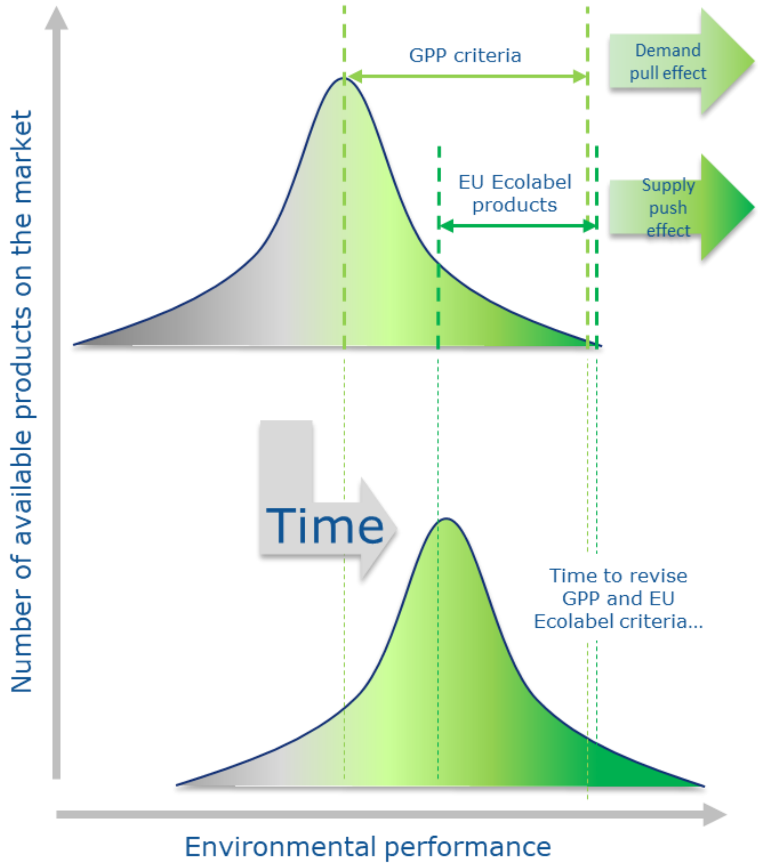
3 See the GPP Training toolkits here: https://ec.europa.eu/environment/gpp/toolkit_en.htm

4 Sustainable principle is based on environmental, social and economic considerations. Sustainable procurement strategy considers the life cycle value of the project, social impact and the economic benefits., for more information about sustainable public procurement, please see: SPP (UNEP)

5 For example, Annex III to the Energy Efficiency Directive obliges central governments to play an exemplary role in the purchase of products, services or buildings with the highest energy efficiency class possible (without compromising cost-effectiveness, economic feasibility, technical suitability or the availability of competition)..

6 See: https://www.oecd.org/gov/public-procurement/green/

Figure 1. Intended effect of voluntary EU GPP and EU Ecolabel criteria on overall environmental performance of defined product groups and services on greening of the market



Source: JRC own elaboration.

This report promotes synergies between EU Ecolabel and EU GPP policies for given product groups and services by recommending selected EU Ecolabel criteria for public authorities to specify in calls for competition. This document provides: 1) a general guidance on the key environmental considerations that should be incorporated into public purchasing specifications (when defining life cycle-based environmental criteria), and 2) ready-to-use EU GPP criteria (and their verification). At the same time, this EU GPP report informs relevant producers and suppliers of key environmental criteria that could make their products and services more suitable for upcoming tendering processes that will look to incorporate green criteria.

Following the adoption of EU Ecolabel criteria for hard covering product(s) in Commission Decision 2021/476 (EC, 2021), producers can now develop and market such products with the supply side signal of the EU Ecolabel. From the full set of EU Ecolabel criteria for hard covering products, this report identifies those that are considered most suitable to be included in a public procurement process.

The selection is made considering three main principles:

1. Compliance with the existing public procurement rules, in particular regarding the link to the subject-matter of the contract being awarded;
2. Verifiability of the criteria by public authorities, beyond the reliance on products having been awarded the EU Ecolabel;
3. Highest environmental relevance as per life-cycle impacts and circular economy objectives (EC, 2020).

The recommendations proposed within the report consider the most dominant environmental impacts of the product group as per the life-cycle assessment stages. Where relevant, findings from background research (Donatello et al., 2018) undertaken when revising the EU Ecolabel criteria for hard covering products, or the final technical report (Donatello et al., 2021), which presents the current EU Ecolabel criteria, have been referred to for the proposed recommendations.

1.1 The procurement process and types of procedure

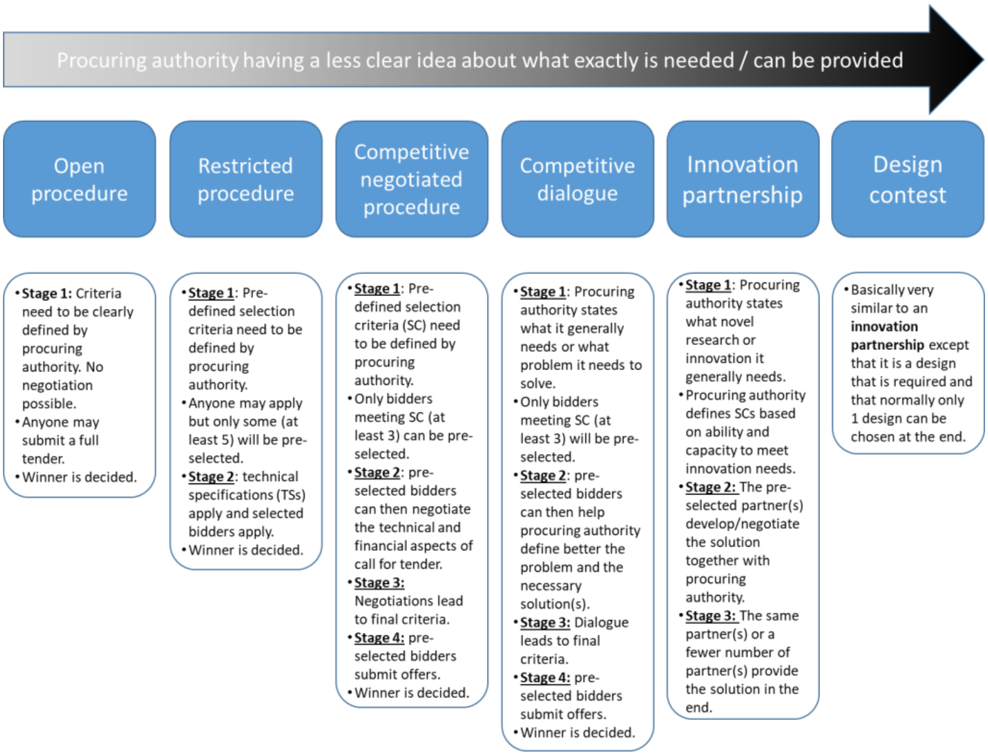
In general, procurement processes follow the sequence of:

1. Needs identification;
2. Choice of procurement method;
3. Allocation of financial resources/budget;
4. Preparation of procurement documentation;
5. Market engagement (optional)
6. Publication of documents for call for competition;
7. Receipt of and opening of offers;
8. Evaluation and verification of offers;
9. Announcement of winning offer;
10. Award and signing of contract.

The contents of this report are especially aimed at steps 4 to 8, to help inform procurers about what "green" requirements to set and how to evaluate compliance with these mandatory or optional "green" requirements.

There are a number of different procurement procedures that can be applied depending on the nature of the goods, works or services being procured and also different types of contracting techniques depending on the needs of the procuring authority. The main types of process are summarised below.

Figure 2. Broad overview of different procurement procedures that are used in the EU



Source: JRC own elaboration.

While all of the processes above have their advantages and disadvantages, unless there is a very good reason for not doing so, public tendering procedures should aim to be as open as possible and to use processes that generate more competition.

The introduction of environmental requirements to the procurement of hard covering products merits some degree of effort from the procuring authority to "prepare the market".

Engaging with the market or trying to prepare the market would essentially be a "stage 0" for the open and restricted procedures, but is already incorporated in the other types of procurement process that include negotiation stages.

The benefits of market preparation cannot be overestimated and the sequential logic of these benefits is as follows:

1. Better prepared economic operators are more likely to become bidders.
2. More bidders means more competition.
3. More competition means more environmentally friendly products.
4. More environmentally friendly products means a greener market.

<u>Engaging with the market:</u>

- Consulting with internal or external experts with a good knowledge of the market for the products to be procured and the current state of the art with green criteria in these products.
- Establishing dialogue with potential bidders and possibly holding information sessions to discuss the feasibility of applying certain green criteria in calls for tender.
- Publishing a Prior Information Notice (PIN) about the environmental criteria you intend to apply in order to give potential bidders sufficient time to prepare (this preparation may also include producers applying for the EU Ecolabel)

1.2 Types of procurement criteria

There are a number of different types of criteria that can be applied in public procurement processes, each of which can incorporate some environmental aspects. These criteria differ in terms of when they apply in the evaluation process, in terms of being mandatory or voluntary in nature and in terms of who or what they apply to. The relative importance of each type of criteria will ultimately depend on how the call for competition is worded and structured by contracting authorities. An illustration of how these criteria potentially come together in a procurement process is provided in Figure 3.

<u>Exclusion criteria (ECs):</u> These are mandatory criteria set in European and national procurement law that apply to the economic operators who are bidding (the bidders). Additional mandatory exclusion criteria may also be defined. Such criteria will relate to non-compliance with applicable laws, grave professional misconduct that could render the integrity of the economic operator as questionable, or significant/persistent deficiencies in performance of substantive requirements under prior contracts that led to termination or comparable sanctions. Any bids from bidders failing the ECs are not evaluated.

<u>Selection criteria (SCs):</u> These are optional criteria in terms of whether they are used or not, but when used, they take on a mandatory character. It is common that SCs are used to set requirements relating to the experience, capacity and professional ability of the bidders. Depending on the exact procurement process and the subject matter of the procurement exercise, SCs will be more or less important to the outcome. In all cases, SCs must be proportionate, linked to the subject matter of the contract and not end up unnecessarily restricting competition (for example by presenting a barrier to SMEs).

<u>Technical specifications (TSs):</u> This is the mandatory core of public procurement criteria and defines the minimum requirements that all offers must meet. All TSs therefore relate directly to the subject matter of the contract. Care must be taken when setting TSs to be sure that there are sufficient products or services on the market that can meet these requirements. If not, then there is a risk that no offers will be received or that only very few offers can be received, which results in less competition.

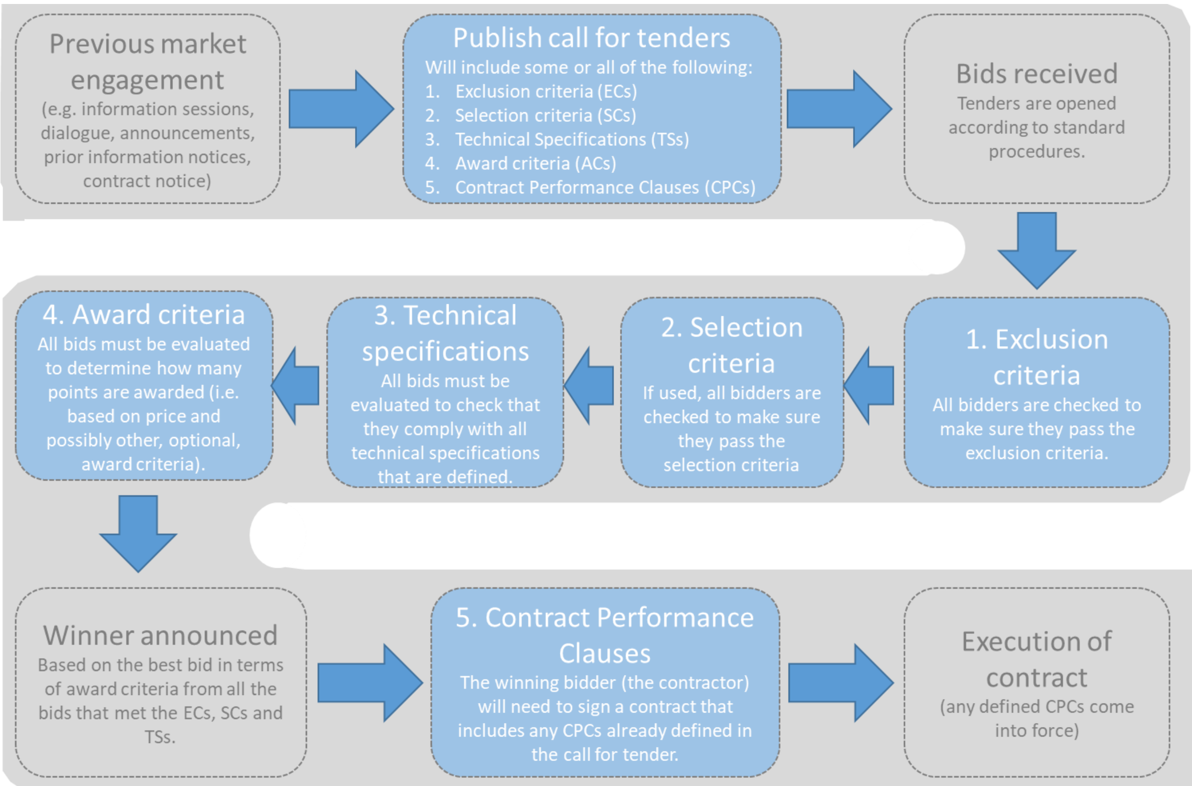
<u>Award criteria (ACs):</u> These criteria are always present in one form or another. The most basic AC is that the winning bid will be the one with the lowest cost (i.e. 100 % weighting on price). But ACs also provide the opportunity to insert a number of additional optional requirements that are related to quality and that can be independent of TSs or complimentary to them. Like TSs, they also apply directly to the subject matter of the contract, and thus to offers received. It is a good idea to use optional ACs when contracting authorities wish to "test the market" when they are unsure about the ability of economic operators to meet more ambitious criteria. The combination of less ambitious TSs with more ambitious ACs allows calls for competition to be published that reward the best products on the market without unnecessarily restricting the potential number of bidders. Awarding extra points for quality or environmental

performance in ACs is a way for contracting authorities to make better quality or more environmentally friendly products more competitive with cheaper and less environmentally friendly alternatives. The precise % weighting given to ACs is for contracting authorities to decide on a case-by-case basis.

Contract Performance Conditions (CPCs): Mandatory rules for how a contract must be carried out. Although CPCs should be defined in the call for competition, this is in order to inform bidders of what conditions would apply to the winning bidder (i.e. the contractor). They shall not have any influence on the awarding of the contract and no means of proof can be requested during the tendering phase. However, failure to comply with them is linked to clear penalties and other consequences, such as the cancellation of the contract.

For green criteria to become better known, it is for procurers to specify them in calls for tender and explain more about them to potential bidders via market engagement exercises prior to calls for tender being published. For more information on market engagement, please see module 6 of the EU GPP training toolkit[7].

Figure 3. Illustration of how the main different types of procurement criteria can apply



Source: JRC own elaboration.

1.3 Use of EU Ecolabel criteria in public procurement

The EU public procurement Directives 2014/24/EU and 2014/25/EU (EC, 2014a and EC, 2014b) define the possibilities of using labels (e.g. ecolabels) in public procurement. Labels can be used at different stages of the procurement process. At the verification stage, ecolabels provide a means of third party verification, which can considerably help procurers to save time and effort while ensuring that high environmental standards are applied in public procurement.

[7] See the GPP Training toolkits here: https://ec.europa.eu/environment/gpp/toolkit_en.htm

In general, labels can be required as means of proof in public procurement, provided that all of the following conditions are fulfilled (taken from Article 43 of Directive 2014/24/EU and Article 61 of Directive 2014/25/EU with some additional text added in square brackets [] for clarity):

a) the label requirements [set in GPP criteria] only concern [proof of compliance with] criteria which are linked to the subject matter of the contract and are appropriate to define characteristics of the supplies or services that are the subject matter of the contract;

b) the label requirements are based on objectively verifiable and non-discriminatory criteria;

c) the labels are established in an open and transparent procedure in which all relevant stakeholders, including government bodies, consumers, social partners, manufacturers, distributors and non-governmental organisations, may participate;

d) the labels are accessible to all interested parties [i.e. manufacturers or service providers can apply for the label and contracting authorities can access the underlying label criteria];

e) the label requirements are set by a third party over which the economic operator applying for the label cannot exercise a decisive influence.

Contracting authorities setting requirements that can be met by works, supplies or services bearing a specifically cited label (e.g. the EU Ecolabel) shall accept any other labels (e.g. Nordic Ecolabel, Blue Angel etc.) as proof of compliance so long as they confirm that the works, supplies or services with these other labels also meet the relevant specified requirements of that specified label.

It should be noted that the EU Ecolabel is an example of an EN ISO 14024 type I ecolabel. Such type I ecolabels require that the criteria that need to be met for labelled products are developed in a transparent manner with input from a diverse range of stakeholder groups. Type I ecolabel criteria should aim to set requirements that address the main environmental impacts of products while considering environmental impacts across their whole life cycle. Only products that have been assessed and verified to meet the EN ISO 14024 type I ecolabel requirements by independent third parties can carry the applicable EN ISO 14024 type I ecolabel. The main EN ISO 14024 type I ecolabels in the EU can be found on the DG Environment website. There are also many other EN ISO 14024 type I ecolabel beyond the EU, many of which are listed in the Global Ecolabelling Network website.

The EU Ecolabel scheme fulfils the above points from b) to e). As regards point a), it is possible that some EU Ecolabel criteria relate to broader aspects of the organisation (e.g. training of staff) that might only be indirectly linked to the subject matter of the contract. While all criteria presented in this GPP report could be considered as fulfilling the requirements of point a) on the link to the subject matter of the contract, this also depends on precisely how contracting authorities define the subject matter of their own calls for competition. Consequently, compliance of GPP criteria with point a) above must be checked on a case-by-case basis.

For more detailed guidance, please refer to resources such as the EU public procurement directive (EC, 2014a), the Buying Green Handbook (EC, 2016), and the Public Procurement Guidance for Practitioners (EC, 2018) published by the European Commission.

Contact us if you have any comments or experiences to share about the public procurement of hard covering products.

2 Product-specific information

The background research for developing EU Ecolabel criteria for hard covering products is also relevant to this EU GPP report because it addresses the same product group and scope. Further details of the background research for EU Ecolabel hard covering products are available in the preliminary report (Donatello et al., 2018) and details on technical rationales can be found in the final technical report (Donatello et al., 2021) for EU Ecolabel for hard covering products.

A brief summary of key points from the background research, plus further information of particular relevance to public procurement is provided below.

2.1 Scope and definition

This GPP report applies for products falling within the same scope and definition as the EU Ecolabel criteria for hard covering products (see Article 1 of Commission Decision (EU) 2021/476 for full wording). This scope includes a number of different materials and product types.

Figure 4. Breakdown of scope of hard covering products covered by the EU Ecolabel

Material	Product types covered by EU Ecolabel	Product types **not** covered by EU Ecolabel
Natural stone	Floor tiles, wall tiles, roof tiles, blocks, slabs, panels, pavers, kerb stones, table-tops, vanity tops and kitchen-worktops.	Ancillary products associated with the installation and fitting of hard covering products (e.g. grouts, adhesives, fastenings etc.) Masonry units under EN 771-6.
Agglomerated stone	Floor tiles, wall tiles, roof tiles, blocks, slabs, panels, pavers, kerb stones, table-tops, vanity tops and kitchen-worktops.	Ancillary products associated with the installation and fitting of hard covering products (e.g. grouts, adhesives, fastenings etc.) Masonry units under EN 771-5.
Ceramic	Floor tiles, wall tiles, ~~roof tiles,~~ blocks, slabs, panels, pavers, kerb stones, table-tops, vanity tops and kitchen-worktops.	Ancillary products associated with the installation and fitting of hard covering products (e.g. grouts, adhesives, fastenings etc.) Masonry units under EN 771-1. Roof tiles under EN 1304. Refactory ceramics, technical ceramics, clay pipes, ceramic tableware, ornamental ware or sanitary ware.
Precast concrete	Floor tiles (including terrazzo tiles), wall tiles, roof tiles, blocks, slabs, panels, pavers, kerb stones (including compressed earth products), table-tops, vanity tops and kitchen-worktops.	Ancillary products associated with the installation and fitting of hard covering products (e.g. grouts, adhesives, fastenings etc.) Masonry units under EN 771-2, -3 and -4 (calcium silicate, aggregate concrete and autoclaved aerated concrete units). Reinforced concrete products.

Source: Adapted from Commission Decision (EU) 2021/476.

Product types refer to the functionality of the hard covering product, which is normally self-evident from the name assigned. These product types can however be produced using different materials, which in turn have different production processes and associated environmental impacts. The EU Ecolabel criteria are based on a combination of material-specific and cross-cutting requirements.

The four materials each have their own niches for hard covering products (e.g. precast concrete is very often used in outdoor pavers, while agglomerated stone is often used in indoor coverings but only rarely outdoors). However, the materials also compete with each other in many product types and it is up to the contracting authority (or their architect) to specify if one particular material should be used.

Main definitions

As a guide, it is worth mentioning the material definitions from Article 2 of Commission Decision (EU) 2021/476 for the main final materials used:

- "*agglomerated stone*" means an industrial product manufactured from a mixture of aggregates of various sizes and natures (generally coming from natural stones), sometimes mixed with other compatible materials, additions and resin binder.
- "*ceramic*" means a material based on clay materials or other non-metallic inorganic materials whose characteristic properties of high strength, wear resistance, long service life, chemical inertness, non-toxicity and resistance to heat and fire are a consequence of a carefully optimised time-temperature transformation occurring during firing operation in a kiln.
- "*fired clay*" means a material produced predominantly from clay or other argillaceous materials by shaping (extrusion and/or pressing), drying and firing of the prepared clay, with or without additives.
- "*natural stone product*" and "*dimension stone*" mean pieces of naturally occurring rock, where the natural stone products have been cut and finished to specified sizes, shapes and surface properties in a transformation plant, whereas dimension stone is the intermediate input material to the transformation plant, consisting of large blocks or slabs of naturally occurring rock obtained from quarrying operations.
- "*precast concrete*" means products made of concrete and manufactured in accordance with specific product standards in a place different from the final destination of use, protected from adverse weather conditions during production and which is the result of an industrial process under a factory production control system and with the possibility of sorting before delivery, including single and dual-layered 'terrazzo tiles', as per EN 13748-1:2004 and 13748-2:2004.

A number of definitions are also provided for different types of products, such as "*floor tile*", "*kerb*", "*kitchen worktop*", "*paver*", "*table-top*", "*vanity top*" and "*wall tile*".

It is important to highlight that while the EU Ecolabel is applicable to roof tiles in general, this was not extended to clay roof tiles due to the outcome of stakeholder consultations. Masonry units, which are specific types of blocks used in walls (normally covered by plaster or rigid wall covering products), are not covered by the scope for any of the four main materials.

Regarding precast concrete, it is worth clarifying that terrazzo tiles (as per EN 13748) are included in the scope, as are compressed earth blocks that use hydraulic or other binders. The exclusion of reinforced precast concrete refers to concrete with steel reinforcement bars inside the block.

Common Procurement Vocabulary (CPV) codes

A single classification system for public procurement aims at standardising the references used by contracting authorities and entities to describe the subject matter of procurement contracts. When procurers publish a call for competition, a CPV code should be used when describing the subject matter of the call. Other CPV codes may also be used at a secondary level. Consequently, it is worthwhile to check how products included in the scope of EU Ecolabel criteria sit within the hierarchy of CPV codes set out in Regulation (EC) No 213/2008 (EC, 2008).

The CPV codes consist of a main vocabulary and a supplementary vocabulary[8]. The main vocabulary is based on a tree structure comprising codes of up to nine digits associated with a wording that describes the supplies, works or services forming the subject matter of the contract. Furthermore, the numerical code has 8 digits, subdivided as follows:

- the first two digits identify the divisions (XX000000-Y),
- the first three digits identify the groups (XXX00000-Y),
- the first four digits identify the classes (XXXX0000-Y),
- the first five digits identify the categories (XXXXX000-Y).

[8] https://single-market-economy.ec.europa.eu/single-market/public-procurement/digital-procurement/common-procurement-vocabulary_en

Each of the last three digits gives a greater degree of precision within each category. A ninth digit serves to verify the previous digits.

With hard covering products, the procurement situation is more complex because these products can be purchased as products or be procured under a broader works contract, which will include labour costs and machinery hire for the works in addition to the material costs. A selection of CPV codes that are considered as particularly relevant to hard covering products are included in Table 1 below.

Table 1. Relevant CPV codes for products, materials and works that could involve EU Ecolabel hard covering products

High level	Medium level	Detailed level
CPV codes for PRODUCTS and MATERIALS that are relevant to hard covering products		
44110000-4 Construction materials	44111000-1 Building materials	44111300-4 Ceramics
		44111700-8 Tiles
		44111900-0 Ceramic flags
	44113000-5 Road-construction materials and 44113100-6 Paving materials	44113120-2 Paving slabs
		44113130-5 Paving stones
		44113200-7 Flagstones
44900000-9 Stone for construction, limestone, gypsum and slate	44910000-2 Stone for construction	44911100-0 Marble
		44912100-7 Granite
		44912200-8 Sandstone
		44912300-9 Basalt
		44912400-0 Kerbstones
	44930000-8 Slate	
CPV codes for WORKS that are relevant to hard covering products		
45000000-7 Construction work	45210000-2 Building construction work	45211360-0 Urban development construction work
		45213316-1 Installation Works of walkways
	45223000-6 Structures construction works	45223300-9 Parking lot construction work
	45230000-8 Construction work for pipelines, communication and power lines, for highways, roads, airfields and railways; flatwork	45233161-5 Footpath construction work
		45233251-3 Resurfacing works
		45233252-0 Surface work for streets
		45233253-7 Surface work for footpaths
		45233260-9 Pedestrian ways construction work
	45240000-1 Construction work for water projects	45246500-8 Promenade construction work
	45260000-7 Roof works and other special trade construction works	45261211-6 Roof-tiling work
		45261212-3 Roof-slating work
		45262650-2 Cladding works
	45430000-0 Floor and wall covering work	45431000-7 Tiling work
		45432112-2 Laying of paving

Source: JRC own elaboration using CPV information.

The higher level codes for construction materials and construction works are extremely broad and there are many more detailed CPV codes that could also potentially involve hard covering products. The list of detailed CPV codes above is not an exhaustive list, it only includes the most relevant ones.

After considering the way the CPV codes are defined, it is clear that any analysis looking at public contracts for works will not distinguish between natural stone, agglomerated stone, ceramics or precast concrete. Similarly, for road construction materials, there are a number of codes that are not material-specific, for example “flagstones” and “paving slabs”.

2.2 Market analysis

An analysis of relevant data from Eurostat’s PRODCOM database[9] for hard covering products was undertaken to assess market trends in the EU. Unfortunately the PRODCOM codes do not match up at all with the CPV codes described earlier. For this reason, it is also necessary to mention the specific PRODCOM product codes considered for the market analysis. An approximate matching up of CPV codes and PRODCOM codes is shown below.

[9] https://data.europa.eu/data/datasets/prodcom2024/?locale=en

Table 2. Comparison of CPV and PRODCOM codes for hard covering products that have relevance to the EU Ecolabel

Material type	CPV code and description	PRODCOM code and description
Ceramic and fired clay	44111300-4 Ceramics	23201100: Ceramic bricks, blocks, slabs, panels etc. (siliceous) 23321130: Clay flooring blocks, support or filler tiles (non-siliceous)
	44111700-8 Tiles 44111900-0 Ceramic flags	23311000: Ceramic tiles and flags
Precast concrete	44113100-6 Paving materials 44113120-2 Paving slabs 44113130-5 Paving stones 44113200-7 Flagstones	23611130: Precast concrete blocks and bricks 23611150: Precast concrete tiles, flagstones etc.
Natural stone	44911100-0 Marble 44912100-7 Granite 44912200-8 Sandstone 44912300-9 Basalt 44912400-0 Kerbstones 44930000-8 Slate	23701210: Natural stone setts, kerbstones and flagstones 23701230: Natural stone tiles and cubes etc. 23701280: Worked slate & agglomerated slate

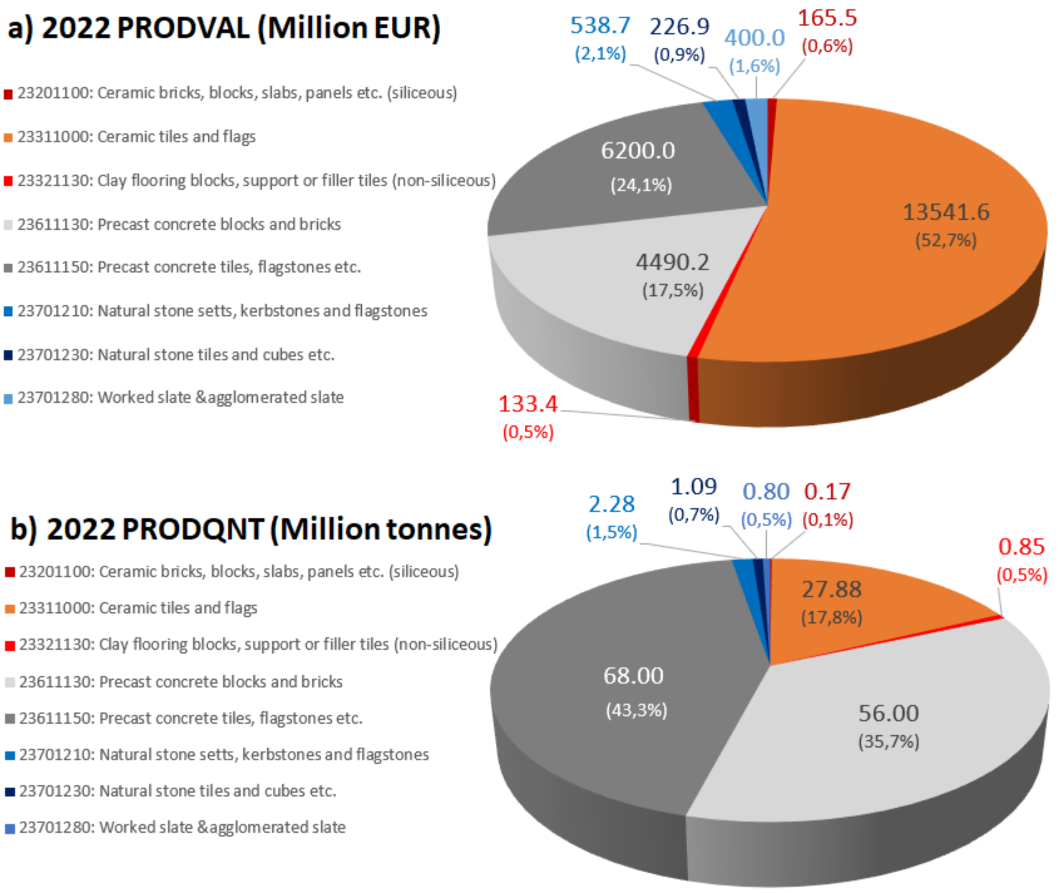
Source: JRC own elaboration using CPV information.

Total sold production value and volume in the EU in 2022

The different PRODCOM codes and descriptors available in the Eurostat database were filtered in order to identify those sub-categories that will partially or fully fall within the scope of EU Ecolabel criteria for hard covering products set out in Commission Decision (EU) 2021/476. It should be noted that:

- Intermediate products (i.e. large quarry blocks and cement or hydraulic lime), while covered by the EU Ecolabel, are not included in this GPP report since the focus is kept on final products. A separate EU GPP manual for cement, lime and alternative cements may be justifiable.
- There are no specific PRODCOM codes for agglomerated stone, so this is assumed to be combined partly with natural stone codes (when resin binders are used) and partly with the precast concrete codes (when cement binders are used).

Figure 5. Snapshot of: a) total sold production value (PRODVAL) and, b) of total sold production quantity (PRODQNT) in EU272020 countries in the year 2022, together with PRODCOM codes counted for analysis



Source: PRODCOM.

Before commenting on the data, it is necessary to state that the quantities for the ceramic tile products had to be converted from m^2 to kg. This was done using an average conversion factor of 20 kg/m^2.

The total sold production for the relevant PRODCOM codes was around 157.1 million tonnes and 25 700 million EUR in 2022 in $EU27_{2020}$ countries. While some intermediate products covered by the EU Ecolabel for hard covering products are not included in the data above (e.g. cement and large quarry stone blocks), it is also worth noting that some products not covered by the EU Ecolabel are actually included in the data above (i.e. bricks and masonry units made of ceramic/fired clay, precast concrete or natural stone).

The information above shows that ceramic tiles, fully covered by the EU Ecolabel, account for just over half (52.7%) of the total sold production value in 2022 but only 17.8% of the total sold quantity – indicating a relatively high unit price. Precast concrete products accounted for around 42% of the total value, but 79% of the total quantity indicating a relatively low unit price. Natural stone final products accounted for the remaining 4.6% of sold value, and also around 2.7% of sold quantity. A breakdown of unit prices for the different types of PRODCOM categories is as follows:

Table 3. EU27 unit prices (PRODVAL divided by PRODQNT) in 2022 for relevant PRODCOM codes

Material type	PRODCOM code	PRODVAL (Million EUR)	PRODQNT (Million tonnes)	Unit cost (EUR/t)
Ceramics/fired clay	23.20.11.00 bricks, blocks, slabs, panels etc. (siliceous)	165.5	0.17	946
	23.31.10.00 tiles and flags	13541.6	27.88	486
	23.32.11.30 flooring blocks, support or filler tiles etc.	133.4	0.85	158

Material type	PRODCOM code	PRODVAL (Million EUR)	PRODQNT (Million tonnes)	Unit cost (EUR/t)
	(non-siliceous)			
Precast concrete (and presumably terrazzo tiles)	23.61.11.30 blocks and bricks	4490.2	56.00	80
	23.61.11.50 tiles, flagstones etc.	6200.0	68.00	91
Natural and agglomerated stone	23.70.12.10 setts, kerbstones and flagstones	538.7	2.28	236
	23.70.12.30 tiles and cubes etc.	226.9	1.09	209
	23.70.12.80 worked slate and agglomerated slate	400.0	0.80	500

Source: PRODCOM.

A closer look at the unit price for different product categories revealed that, while ceramics are generally the most expensive types of hard covering product material, this could vary significantly depending on the type of ceramic or fired clay product in question (i.e. very high for siliceous bricks, blocks, slabs, panels etc., but very low for clay flooring blocks and support or filler tiles). The ceramic tile unit price of 486 EUR/kg dominates the relevant ceramic/clay products analysed, because it accounts for 98 % of total sales quantity.

Natural stone products also revealed a major variation in unit cost for different sub-categories of relevant products. Tiles and cubes can have a lower unit cost (e.g. 209 EUR/tonne in 2021 - but much lower in previous years) while setts, kerbstones and flagstones come in at 236 EUR/tonne and worked slate at 500 EUR/tonne.

Precast concrete products had by far the lowest unit price on average, and there was no major difference in unit prices for the two categories analysed here (80 and 91 EUR/tonne).

These differences in unit cost are important for procurers to bear in mind because if the specific material is not specified for hard covering products, the materials with the cheapest unit cost will have an advantage.

Significance of import and export to EU production

The relative importance of EU production compared to exports and imports for given PRODCOM codes can be determined by reporting on exports and imports as % values of EU production (EU sold production being a reference point equivalent to 100% for any given PRODCOM code). This information is potentially useful to procurers as it will give an indication of how strong the domestic market is and, the stronger it is, the easier it will be to find producers in the EU and, generally speaking, it will be easier to verify criteria compliance with EU producers than non-EU producers.

Table 4. Comparison of imports and exports with EU27 sold production values and unit prices in 2022

PRODCOM category	Sold production values (**Mil. € and as** a relative % of EU27 production value)		Unit prices (**€**/t and as a relative % of avg. EU27 unit price)	
	EU production	EU import	EU prod.	EU import
23201100 Ceramic bricks, blocks etc. (siliceous)	165 Mil. € (100%)	6.5 Mil. € (3.9%)	946 €/t (100%)	377 €/t (40% of EU)
23311000 Ceramic tiles and flags	13542 Mil. € (100%)	834 Mil. € (6.2%)	486 €/t (100%)	416 €/t (86% of EU)
23321130 Clay flooring blocks etc. (non-siliceous)	133 Mil. € (100%)	4.8 Mil. € (3.6%)	158 €/t (100%)	141 €/t (89% of EU)
23611130 Precast concrete blocks and bricks	4490 Mil. € (100%)	36 Mil. € (0.8%)	80 €/t (100%)	108 €/t (135% of EU)
23611150 Precast concrete tiles, flagstones etc.	6200 Mil. € (100%)	86 Mil. € (1.4%)	91 €/t (100%)	942 €/t (1033% of EU)
23701210 Natural stone setts, kerbstones and flagstones	539 Mil. € (100%)	190 Mil. € (35.2%)	236 €/t (100%)	316 €/t (134% of EU)
23701230 Natural stone tiles and cubes etc.	227 Mil. € (100%)	18 Mil. € (7.9%)	209 €/t (100%)	765 €/t (366% of EU)
23701280 Worked slate and	400 Mil. €	80 Mil. €	500 €/t	802 €/t

PRODCOM category	Sold production values **(Mil. € and as** a relative % of EU27 production value)		Unit prices (**€**/t and as a relative % of avg. EU27 unit price)	
	EU production	EU import	EU prod.	EU import
agglomerated slate	(100%)	(19.9%)	(100%)	(161% of EU)
TOTAL	**25696 Mil €** (100%)	**1255 Mil €** (4.9%)		

Source: PRODCOM.

In general, most PRODCOM categories showed that EU production was dominant compared to imported products. Import values were less than 8% of EU sold production values, with the exception of natural stone setts (35.2%) and worked and agglomerated slate (19.9%). Unit prices of imports were significantly more expensive than EU production for precast concrete and natural stone products, indicating that mainly high-end versions of these products are being imported to the EU. However, with ceramic and fired clay products, imports were slightly cheaper and, in the case of siliceous ceramic bricks and blocks, significantly cheaper.

Overall, each of the product categories listed above have very strong domestic production in the EU when considered in the context of import data. Cheaper imports were only an issue with siliceous ceramic bricks, blocks etc., but this was only a small fraction (3.9%) of EU production of these products.

Potential and real-life examples of procurement exercises

The procurer might use the real-life good-practice examples as an aid to identify the elements of tendering process that raise the demand for "green" products and guide the market transition towards sustainability.

Consequently, this section aims to review good practice case studies available on the DG Environment website[10] or on the TED platform[11].

A review of the case studies on the DG Environment website revealed only a very limited number of relevant tenders, and fewer still criteria that were focused specifically on hard covering products. Most case studies for construction and renovation of buildings or infrastructure focused on energy efficiency improvements, site waste management or CO_2 emissions at the level of the building, not of the construction materials.

Public authorities often procure hard covering products indirectly as a smaller aspect within much larger works contracts (e.g. building construction, road construction, etc.).

Table 5. Summaries of real-life procurement exercises

Procuring authority	Subject matter of contract	Relevant green requirements for hard covering products
Barcelona (ES)	Maintenance of parks	Most relevant requirement was a contract performance condition that products used should be ecolabelled as far as possible. Although this was directed more at cleaning products, paints, growing media etc. than paving materials.
Rincón de la Victoria (ES)	Green public space maintenance	Most relevant requirement was a vague award criterion that materials and chemical products should be considered in terms of their contribution to sustainability, environmentally respectful production processes and durability.
Pembroke (MT)	Construction of a primary school	Only vague requirements relating to environmental performance of construction materials and how they affect building energy demand. Most green criteria focused on energy self-sufficiency, water efficiency and biodiversity of the building and plot area.
Zurich (CH)	Low carbon, circular concrete	Applies to all types of concrete used in public works in the city and

[10] See: https://ec.europa.eu/environment/gpp/case_group_en.htm
[11] See: https://ted.europa.eu/TED/main/HomePage.do?lg=en

Procuring authority	Subject matter of contract	Relevant green requirements for hard covering products
		green criteria were to incorporate recycled aggregates into concrete as much as possible and to use low carbon Portland cement (specifically the CEM III/B class).
Hyvinkää (FI)	Construction of a new pre-school.	Main requirements were aligned with the Nordic Ecolabel for buildings. In terms of materials, the most relevant criterion was that materials are emission free (presumably for assuring indoor air quality). Most award points were associated with architectural features of the design.
Frankfurt (DE)	Guidelines for economical buildings.	Most relevant requirements are that construction products must be durable, recyclable and easy to disassemble. The criteria mainly focus on life cycle costing, which involves the building design to be optimized for energy efficiency and low maintenance costs.
Cornwall (UK)	Design of sustainable bus shelters	Most relevant requirement is that tenders needed to demonstrate the sustainability of the shelter by considering, amongst other aspects, environmental issues associated with the materials used, their sourcing, transportation and production. Recycled aggregates were used by the winner in concrete structural elements and pavers.
Lorüns (AT)	Green building materials for a fire station	The most relevant requirement was the use of low emission construction materials.
University of Malta (MT)	Internal finishing works	Included hard floor coverings (e.g. ceramic tiles), gypsum wall panels, window frames, paints etc. Products with ISO 14024 type I ecolabels, ISO 14001, EMAS or other equivalent requirements were required.
Basque region (ES)	Greening tenders for the construction, restoration and design of industrial buildings.	Tenders are assessed based on a number of environmental impact categories - the most relevant of which is "materials used". However, it seems that the criteria is more focused on favouring biogenic materials over mineral or fossil-based materials.
Alzira (ES)	Renovation of an unused warehouse into a sustainable youth centre	Criteria were mainly focused on energy efficiency of the building and life cycle, using provided tools. A minor award criterion was the use of ecolabelled materials.
Flanders (BE)	Design, construction and leasing of a new building for the Flemish government	Waste prevention and life cycle and sustainability assessment using defined tools (TOTEM and GRO). Material passports, VOC emissions and sustainable certified materials (Cradle2Cradle, Nordic Swan, EMICODE or equivalent) were also specified.
Berlin (DE)	Specification of recycled content in concrete using in building construction.	Set requirements for the use of recycled content in all concrete procured in new building construction, so long as technical performance can be proven (which was the case). This was mainly focused on ready-mix concrete, but is even easier to do in precast concrete.

Source: DG Environment website: https://ec.europa.eu/environment/gpp/case_group_en.htm

There were no GPP case studies that exclusively focused on the procurement of hard covering products. The main types of public procurement case studies that had some relevance to hard covering products were focused on works (construction, renovation, redevelopment of buildings and roads) and services (public space maintenance) where hard covering products only form a small part of the overall environmental impact. According to the case studies available on the DG Environment website, the main focus of these types of calls for tender were:

- For road construction or renovation tenders: the main focus was on recycled asphalt (not in the scope of EU Ecolabel), use of recycled aggregates (no EU Ecolabel just for aggregates), drainage systems, soil and waste management etc. Sometimes the overall requirements were linked to CO_2 emissions or life cycle costs.

- For green space maintenance tenders: criteria mainly focused on the use of electrical vehicles and equipment instead of fossil fuel-based alternatives, biodiversity-related requirements for flora and fauna, water efficiency and waste management. Any requirements linked to ecolabelling appeared to have soil improvers, growing media and cleaning products in mind more than hard covering products.
- For building construction or renovation tenders: criteria predominantly focused on energy efficiency of the building as a whole and material efficiency (either in terms of maximised material reuse in renovation projects or in using recycled content in new construction and/or in recycling of waste generated by the same). Only a few tenders made reference to ecolabelled construction materials and in some of these cases, wood was explicitly mentioned but not hard coverings.

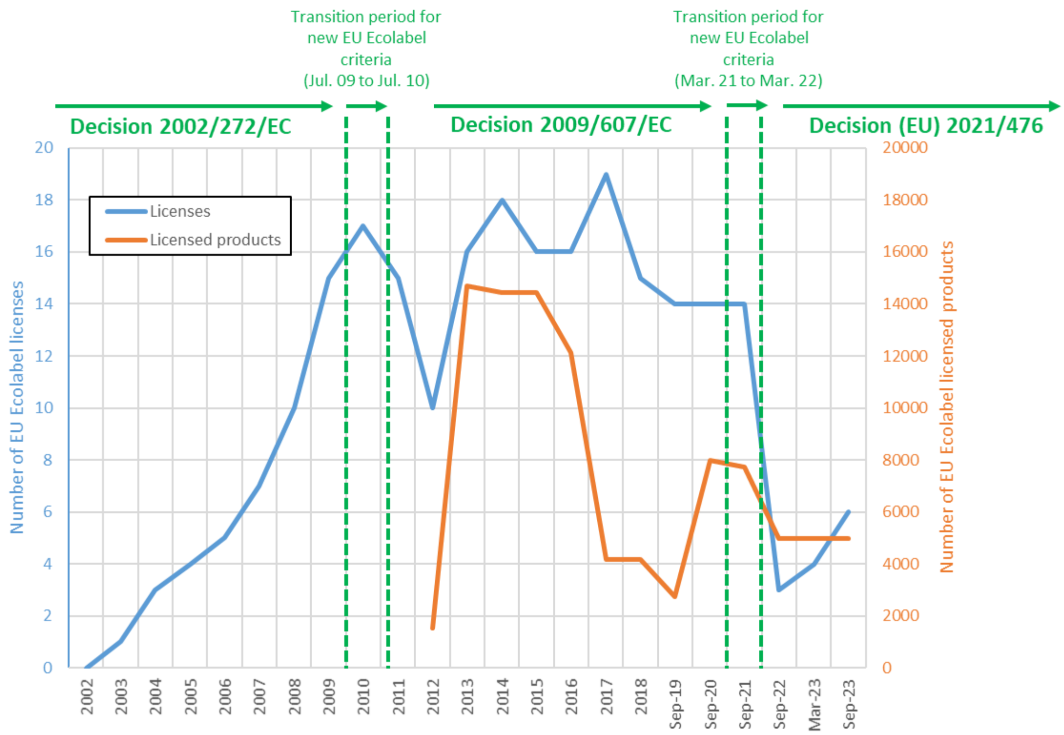
As with any green criteria that are not widely applied in the market, for them to become better known, it is necessary to increase awareness of them amongst procurers and for them in turn, to specify these criteria and explain more about them to potential bidders via market engagement prior to calls for tender being published, and/or to actively discuss these types of criteria in negotiation an innovation procedures. For more information on market engagement, please see module 6 of the EU GPP training toolkit[12].

Given the lack of suitable case studies found, it was necessary to look more closely for relevant tenders on TED, the results of which are summarised in the next sub-section.

Availability of EU Ecolabel products on the market

The aim of this EU GPP report is to find synergies between the EU Ecolabel and EU GPP policies by using criteria in GPP that can already have been assessed and verified for EU ecolabelled products. Consequently, it is of interest to know about the current availability of EU Ecolabel products on the market.

Figure 6. Trends in relevant EU Ecolabel licenses and licensed products over the last 8 years



Source: data from https://environment.ec.europa.eu/topics/circular-economy/eu-ecolabel-home/business/ecolabel-facts-and-figures_en

[12] See the GPP Training toolkits here: https://ec.europa.eu/environment/gpp/toolkit_en.htm

The current EU Ecolabel criteria in Decision (EU) 2021/476 are now the third version of criteria that have been adopted in the Official Journal of the EU for hard covering products (2002, 2009 and now 2021).

Although there have been relatively few licensed companies (never more than 19 in the EU at any one time), there have always been thousands of hard covering products carrying the EU Ecolabel license. However, it is also necessary to check how these products are spread across the four main materials covered by the scope (natural stone, agglomerated stone, ceramics and precast concrete).

Historically, most hard covering products carrying the EU Ecolabel have been ceramic tiles. According to the EU Ecolabel catalogue, the following licenses can currently (September 2023) be seen:

- Minera de Rocas SLU (ES, Galicia): natural stone products
- Granitos del Louro S.A. (ES, Galicia): natural stone products
- Lasselsberger s.r.o. (CZ): ceramic tiles (many products)
- BESCO Berliner Steincontor GmbH (DE): natural stone products
- Canteras de Lalin S.L. (ES, Galicia): natural stone products
- Aridos H. Carballido S.L. (ES, Galicia): natural stone products

So it can be seen that there are currently 6 licenses (and 4995 products), none of which address agglomerated stone or precast concrete products. The low number of EU Ecolabel licenses. In order to ensure sufficient competition and that the market is prepared in time, it is recommended at this stage that:

- procurers should clearly state their intentions to buy "green" hard covering products and that the EU Ecolabel is an easy means of complying with whatever they will ask in the future in terms of environmental criteria, and/or
- procurers should give sufficient time for the market to prepare (e.g. via market engagement and prior information notices) because obtaining the EU Ecolabel can take at least 12-18 months depending on how well-prepared tenderers and Competent Bodies are.

While at the discretion of contracting authorities, if there are doubts about the number of tenders that could meet the EU GPP technical specifications, they could be applied instead as award criteria. The more weighting given to award criteria regarding EU Ecolabel requirements, the stronger the market signal.

2.3 Environmental hotspots

Although the four main categories of hard covering products have some raw material supply chains in common, and although they can also have similar properties and product applications, the production processes are very different and thus so are the environmental hotspots. Consequently, it is necessary to provide an overview of four different production processes in Figure 7 below. The information on the LCA is summarised from Preliminary Report developed in the context of the revision of the EU Ecolabel criteria for hard coverings products (2018-2021).

2.3.1. Upstream processes

Hard covering products are mineral-based, and so the extraction of mineral materials accounts for the vast majority of mass in the final products. However, the extraction of organic chemical feedstocks is also relevant for those organic chemicals to be used later on in hard covering product manufacture. This could include very low amounts (e.g. 0.1%) of resins, plasticisers, lubricants or demoulding agents in the production processes and the much higher amounts of resin used in agglomerated stone manufacture (up to 10% by mass of final product). Impacts associated with the extraction of crude oil and its refining are well documented. With bio-based organic chemical feedstocks, impacts associated with land use, fertiliser application, harvesting, transport and processing are relevant.

The extraction of mineral materials is common to all hard covering products. Although a separate column has been made for natural stone quarrying (in Figure 7), this is simply a more precise and controlled means of extraction of mineral materials from a quarry. In a natural stone quarry, massive blocks are selectively cut from the quarry face using dry- or wet-cutting techniques. These massive blocks are then cut into transportable blocks (dimension stone) of around 2 m by 2 m by 3 m size. Dimension stone is then transported to transformation plants, which are often located very close to the quarry. However, transformation plants may also receive dimension stone from quarries much further away so that they can offer a wide range of products to customers (Yarahmadi et al., 2018).

All raw material extraction and processing in the upstream stages require inputs of energy (fuel and electricity) for operating heavy machinery and other onsite equipment (Mendoza et al., 2024).

Due to the large masses involved, impacts associated with the transport of these materials will be sensitive to the mode of transport and the distance to the hard covering product factory. The main impact of conventional modes of transport is linked to emissions to air from fuel combustion (Mendoza et al., 2024).

2.3.2. Core processes

With the core processes, it is necessary to describe each of the four main types of hard covering product separately. Using the general trend towards producing sectorial-level EPDs for ceramic tile, (e.g. Confindustria Ceramica, 2016) precast concrete (e.g. British Precast 2017a, 2017b, 2018) and natural stone (e.g. EUROROC, 2014), it was possible to reach a general conclusion on the production stage and installation stage (core processes) were the dominant aspects for the overall life cycle impacts of the products take place.Ceramics and fired clay: the mined clay raw material will be milled (wet or dry) to required particle size specifications. In the case of fired clay, the milled clay may be simply combined with any additives (e.g. pigments) and then be mixed, extruded or moulded and fired in the kiln at temperatures of 900 to 1000 C. With ceramic tile production, the supply chain is more complex. First of all, the clay material will often be "atomised" using a spray drying procedure that rapidly dries a slurry of clay and water at around 400 C. The process uses natural gas and is quite energy intensive. Clay powder can then be pressed, rolled or moulded before being fired in a kiln at temperatures up to 1200°C. Ceramic tiles are normally glazed, and there is a separate supply chain for frits, pigments and other ingredients associated with glazing formulations. Wastewater from fired clay and ceramic production is generally a minor issue and many plants can recirculate the clarified wastewater for wet-milling or for dosing with dry-milled clay material – leading to zero wastewater emission plants. With the exception of glazing wastes, solid waste is not an issue either, and material can often be reincorporated into the same production process. The dominant source of environmental impacts is with energy consumption, especially fuel consumption (almost exclusively natural gas) for spray drying and kiln firing. Emissions of CO_2 and NOx are related to the combustion process, while emissions of HF and SOx are highly sensitive to the F and S contents of the raw materials.

Precast concrete: the mass composition of concrete is dominated by aggregates and sand, which are relatively low environmental impact processes. The actual precast concrete factory does not involve any combustion processes and can run entirely on electricity. Most energy consumption is associated with the operation of plant equipment (mixers, vibration tables, hydraulic devices, pumps etc.). The dominant source of energy consumption is actually associated with the production of cement used in concrete, which can account for 10-15 % by mass of the concrete. Cement is essentially an intermediate product used by precast concrete producers. Due to the fact that literally no precast concrete producers will be making the cement that they use, it was considered necessary to allow for the option that cement producers can apply for the EU Ecolabel themselves. Cement is produced by the firing of a mixture of limestone and clay in a rotary kiln at temperatures of up to 1450°C. Emissions of CO_2 (both from combustion and from limestone decarbonation), of NOx, of SOx and dust to the atmosphere are particular concerns. Water consumption is generally for cleaning of dust from the plant. Emissions of wastewater are not generally considered as much of an issue, neither with cement nor with precast concrete production. Cement kiln dust can be considered as a hazardous solid waste, but can to some extent be reincorporated into the cement production process. Solid wastes from precast concrete production can be crushed into aggregates or fines and be used in the production of new concrete onsite or offsite.

Agglomerated stone: like precast concrete, there is no combustion required to manufacture agglomerated stone products. Crushed stone is supplied as a finely ground powder or is crushed and milled onsite. The stone powder will normally be sourced from by-products of natural stone production but could also include other inorganic mineral wastes like glass or ceramics. The stone is mixed with a precise amount of resin (typically a polyester resin at levels of 5-10% by mass of the mixture) and is poured into the patented Breton-style moulding system or similar. The mould is closed, subjected to pressure and slightly elevated temperatures that allow the resin to set – creating a uniform solid slab of agglomerated stone. The appearance of the stone will be determined by the constituent powders used, but surface treatments are also possible that can impart many different colours and patterns according to client demand.

Natural stone: There are two main steps in the production of natural stone hard covering products. The first is the quarrying of stone, where the main environmental impacts relate to land use, biodiversity, emissions of dust to water and air and waste production. The cutting operations create sludge that may contain undesirably high levels of metal particulates from the wearing down of saw blades and chainsaws. Even if waste dust is collected, its improper storage onsite can lead to secondary dust emissions. Another important impact is the typically low material efficiency of quarry block extraction. Typically only 25-30% of the material extracted remains in a suitable enough condition to be sold as dimension stone. The rest are broken fragments or pieces with impurities or fractures that would break easily when being cut into slabs. This type of waste can be considered as by-products since there are a number of sectors that could potentially use these (e.g. precast concrete production, agglomerated stone production, geotechnical fill etc.).

The second part of the natural stone hard covering production process is the transformation plant. These plants may be operated by the same quarry operator, but this is generally not the case. The main environmental impacts at the transformation plant are similar to those of the quarry, although the former is a much more controlled environment. Dust emissions in the transformation plant can be channelled to dust abatement filters, water supply is much more secure and operations are not compromised by adverse weather (e.g. too much wind → uncontrolled dust emissions or too much rain → risks with ground stability and mobility of equipment on unpaved ground).

The information in Figure 7 illustrates the upstream processes for making the raw materials that end up in hard covering products. In terms of mass, inorganic minerals are by far the most significant material component.

2.3.3. Downstream processes

Impacts associated with distribution relate to transport from the factory gate to the consumer, which may or may not go via intermediate actors in the commercial and retail parts of the supply chain. These impacts will be larger when materials are sourced from other countries. However, this is only normally the case with ceramic tile products, since the transportation cost of hard covering products is generally quite significant due to their mass and relatively low value per unit of mass.

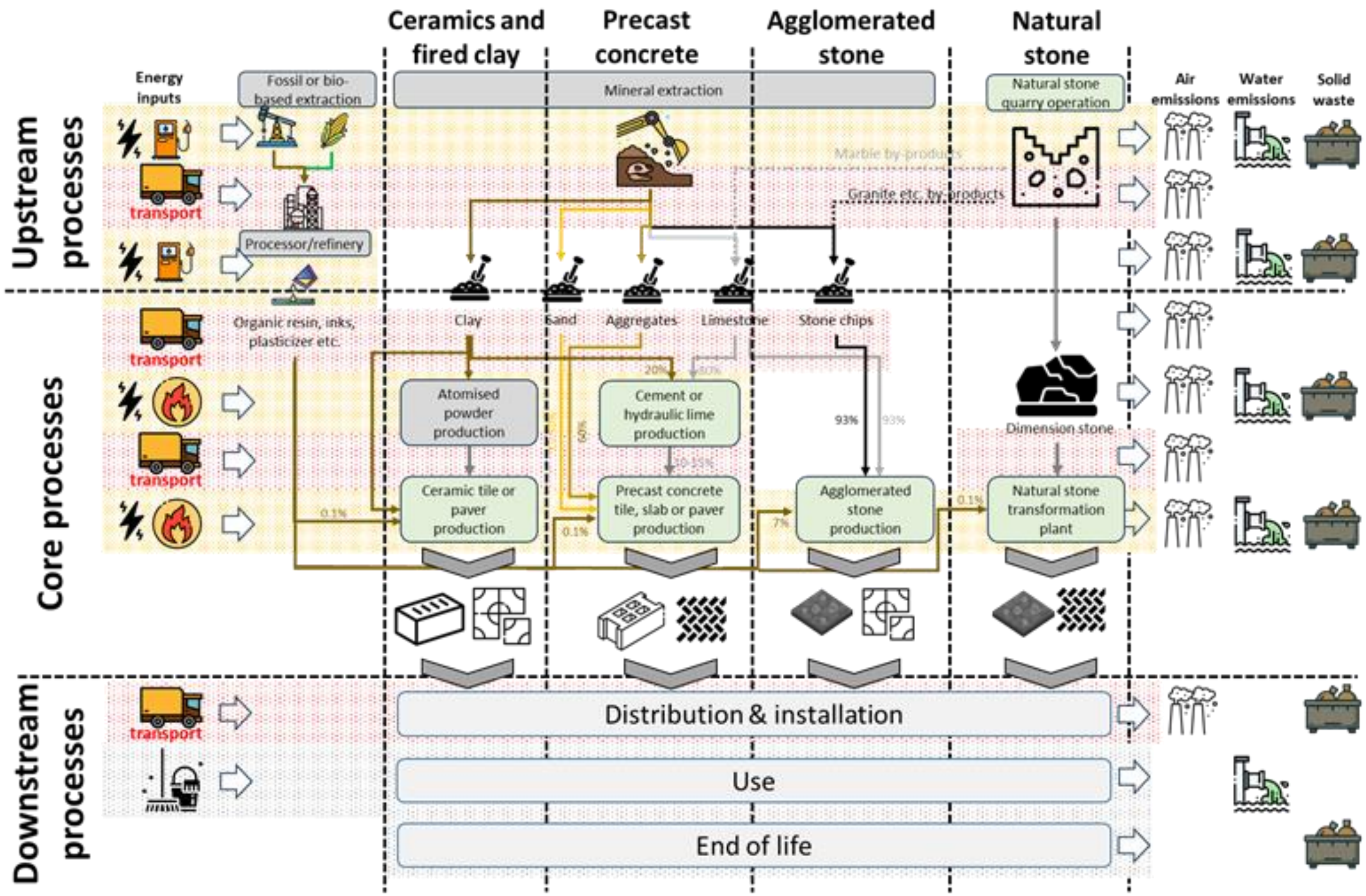
Installation impacts can be limited to some extent by the provision of user information, but some losses are inevitable due to the need to cut some tiles, slabs or blocks to size onsite or due to installer error.

The use phase impacts will be dominated by any cleaning operations to maintain the surface. These will vary greatly depending on the use environment and on the degree to which dirt is likely to accumulate (e.g. wall tiles need a lot less cleaning that floor tiles).

The end-of-life stage will normally come during renovation or demolition works and it is like that the tiles would still have a useful lifetime remaining. However, due to the fact that most hard covering products are bound to walls and floors by adhesives, the potential to recover them for reuse is greatly limited. Nonetheless, hard covering products can be considered as inert materials that can easily be recycled as aggregate in a variety of applications.

The images in Figure 7 should be read in vertical for the production of particular hard covering products by material, going through the life cycle from top to bottom. Manufacturing processes are in grey or green boxes. The green boxes are where an EU Ecolabel can be obtained and any products in green line can carry the EU Ecolabel. The most environmentally significant inputs at each stage (either electricity, fuel or transport) come in at the left, pass through the relevant production process and come out as environmental impacts on the right-hand side.

Figure 7. Overview of main processes and life cycle stages for the manufacturing of hard covering products



Source: JRC own elaboration.

The nuanced approach of the EU Ecolabel

Specific requirements of the EU Ecolabel have been nuanced based on the nature of the production process and available data for each sub-product in the literature. For example, where sufficient data is available to define specific energy consumption benchmarks, such benchmarks were defined. When this was not possible, criteria on energy required an energy inventory to be kept and an energy consumption reduction plan (towards optimum levels) to be implemented. Material efficiency concepts always relate to the reuse of process waste but, where plausible (based on the nature of the product) and justifiable (based on relative distance of sourcing compared to virgin materials), will also reward any incorporation of recycled or secondary materials. Where the production process is combustion based, emissions to air focus on dust, NOx, SOx and CO_2, whereas if they are not, emissions to air only focus on dust. Emissions of NOx and SOx to air are dominant factors in acidification impacts.

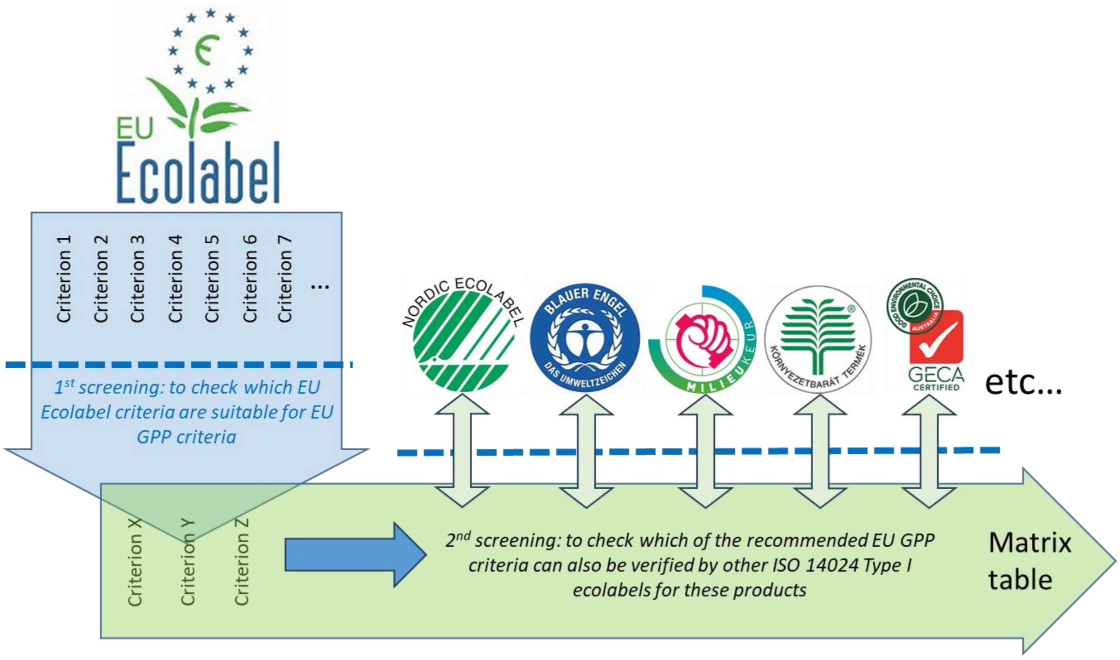
3 Identification of EU Ecolabel-based criteria for the public procurement of hard covering products.

When deciding on the original EU Ecolabel criteria, the coverage of the main environmental hotspots as well as how an independent third party could assess and verify compliance, were already taken into account. Instead of rethinking new EU GPP criteria from scratch, inspiration should be taken directly from the recently adopted EU Ecolabel criteria.

This section explains the methodology applied during the screening exercise to identify the EU Ecolabel criteria for hard covering products that are most suitable for EU GPP. These criteria are valid at least until 31 December 2028.

The screening exercise is two-fold: first to screen the existing EU Ecolabel criteria for their suitability to be used in EU GPP criteria; and secondly, to screen other relevant ISO 14024 type I ecolabels (to see if they have identical or sufficiently similar criteria in order to be used as an alternative means of verification for the selected EU GPP criteria).

Figure 8. Illustration of two-part screening exercise conducted during the development of this EU GPP report



Source: JRC own elaboration.

3.1 Screening exercise: part 1

As previously mentioned, the suitability of each EU Ecolabel criterion set out in Commission Decision (EU) 2021/476 for use in the EU GPP recommendations was analysed and screened against these three parameters.

1. Be clearly linked to the subject-matter of the procurement contract being awarded.
2. Be verifiable by public authorities (in cases when products do not carry the EU Ecolabel).
3. Be of high environmental relevance from the perspective of LCA analysis and/or fit with circular economy objectives.

Screening of each of the EU Ecolabel criteria has been carried out and the arguments for and against each of them being recommended for use into EU GPP criteria are summarised in Annex 1. It should be noted that the EU Ecolabel criteria for hard covering products are a mixture of optional and mandatory requirements.

A total of 34 EU Ecolabel criteria were screened in Annex 1, leading to 9 being considered as potentially relevant to use (when it is clear that only one specific type of hard covering product is to be procured) and a further 13 that could be considered as cross-cutting for all types of hard covering products. These relevant criteria can be grouped into 3 EU GPP criteria themes, so long as the legal text of the criteria can be adapted accordingly for each sub-product:

- "Energy consumption and CO_2" (management system and inventory for all, specific limits for agglomerated stone and ceramics);
- "Emissions to air" (management system and best site practice for dust from stone quarries, transformation plants and agglomerated stone facilities, specific limits for dust and other pollutants from ceramic and cement kilns);
- "Process waste reuse" (specific limits for each).

More specific details about why these criteria were chosen and what type of procurement criteria they are recommended to be used as (e.g. technical specifications, award criteria, contract performance conditions etc.) are provided immediately after the criteria.

3.2 Screening exercise: part 2

The design, assessment and verification of environmental requirements in product tenders can be complex and may require technical expertise and analysis. Recognised international, European and national environmental labels or certifications related to hard covering products might not only be a useful reference for defining individual procurement criteria, but also offer a straightforward, time-saving and effective means of third-party verification for products that carry such labels or certificates.

In general, ISO 14024 type I ecolabels try to set criteria based on life cycle considerations of products or services. These are voluntary, multiple criteria-based schemes that are third-party verified. The ISO 14024 standard also addresses procedures, governance and transparency regarding how pre-defined environmental criteria should be set in the first place. The EU Ecolabel is an example of an ISO 14024 type I ecolabel[13].

After a call for feedback on other relevant ISO 14024 type I ecolabels that were considered potentially relevant to the scope of EU Ecolabel hard covering products, the following ecolabel schemes were screened against the EU GPP criteria recommendations of this report:

- Blue Angel DE-UZ 216 (Concrete products containing recycled aggregates for outdoor flooring), Germany.
- Milieukeur (unreinforced concrete products), Netherlands.
- Kornyezetbarat Termek (KT44: requirements for crushed stone products from mining technology), Hungary.
- Kornyezetbarat Termek (KT13: requirements for stone construction products for poured concrete, lime products and porous concrete insulation products), Hungary.
- GECA, (HS: Hard Surfacing), Good Environmental Choice Australia.
- GECA (Cement, Concrete and Concrete Products), Good Environmental Choice Australia.

[13] A list of further ecolabelling schemes can also be obtained at the web site of the Global Eco-labelling Network (GEN) www.gen.gr.jp/product.html

These ecolabels guarantee that products bearing them have been verified by third parties for compliance with pre-defined environmental criteria. However, none of the ISO 14024 type I ecolabels are fully equivalent to the screened EU Ecolabel criteria that were selected for EU GPP criteria.

A general comparison of screened EU Ecolabel criteria and English versions of similar criteria requirements in the other relevant ecolabels is provided in Annex 2 and summarised in Table 6 below.

Table 6. EU Ecolabel - based criteria for public procurement of hard covering products in relation to selected ISO 14024 type I ecolabels

Scope or proposed EU GPP criterion		EN ISO 14024 type I ecolabel			
	EU Ecolabel[14]	Blue Angel[15]	Milieukeur[16]	GECA[17]	GECA[18]
Scope – natural stone	✓	X	X	✓	X
Scope – agglomerated stone	✓	X	X	✓	X
Scope – ceramic/fired clay	✓	X	X	✓	X
Scope – precast concrete	✓	✓	✓	X	✓
Criteria – Energy consumption & CO_2	✓	✓	X	✔	✔
Criteria – Emissions to air	✓	X	X	✔	✔
Criteria – Process waste reuse	✓	✔	X	✔	✔

Sources: See footnotes.

**Note: the list of type I Ecolabels is not exhaustive. These schemes were selected due to their correlation with the EU Ecolabel*

✓ = covered; ✔ = partially or potentially covered/further assessment required; X = not covered

When conducting the cross-checking exercise of EU Ecolabel criteria with those of other EN ISO 14024 type I ecolabels for the same or similar product groups, it is important to specify the exact version of the other ecolabel criteria (see footnotes), since it can be updated or completely changed in later versions and the comparison summarised above may become inaccurate or invalid over time.

Other Type I ecolabels may undergo regular updates which make them more or less similar to EU Ecolabel criteria compared to today.

In order to ensure that comparisons remain valid, the screening exercise in Annex 2 should be repeated every few years. Updated versions of Table 6 and Annex 2 could be

[14] Commission Decision (EU) 2021/476 of 16 March 2021 establishing the EU Ecolabel criteria for hard covering products OJ L 99, 22.3.2021, p. 53–72, available at: https://eur-lex.europa.eu/eli/dec/2021/476/oj

[15] Blue Angel criteria for "Concrete products containing recycled aggregates for outdoor flooring" DE-UZ 216, version 1, January 2021. Available online at: https://www.blauer-engel.de/en/productworld/concrete-products-containing-recycled-aggregates-for-outdoor-flooring-new

[16] Milieukeur criteria for "BETONPRODUCTEN: Betonstraatstenen, betontegels, betonbanden, daktegels van beton en Grasbetontegels" BTP.17 MK.58, 2022 version. Only available in Dutch, but refers to concrete products.

[17] GECA (Good Environmental Choice Australia) "Hard Surfacing" standard No. HS v2.0i-2019. Available online for free upon request at: https://geca.eco/standards/hard-surfacing-hsv2-0i-2019/

[18] GECA (Good Environmental Choice Australia) "Cement, concrete & concrete products" standard No. CCCP v1.0iii-2021. Available online for free upon request at: https://geca.eco/standards/hard-surfacing-hsv2-0i-2019/

made available on the DG ENV website, on the same link where this report is made available.

Overall, no EU-based ecolabels were found that matched the scope of EU Ecolabel hard covering products. Outside of the EU, the two sets of GECA criteria: (i) for hard surfacing, and (ii) for cement, concrete & concrete products, combined to cover the full scope of the EU Ecolabel hard covering products.

The Blue Angel criteria on concrete products containing recycled aggregates for outdoor flooring sets a minimum 30% content for aggregates >2mm diameter to be recycled from concrete, from other construction or demolition waste, or from the manufacturing waste (this last part is not technically recycled content according to ISO 14021). All non-virgin aggregates must be registered as part of a material flow analysis (similar to the monthly balance sheet required for EU Ecolabel precast concrete). Final concrete products need to be tested for the ecotoxicity of leachate. The criteria also require an EPD to be carried out and for the plant to be operated under continuous improvement principles towards optimal energy consumption. Furthermore, at least 50% of electricity consumed must be from renewable sources and/or highly efficient combined heat and power units. There are also requirements on carbon offsetting and a voluntary criteria applicable to permeable pavers.

The Milieukeur criteria (only available in Dutch) focused on precast concrete products but were limited to a minimum content of recycled aggregate (i.e. at least 15%) and then environmental requirements on those recycled aggregates (e.g. leaching, Polycyclical Aromatic Hydrocarbon content and technical quality). The Milieukeur criteria also include a criterion on functionality.

The Környezetbarát Termék criteria KT 13 (*"Kőszerű építési termékek követelményei pórusbeton, mészhomok termékekhez és pórusbeton technológiával előállított ásványi hőszigeteléshezonly"*, only available in Hungarian) were screened but concluded to not be overlapping with the scope for EU Ecolabel hard covering products. The KT13 referred to calcium-silicate and autoclaved aerated concrete masonry units, but masonry units were explicitly excluded from the scope of EU Ecolabel criteria for hard coverings due to a lack of support from industry stakeholders.

The Környezetbarát Termék criteria KT44 (*"Kőszerű építési termékek követelményei bányaipari technológiával előállított zúzottkő termékekhez"*, also only available in Hungarian) were not considered to overlap with the scope for EU Ecolabel hard covering products because they only applied to the upstream stage of producing aggregates or "crushed stone".

The Blue Angel criteria are valid until 31 December 2025, the Milieukeur criteria are valid until 1 November 2024, while the Környezetbarát Termék criteria KT 13 and 44 are both valid until 31 December 2024.

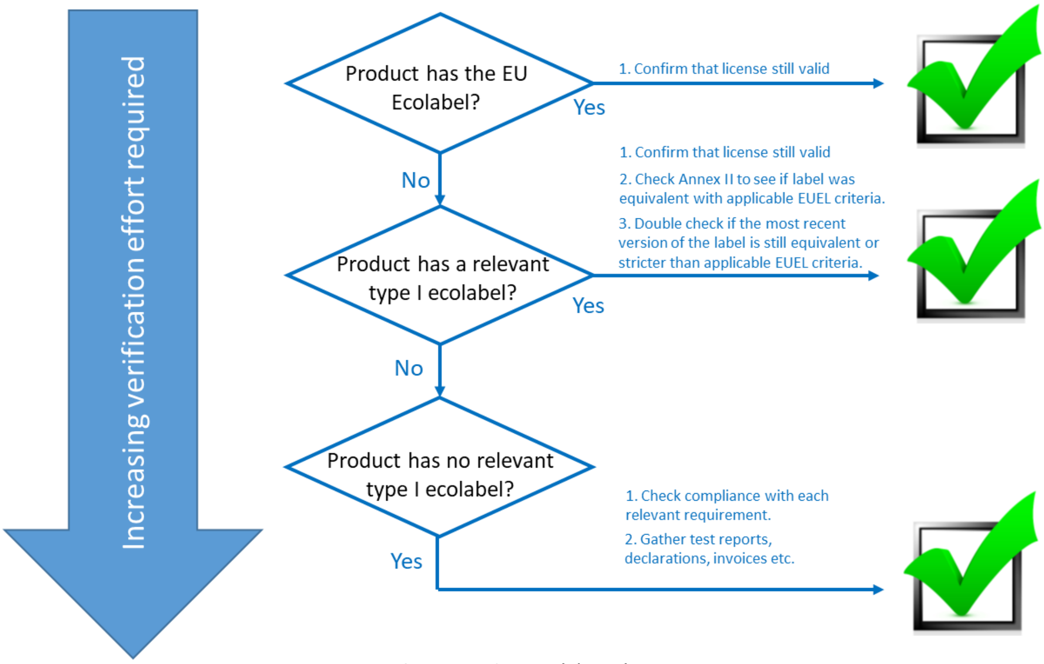
The analysis in Annex 2 only focuses on a cross-check with Blue Angel and GECA criteria since these are the only type I ecolabels with potentially equivalent criteria.

3.3 General considerations about verification via ecolabels

According to Article 43 of Directive 2014/24/EU, third-party environmental labels can be stipulated in technical specifications, award criteria, or contract performance conditions as means of proof. However, their applicability always needs to be checked in relation to the actual subject matter and criteria used in the tender, and equivalent means of verification for products without labels must be permitted.

When using criteria based on the EU Ecolabel in calls for competition, verification may be more or less complicated as illustrated below.

Figure 9. Verification hierarchy for GPP criteria based on EU Ecolabel criteria



Source: JRC own elaboration.

The flow diagram above implies that products with the EU Ecolabel are associated with the least verification effort. However, in cases of doubt about the validity of the EU Ecolabel, procurers can consult the online catalogue (ECAT)[19] where searches can be made by product name, company name or license number. In case the product or license number cannot be found in the EU Ecolabel catalogue, the relevant national Competent Body[20] should be consulted.

If the products are currently undergoing the application process to obtain the EU Ecolabel (or a relevant type I ecolabel), this cannot be accepted as proof of compliance. Instead, compliance with individual requirements would be necessary just like for any other product without a relevant ecolabel.

> Wherever equivalent third-party operated labelling scheme are not applicable, a full assessment and verification process is needed.

Where environmental labels or certificates are not available or applicable, a full assessment and verification process needs to be conducted. Each EU GPP criterion indicates information about, for example, relevant standards, test methods or other documentation that could be required to demonstrate compliance.

[19] http://ec.europa.eu/ecat/
[20] More details can be found here: https://ec.europa.eu/environment/ecolabel/competent-bodies.html

3.4 Recommended EU GPP criteria for the public procurement of hard covering products.

A total of 3 different themes for green criteria are recommended in this section that split into sub-criteria that are specific to the particular materials desired. If procurers are unsure about what materials they want, but they do know what environmental theme they are interested in, they should copy all the sub-criteria for that theme into their call for competition.

The criteria recommended here are formulated as technical specifications (TSs) – which should be used in the case of buying standard products that have already been produced or that are currently being produced before the award of any contract. In this case, tenderers should be able to demonstrate compliance at the point of the deadline for the call for competition.

No award criteria (ACs) have been recommended for two main reasons: (i) that in cases of doubt about the ability of the market to meet the requirements, the TSs should be converted to optional ACs, and (ii) the potential ACs of simply rewarding higher recycling rates or lower energy consumption or emissions than the minimum requirements of the EU Ecolabel is possible. However, verification would be more complicated, even for products already carrying the EU Ecolabel, since these numbers are dynamic and will change each month.

In cases where a long-term supply contract is being awarded and it will cover products that have not yet been produced (whether standard products or customised products), the same TS criteria could be converted to Contract Performance Conditions (CPCs). The only additional work needed from the contracting authority would be to decide on any penalties for non-compliance.

Criterion TS1: Energy management and consumption

Based on EU Ecolabel criteria 2.1 & 2.7 (for natural stone), criterion 3.1 (agglomerated stone), criteria 4.1 & 4.2 (ceramic and fired clay) and criteria 5.2 & 5.5 (precast concrete) on energy consumption and CO_2, as established by Commission Decision (EU) 2021/476.

Technical specification (TS)
TS1.1. Energy consumption and CO_2 emissions for natural stone products *For natural stone transformation plants:* The tenderer shall have established a program to systematically monitor, record and reduce specific energy consumption and specific CO_2 emissions to optimal levels* in the transformation plant where the products are manufactured. This shall explicitly cover any specific production line(s) for the products being procured. The tenderer shall report energy consumption as a function of energy source (e.g. electricity and diesel) and purpose (e.g. use of onsite buildings, lighting, cutting equipment operation, pumps and vehicle operation). The tenderer shall report on energy consumption for the site both on an absolute basis (in units of kWh or MJ) and on a specific production basis (in units of kWh or MJ per m^3, m^2 or t of material sold/produced and ready for sale) for a given calendar year. A plan to reduce specific energy consumption and specific CO_2 emissions shall describe measures already taken or planned to be taken (e.g. more efficient use of existing equipment, investment in more efficient equipment, improved transportation and logistics etc.). Verification: *For natural stone transformation plants:* *Natural stone products which have been awarded the EU Ecolabel according to Commission Decision (EU) 2021/476, or with another EN ISO 14024 type I ecolabel** that has equivalent criteria, are deemed to comply with the requirements.* *The tenderer shall provide an energy inventory for the transformation plant for a period of at least 12 months*** prior to the deadline date of the call for competition. The energy inventory shall distinguish the different types of fuel consumed, highlighting any renewable fuels or renewable content of mixed fuels. As a minimum, the specific-energy consumption and CO_2 emission reduction plan must define the baseline situation with specific energy consumption at the natural stone transformation plant when the plan was established. The plan must*

also identify and clearly quantify the different sources of energy consumption at the transformation plant, and identify and justify actions to reduce specific energy consumption and to report results on a yearly basis.

*Any program to reduce energy consumption will eventually reach an optimum level. Efforts to reduce energy consumption further than the optimal level are considered as those that would adversely affect product quality or consistency of quality.

**No other EU-based ecolabel schemes were identified during the screening exercise. Beyond the EU, GECA (Australia) criteria were found to be quite similar, but not fully equivalent.

***An exception to the 12 months can be made for production lines that are new and have been running for less than 12 months so long as a minimum of 2 months of data can be provided.

TS1.2. Energy consumption for agglomerated stone products

The specific process electricity consumption for agglomerated stone production (including raw material batching, primary mixing, secondary mixing, moulding and finishing) shall not exceed 1.1 MJ/kg.

If grinding of stone raw material is carried out, the specific electricity consumption of the grinding process (in MJ/kg) shall be reported separately but shall not be added to the total for the process.

Verification:

Agglomerated stone products which have been awarded the EU Ecolabel according to Commission Decision (EU) 2021/476, or with another EN ISO 14024 type I ecolabel that has equivalent criteria, are deemed to comply with the requirements.*

Specific process electricity consumption shall be calculated by dividing the electricity consumption for relevant process equipment by the volume of production (in kg or m^3). A report shall be presented with data that is representative of the product(s) being offered. In cases where different products covered by the same offer have significantly different values, the data shall be reported separately for each product. In cases where production data is available in m^3, it should be converted to kg using the relevant bulk density factor (in kg/m^3) for the agglomerated stone product(s).

*No other EU-based ecolabel schemes were identified during the screening exercise. Beyond the EU, GECA (Australia) criteria were found to be quite similar, but not fully equivalent.

TS1.3. Energy consumption and CO_2 emissions for ceramic and fired clay products

The specific fuel energy consumption and CO_2 emissions for drying and firing processes shall not exceed the relevant mandatory limits defined below.

- Spray dried powder (when used): 1.8 MJ/kg powder and 84 kgCO_2/t.
- Ceramic tile individual product: 4.1 MJ/kg and 280 kgCO_2/t.
- Ceramic tile family of products: 5.5 MJ/kg and 360 kgCO_2/t.
- Fired clay pavers: 3.5 MJ/kg and 192 kgCO_2/t.

Verification:

Ceramic or fired clay products which have been awarded the EU Ecolabel according to Commission Decision (EU) 2021/476, or with another ISO 14024 type I ecolabel that has equivalent criteria, will be deemed to comply with the requirements.*

Regarding energy consumption:

The tenderer shall declare the specific fuel consumption value(s) for the relevant product(s). The specific fuel consumption shall be calculated by dividing the fuel consumption (in MJ) for relevant process equipment by production volume (in kg) during the relevant production period.

In cases where production data is only available in m^2 but needs to be reported in kg, the value should be converted using a fixed bulk density factor (in kg/m^2) for the product or family of products.

*Data for an entire family of products shall be representative of any production line(s) for a 12-month** period prior to the deadline date of the call for competition. Data for specific individual products, shall be representative of stable conditions during the actual production run(s).*

Volumetric or mass inputs of fuel to the kiln and dryer systems shall be taken from site readings and be converted into MJ by multiplying the volume/mass of fuel consumed over the defined production period (e.g. in kg, t, L or Nm^3) by a specific or generic calorific value for the same fuel (e.g. in MJ/kg, MJ/t, MJ/L or MJ/Nm^3).

In cases where fuel used to generate heat for drying operations is fed to a cogeneration system, the electricity generated by the system during the defined production period (measured in kWh and converted into MJ) should be subtracted from the total dryer fuel consumption reading.

Regarding CO_2 emissions:

For products from installations within the scope of Directive 2003/87/EC[21], the calculation of specific emissions per tonne of product shall be based on the emissions level and activity levels as per the monitoring methodology plan established under Article 6 of Regulation (EU) 2019/331[22] on free allocation rules.

For products from installations not within the scope of Directive 2003/87/EC, results shall be declared in accordance with the relevant calculation methodology defined in Commission Implementing Regulation (EU) 2018/2066[23].

In all cases, the specific CO_2 emission value shall be estimated at the level of the product(s) being offered for the call for competition.

*No other EU-based ecolabel schemes were identified during the screening exercise. Beyond the EU, GECA (Australia) criteria were found to be quite similar, but not fully equivalent.

**An exception to the 12 months can be made for production lines that are new and have been running for less than 12 months so long as a minimum of 2 months of data can be provided.

TS1.4. Energy consumption and CO_2 emissions for precast concrete or compressed earth products

The tenderer shall have established a program to systematically monitor, record and reduce specific energy consumption and specific CO_2 emissions to optimal levels* in the production plant where the products are manufactured. This shall explicitly cover any specific production line(s) for the products being procured. The tenderer shall report energy consumption as a function of energy source (e.g. electricity and diesel) and purpose (e.g. use of onsite buildings, lighting, cutting equipment operation, pumps and vehicle operation). The tenderer shall report on energy consumption for the site both on an absolute basis (in units of kWh or MJ) and on a specific production basis (in units of kWh or MJ per m^3, m^2 or t of material sold/produced and ready for sale) for a given calendar year.

A plan to reduce specific energy consumption and specific CO_2 emissions shall describe measures already taken or planned to be taken (e.g. more efficient use of existing equipment, investment in more efficient equipment, improved transportation and logistics etc.).

For cement or lime used in precast concrete, the specific CO_2 emissions shall not exceed the relevant mandatory limits defined below:

- Grey Portland cement clinker: 816 $kgCO_2$/t clinker
- Lime: 1028 $kgCO_2$/t hydraulic lime
- White Portland cement clinker: 1063 $kgCO_2$/t clinker
- Alternative cements: 571 $kgCO_2$/t cement

Verification:

*Precast concrete or compressed earth products which have been awarded the EU Ecolabel according to Commission Decision (EU) 2021/476, or with another EN ISO 14024 type I ecolabel** that has equivalent criteria, are deemed to comply with the requirements.*

Regarding energy consumption:

*The tenderer shall provide an energy inventory for the production plant for a period of at least 12 months*** prior to the deadline date of the call for competition. The energy inventory shall distinguish the different types of fuel consumed, highlighting any renewable fuels or renewable content of mixed fuels. As a minimum, the specific-energy consumption and CO_2 emission reduction plan must define the baseline situation with specific energy consumption at the precast concrete plant, when the plan was established. The plan must also identify and*

[21] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (OJ L 275, 25.10.2003, p.32).

[22] Commission Delegated Regulation (EU) 2019/331 of 19 December 2018 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council (OJ L 59, 27.2.2019, p. 8).

[23] In the EU Ecolabel it was written Commission Regulation (EU) No 601/2012, however Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council (OJ L 181, 12.7.2012, p. 30), is repealed by Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 601/2012 (OJ L 334, 31.12.2018, p. 1), so the Commission Implementing Regulation (EU) 2018/2066 is now mentioned.

clearly quantify the different sources of energy consumption at the precast concrete plant and identify and justify actions to reduce specific energy consumption and to report results on a yearly basis.

Regarding CO_2 emissions:

For products from installations within the scope of Directive 2003/87/EC[24], the calculation of specific emissions per tonne of product shall be based on the emissions level and activity levels as per the monitoring methodology plan established under Article 6 of Regulation (EU) 2019/331[25] on free allocation rules.

For products from installations not within the scope of Directive 2003/87/EC, results shall be declared in accordance with the relevant calculation methodology defined in Commission Implementing Regulation (EU) 2018/2066[26].

In cases where an alternative cement is used, the tenderer shall provide a copy of the carbon footprint analysis, which shall be in accordance with ISO 14067 and have been verified by an accredited third party. The footprint analysis must cover production of all of the main raw materials used and all chemical activators for life cycle stages A1-A3. In the absence of specific data from material suppliers, the generic emission factors from a life cycle inventory database should be used.

In all cases, the specific CO_2 emission value shall be estimated at the level of the product(s) being offered for the call for competition.

*Any program to reduce energy consumption will eventually reach an optimum level. Efforts to reduce energy consumption further than the optimal level are considered as those that would adversely affect product quality or consistency of quality.

**The screening exercise identified the Blue Angel criteria set our in DE-UZ 216 for precast concrete as suitably equivalent. Beyond the EU, GECA (Australia) criteria were found to be quite similar, but not fully equivalent.

***An exception to the 12 months can be made for production lines that are new and have been running for less than 12 months so long as a minimum of 2 months data can be provided.

Further information on energy and CO_2 emission requirements:

For more detailed technical aspects and references relating to the rationale for the EU GPP criteria recommended above on energy consumption and CO2 emissions, the reader is referred to the rationale sections for criteria 2.1 & 2.7 (natural stone), criterion 3.1 (agglomerated stone), criteria 4.1 & 4.2 (ceramic and fired clay) and 5.2 & 5.5 (cement and precast concrete) in the Technical Report for the EU Ecolabel criteria (Donatello et al., 2021).

For natural stone requirements

The criterion on energy consumption and CO_2 is largely inspired by similar approaches defined by the Natural Stone Council (NSC, 2011) in the US. The NSC criteria consider the following elements that relate to energy consumption:

- Systematic monitoring and recording of energy consumption (mandatory)
- Specific energy consumption reduction plan (optional)
- Renewable electricity (optional)
- Carbon footprint analysis (optional)

24 Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (OJ L 275, 25.10.2003, p.32).

25 Commission Delegated Regulation (EU) 2019/331 of 19 December 2018 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council (OJ L 59, 27.2.2019, p. 8).

26 In the EU Ecolabel it was written Commission Regulation (EU) No 601/2012, however Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council (OJ L 181, 12.7.2012, p. 30), is repealed by Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 601/2012 (OJ L 334, 31.12.2018, p. 1), so the Commission Implementing Regulation (EU) 2018/2066 is now mentioned.

The mandatory element already overlaps quite well with any organisation that would be EMAS registered or ISO 14001 certified, although it is unlikely that many natural stone quarries or transformation plants would be EMAS registered or ISO 14001 certified. In any case, the gathering of such data is vital for optimising energy consumption and would also be required anyway for any product-focussed carbon footprint or environmental product declaration.

The specific energy consumption reduction plan is optional in the NSC approach but is made mandatory in the EU GPP criteria (and in EU Ecolabel criteria) because this is the only way to be sure that the tenderer is made aware of the potential for improvement.

Neither the NSC nor the EU Ecolabel criteria set specific benchmarks for energy consumption because this is notoriously difficult to do so for natural stone quarries. Actual energy consumption varies by the nature of the rock, the cutting technique and equipment used and the site topography. In turn, the choice of cutting equipment is partly dictated by site topography, rock type and rock quality, and thus the resulting specific energy consumption.

For agglomerated stone requirements

Energy is consumed first of all by crushing the natural stone to the required fineness. The crushed material is mixed with resins in batching mixers before it is fed into a mould. In the mould, vibration, vacuum/pressure and heat may be applied to create optimum and reproducible conditions for the resin/crushed rock mixture to set in a reproducible way. The technology is highly standardised via patented BretonStone technology, which is entirely electricity based. Improvements in specific electricity consumption have occurred via piecemeal improvements in successive generations of BretonStone technology. Newer models produce bigger slabs and offer better quality control. Further energy is consumed via surface treatment and finishing operations.

Feedback from industry stakeholders in response to an EU Ecolabel questionnaire implied that a specific consumption of 1.1 MJ/kg would be suitably ambitious as a mandatory requirement and the lowest value achievable would be 0.7 MJ/kg. This lower value presumably reflects advances in the production process technology since 2009.

There was no apparent difference in energy values as a function of the type of rock material used (i.e. marble or quartz).

Due to doubts about the importance of energy consumption for grinding of raw stone material, and the variable values that could result depending on the grain size of feed rock and product powder, it was decided to set the specific electricity consumption values <u>exclusive of the electricity consumed in grinding operations</u>. However, in order to better inform researchers in any future revision of this criterion, the electricity consumption associated with grinding should be reported by the tenderer if grinding is carried out onsite, or by their supplier if supplied material is already ground.

For ceramic and fired clay requirements

Overall, a general rule of thumb for a ceramic and fired clay products included in the EU Ecolabel scope is that total energy consumption is approximately 90% fuel and 10% electricity. Consequently, it was considered justifiable for the energy criterion to continue to focus only on fuel consumption.

Fuel consumption in drying processes is also considered in the new criterion since it is particularly significant to the total fuel consumption in ceramic tile production. For example, Mezquita et al., (2014) stated that around 45% of total fuel consumption for the production of ceramic tiles could be attributed to drying processes (36% due to spray drying and 9% due to ceramic body drying).

Thresholds were set not only for kiln firing but also drying of material before it enters the kiln because the energy consumption of these two stages are interlinked.

For cement and precast concrete requirements

The CO_2 footprint (and embodied energy) of concrete is dominated by its cement content, despite the fact that cement only accounts for some 10-15% by weight of concrete. For example, Flower and Sanjayan (2007) found that cement was responsible for 74-81% of the CO_2 footprint of concrete. The cement content in concrete cannot be varied very much due to requirements for minimum early strength and workability of the fresh mix. However, the composition of the cement can be altered with a view to lowering its CO_2 footprint. For these reasons, the criterion on CO_2 emissions is focused directly on cement rather than on concrete.

Criterion TS2: Emissions to air

Based on EU Ecolabel criteria 2.9 and 3.2 (for natural stone and agglomerated stone), criterion 4.4 (for ceramics and fired clay) and on criterion 5.3 (for cement used in precast concrete) as established by Commission Decision (EU) 2021/476.

Technical specifications (TS)

TS2.1. Control of dust emissions at natural stone or agglomerated stone production facilities

The tenderer shall demonstrate that operational site measures have been implemented for dust control at the natural stone transformation plant or agglomerated stone production facility, as relevant. Measures should include the following aspects for all production sites:

- Use of dust suppression water sprays or vacuum hoods linked to dust filter bags/electrostatic precipitators for any dry cutting or shaping activities that are likely to generate significant quantities of dust.
- Regular cleaning of dust from indoor floor areas using either water sprays on surfaces that drain to a water treatment system onsite or the use of a vacuum device for dry dust removal (sweeping of dry dust should not be carried out).
- Provision of an enclosed storage area for all dewatered sludge from wet cutting and/or all dust from dry cutting operations prior to sale, prior to shipment for reuse, prior to reuse onsite or prior to shipment to landfill.
- Covering the most heavily used road areas with concrete or asphalt paving.
- Provision of appropriate training* to employees about good practice for dust control and provision of adequate personal protective equipment** to employees and visitors.
- Provision of routine medical check-ups for employees, with the possibility for more frequent monitoring for the identification of respiratory problems and possible onset of silicosis (the latter point being applicable only to transformation plants processing granite and other siliceous rock).

Verification:

*Natural stone or agglomerated stone products which have been awarded the EU Ecolabel according to Commission Decision (EU) 2021/476, or with another EN ISO 14024 type I ecolabel*** that has equivalent criteria, are deemed to comply with the requirements.*

The tenderer shall provide a declaration of compliance with this criterion, supported by relevant documentation and: (i) a description of the dust control measures implemented at the natural stone transformation plant or agglomerated stone production facility, and (ii) details of the medical check-up system for employees, as appropriate.

*Appropriate training in this context means training on good practice to reduce the extent of dust emissions from site activities in general and to be aware of and competent in measures and behaviours to reduce exposure to dust already in the atmosphere.

**Adequate personal protective equipment refers to the provision of earplugs, safety helmets, safety boots, safety glasses and masks to any staff or visitors that are exposed to high noise levels, areas of dust emission and any other areas where heavy machinery is operating.

***No other EU-based ecolabel schemes were identified during the screening exercise. Beyond the EU, GECA (Australia) criteria were found to be quite similar, but not fully equivalent.

TS2.2. Control of dust, HF, NOx and SOx emissions at ceramic and fired clay production sites

Measures to reduce dust emissions from "cold" dusty operations at the ceramic tile production site shall cover at least the reception, blending and milling of raw materials and the shaping and glazing/decoration of tiles.

The specific dust, HF, NOx and SOx emissions to air associated with the production of ceramic or fired clay products shall not exceed the relevant mandatory limits defined in the table below.

Emission parameter	Mandatory limit	Test method
Dust (kiln)	50 mg/kg	EN 13284
HF (kiln)	20 mg/kg	ISO 15713
NOx as NO_2 (kiln)	250 mg/kg	EN 14792
SOx as SO_2 (kiln)	1300 mg/kg	EN 14791

Verification:

Ceramic or fired clay products which have been awarded the EU Ecolabel according to [Commission Decision (EU) 2021/476](), or with another EN ISO 14024 type I ecolabel that has equivalent criteria, are deemed to comply with the requirements.*

*The tenderer shall provide a declaration of compliance with the mandatory requirements of this criterion, supported by (i) a description of the measures in place to reduce dust emissions from "cold" dusty operations and, (ii) site data in mg/Nm^3 and expressed as an annual average** value calculated from daily average values. The data shall have been generated via continuous or periodic monitoring according to relevant EN or ISO standards. In cases of periodic monitoring, at least three samples shall be taken during stable running of the kiln for production runs of the product(s) being offered.*

In cases where production data is only available in m^2 but needs to be reported in kg, the value should be converted using a fixed bulk density factor (in kg/m^2) for the products being offered.

*Data should be representative of any production line(s) for a 12-month period** prior to the deadline date of the call for competition. Data for specific individual products from shorter production runs should be representative of stable conditions during the actual production run(s).*

To convert exhaust gas monitoring results from mg/Nm^3 (at 18% O2 content) into mg/kg of ceramic/fired clay product, it is necessary to multiply by the specific gas flow volume (Nm^3/kg product). One Nm^3 refers to one m^3 of dry gas under standard conditions of 273K and 101.3 kPa.

In case it is not possible to provide specific data for a production line or product, the tenderer shall refer to data for the entire plant and allocate emissions to the EU Ecolabel production on a per mass basis.

*No other EU-based ecolabel schemes were identified during the screening exercise. Beyond the EU, GECA (Australia) criteria were found to be quite similar, but not fully equivalent.

**For production lines that are new and have been running for less than 12 months, representative data for a shorter period can be accepted in lieu of the annual average so long as a minimum of 2 months of data can be provided.

TS2.3. Control of dust, NOx and SOx emissions at cement or lime kilns for cement or lime used in precast concrete products

Any alternative cements with a clinker content less than 30 % by weight shall be considered as exempt from this technical specification.

The specific dust, NOx and SOx emissions to air from the cement kiln or lime kiln shall not exceed the relevant mandatory limits defined in the table below:

Emission parameter	Mandatory limit	Test method
Dust (kiln)	34.5 g/t clinker or hydraulic lime	EN 13284
NOx as NO_2 (kiln)	1472 g/t clinker or hydraulic lime	EN 14791
SOx as SO_2 (kiln)	460 g/t clinker or hydraulic lime	EN 14792

Verification:

Precast concrete or compressed earth products which have been awarded the EU Ecolabel according to [Commission Decision (EU) 2021/476](), or with another EN ISO 14024 type I ecolabel that has equivalent criteria, are deemed to comply with the requirements.*

*The tenderer shall provide a declaration of compliance with the mandatory requirements of this criterion, supported by site data for emissions from the cement kiln or lime kiln, in mg/Nm^3 and expressed as an annual average** value calculated from daily average values. The site data shall have been generated via continuous monitoring according to relevant EN standards or equivalent ISO standards.*

To convert exhaust gas monitoring results from mg/Nm^3 (at 10 % O2 content) into g/t of clinker, it is necessary to multiply by the specific kiln gas flow volume (Nm^3/t clinker). The specific gas flow volumes for cement kilns typically range from 1700 to 2500 Nm^3/t clinker. The cement producer must clearly state the specific airflow rate in the calculations of dust, NOx and SOx emissions. One Nm^3 refers to one m^3 of dry gas under standard conditions of 273K and 101.3 kPa.

To convert exhaust gas monitoring results from mg/Nm^3 (at 11 % O_2 content) into g/t of lime, it is necessary to multiply by the specific kiln gas flow volume (Nm^3/t lime). The specific gas flow volumes for lime kilns can generally range from 3000 to 5000 Nm^3/t lime, depending on the kiln type used. The lime producer must clearly state the specific airflow rate in the calculations of dust, NOx and SOx emissions. One Nm3 refers to one m^3 of dry gas under standard conditions of 273K and 101.3 kPa.

*For continuous production campaigns, data should be representative of a 12-month period** prior to the deadline date of the call for competition. For shorter production campaigns, the actual production period(s) shall be stated and site data should represent at least 80 % of the production campaign.*

In case it is not possible to provide specific data for a production line or product, the tenderer shall refer to data for the entire plant.

*No other EU-based ecolabel schemes were identified during the screening exercise. Beyond the EU, GECA (Australia) criteria were found to be quite similar, but not fully equivalent.

**For production lines that are new and have been running for less than 12 months, representative data for a shorter period can be accepted in lieu of the annual average so long as a minimum of 2 months of data can be provided.

Further information on emissions to air:

For more detailed technical aspects and references relating to the rationale for the EU GPP criteria recommended above on energy consumption and CO2 emissions, the reader is referred to the rationale sections for criteria 2.4 & 2.9 (natural stone), criterion 3.2 (agglomerated stone), criteria 4.4 (ceramic and fired clay) and 5.3 (cement for precast concrete) in the Technical Report for the EU Ecolabel criteria (Donatello et al., 2021).

For natural stone and agglomerated stone production:

The minimisation of dust emissions is a key environmental issue and operational plans and equipment should be designed to reduce dust emissions both for the health and safety of workers and local residents.

Dust emissions can be limited on site through a variety of potential control measures. The exact combination of measures required at a site can vary widely, and depends on the production and shipping rates, size of the site, and distance to neighbouring residents. Therefore the criterion does not require a specific technique or measure to be implemented but the assessment and implementation of the most convenient techniques to minimise the air quality impacts.

Practical measures and best management practices must be implemented to prevent or mitigate impacts on the air quality within the local areas. Examples of potential control measures can include:

- Spraying, washing, vacuum sweeping and paving of haul roads, parking areas, entrances and exits.
- Reducing haul trips and limiting speeds on unpaved roads.
- Wetting material prior to processing or loading.
- Covering stockpiles, conveyor belts, and loads in trucks.
- Locating stockpiles in locations that limit their exposure to wind.
- Scheduling loading, unloading and blasting activities on days when there is less wind.
- Proper loading of trucks.
- Lowering the drop distances at transfer points.
- Minimising the area of disturbance and progressively revegetating disturbed areas as soon as possible to reduce erosion and minimize dust.

Additionally, education, awareness and training of staff on dust prevention, control measures, monitoring and reporting are important in reducing dust emissions at a quarry operation.

For ceramic and cement or lime production:

The ceramic, cement and lime produce high and low temperature emissions to air. Low temperature emissions mainly carry dust, while high temperature exhaust gases also carry significant concentrations of NOx and potentially SOx and HF. Both dust and NOx emissions are considered as major contributors to adverse human health and premature mortality. Emissions of NOx have the added impact of contributing to eutrophication, and emissions of NOx, SOx and HF all contribute to the acidification of rainwater. For these reasons, EU legislation and monitoring technologies have especially focused on these types of emissions.

Criterion TS3: Process waste reuse

Based on EU Ecolabel criterion 2.10 (for natural stone), criterion 3.5 (for agglomerated stone), criterion 4.6 (for ceramic and fired clay) and criterion 5.4 (for precast concrete) as established by Commission Decision (EU) 2021/476.

Technical Specification (TS)
TS3.1. Reuse of process waste from the natural stone transformation plant or production facilities for agglomerated stone or ceramic/fire clay products The tenderer shall complete an inventory of process waste production for the transformation plant or agglomerated stone production facility. The inventory shall detail the type and quantity of waste produced (e.g. process scrap* and process sludge**). The process waste inventory shall cover a 12 month*** period and, during that same period, the total product output shall be estimated both in terms of mass (kg or tonne) and surface area (m^2). For natural stone products: At least 80% by mass of the process scrap generated from natural stone processing operations onsite shall be reused in other applications or stored onsite in preparation for future sale. For agglomerated stone products: At least 70% of process waste (scrap plus sludge) generated from agglomerated stone slab and block production shall be reused in other production processes. For ceramic/fired clay products: At least 90% by mass of the process waste (scrap plus sludge) generated by ceramic or fired clay product manufacturing shall be reincorporated into the production process onsite, be reincorporated into ceramic or fired clay production processes offsite or be reused in other production processes. Verification: *Natural stone, agglomerated stone, ceramic or fired clay products which have been awarded the EU Ecolabel according to Commission Decision (EU) 2021/476, or with another EN ISO 14024 type I ecolabel† that has equivalent criteria, are deemed to comply with the requirements. The tenderer shall provide a waste inventory for the transformation plant for a period of at least 12 months prior to the deadline date of the call for competition.* *The tenderer shall provide a declaration of compliance with this criterion, supported by a calculation of total production process scrap (in kg or t). Details about the destination of these process wastes shall also be provided with clarifications about whether it is external reuse in another process or sent to landfill. For any external reuse or landfill disposal, shipment notes shall be presented.* *'Process scrap' means fragments and trimmings from cutting operations and reject products in the production of natural stone or agglomerated stone hard covering products. **'Process sludge' means solids recovered from the onsite treatment of wastewater resulting from dust control, cutting and/or finishing operations in the production of natural stone, agglomerated stone or ceramic/ fired clay hard covering products. ***An exception to the 12 months can be made for production lines that are new and have been running for less than 12 months so long as a minimum of 2 months of data can be provided. †No other EU-based ecolabel schemes were identified during the screening exercise. Beyond the EU, GECA (Australia) criteria were found to be quite similar, but not fully equivalent.
TS3.2. Reuse of process waste from precast concrete production The tenderer shall have procedures in place for any batches of returned or rejected concrete in which all returned/rejected material is either: - Recycled directly into new concrete batches which are cast prior to the returned/rejected concrete hardening; or - Recycled as aggregate in new batches after returned/rejected concrete hardening: or - Recycled offsite either prior to or after hardening as part of a contractual arrangement with a third party. Verification: *Precast concrete products which have been awarded the EU Ecolabel according to Commission Decision (EU) 2021/476, or with another EN ISO 14024 type I ecolabel* that has equivalent criteria, are deemed to comply with the requirements.* *A monthly balance sheet of recycled/secondary materials and responsibly sourced materials shall be presented*

*based on the 12 months** of production prior to the deadline date of the call for competition. The balance sheet shall provide the quantities of ingoing recycled/secondary materials (justified by delivery notes and invoices) and outgoing recycled/secondary materials in all sold or ready for sale precast concrete production with recycled/secondary material or responsibly sourced content claims (justified by product quantities and % claims).*

Due to the batch nature of the precast concrete production process, recycled/secondary material content claims shall be based on mix compositions used at the batch level. Allocation of recycled/secondary/responsibly sourced materials shall not be permitted.

*The screening exercise identified the Blue Angel criteria set out in DE-UZ 216 for precast concrete as suitably equivalent. Beyond the EU, GECA (Australia) criteria were found to be quite similar, but not fully equivalent.

**An exception to the 12 months can be made for production lines that are new and have been running for less than 12 months so long as a minimum of 2 months of data can be provided.

Further information on process waste reuse:

For more detailed technical aspects and references relating to the rationale for the EU GPP criteria recommended above on energy consumption and CO2 emissions, the reader is referred to the rationale sections for criteria 2.10 (natural stone), criterion 3.5 (agglomerated stone), criteria 4.6 (ceramic and fired clay) and 5.4 (precast concrete) in the Technical Report for the EU Ecolabel criteria (Donatello et al., 2021).

For natural stone waste:

It is important to distinguish between process sludge (contains traces of metals from cutting abrasion and grease and any flocculants used to aid sedimentation) and process scrap (solid fragments and trimmings from cutting operations as well as rejected products). The latter is much easier to reuse because it has no undesirable pollutants and is essentially natural rock. Unlike agglomerated stone, ceramic, fired clay or precast concrete or production, there is no real opportunity for the process sludge to be reincorporated into the natural stone production process.

Another complicating factor in waste reuse is the normal practice is that a plant may process blocks from a large number of quarries, resulting in a high heterogeneity of the process waste (e.g. granite and marble process scrap being mixed together).

Reuse of natural stone process sludge: Given the costs of the potential transportation of this this waste and the environmental impact that can be caused by the large volumes of sludge produced, studies have been performed examining its potential reuse in civil construction. In its natural state, after dewatering, the waste sludge has a moisture level between 20 and 30%.

In a comprehensive review of the potential reuse of dimension stone waste in concrete, Rana et al., (2016) concluded that the reuse potential was highest for the substitution of coarse aggregates (100%), then fine aggregates (5 to 100% depending on the type of waste) and then cement replacement (up to 20% for quarry dust).

For agglomerated stone process waste:

Waste from the agglomerated stone production process may originate from cutting operations, reject batches, finishing operations and so on.

There is also likely to be a significant difference between process waste from quartz-based products and marble-based products. The former have the disadvantage of potentially containing crystalline silica fines, which may require special handling and disposal operations due to health hazards associated with fine particulate crystalline silica that restrict potential reuse and recycling options.

However, the reuse of process waste was especially viable in cement production, due to the pure streams of Ca from calcium carbonate set in organic resin or of Si from quartz set in organic resin. For this reason, a mandatory minimum reuse of process waste of 70% was considered justifiable.

For ceramic/fired clay process waste:

Process waste from ceramic production has a high potential to be reused within the same process that generated it. In particular, sludge and dust from "*cold processes*" can be directly returned to wet grinding processes as new raw materials or dried first before being incorporated into dry grinding processes.

Allowance has to be made for the external reuse of these materials since some ceramic tile producers simply buy spray dried material and so do not have a significant material grinding capacity onsite.

In terms of onsite reuse, sludge production has been estimated to be in the range of 0.09 to 0.15 kg/m^2 which, if completely reincorporated to the production of ceramic tiles of 20 kg/m^2 density, would amount to approximately 0.4 to 1.0% of the total produced ceramic tile mass (BREF, 2007). Such small additions are not expected to have any adverse effect on the predictability of raw body physical properties.

Unfired reject material can easily be reincorporated into the ceramic tile production process as well as small amounts of fired materials. Due to the toughness of fired material, it may be considered as a very useful secondary aggregate in road base, geotechnical fill or concrete.

Wastes from flue gas treatment will be more difficult to find reuse applications for. However, in cases where SO_2 emissions are a concern and hydrated lime is used in gas scrubbing, the generated flue gas desulphurisation residue can potentially be used in other industries such as plasterboard and cement production.

For precast concrete process waste:

A large volume of research has been published regarding the use of recycled aggregates in concrete products. Structural engineers are reluctant to use recycled aggregates in structural concrete due to concerns about consistency of technical properties, especially the fact that recycled aggregates tend to be weaker than natural ones and that they will show a higher, and more variable water absorption. Poon et al., (2002) explained that any concerns about recycled aggregate in structural concrete do not extend to mechanically moulded concrete bricks and blocks. The authors demonstrated that up to 100% of the natural aggregate could be replaced by recycled aggregate of a suitable size distribution with only a minor decrease in compressive strength, a minor reduction in density, a minor increase in drying shrinkage and a notable increase in skid resistance. With both brick and paving blocks, the same authors showed that a 50% replacement of natural aggregates by recycled aggregates improved all physical properties.

Since waste rates will be well below 50% of production volumes, it can be considered highly feasible that all non-hazardous waste from the precast concrete process could be reused or recycled or returned into the same process that generated it.

4 Conclusions

This report acts as a guide for public procurers to know how to define criteria in calls for competition that help stimulate demand for green products. Furthermore, verification of compliance with such green requirements has been made potentially easy by aligning them with green criteria already defined for and met by relevant products that carry the EU Ecolabel and, in some cases, other labels too.

The market analysis revealed that sales of natural stone, ceramics and precast concrete have increased significantly in the last 3-4 years, to the extent that sales finally have recovered (or exceeded) sales levels before the global economic crisis in 2008. For ceramic products at least, part of the sales increase is due to important increases in average unit prices, perhaps caused by the energy crisis and spikes in wholesale gas prices.

When looking for good practice examples of typical procurement exercises involving these products, some examples were found for all the main Common Procurement Vocabulary codes. However, upon closer inspection, hard covering products where around half of the time just a minor element of works contracts (where labour costs and other materials dominate the overall price and criteria). In supplies contracts, hard covering products were often just one of a broad group of construction materials being procured. A few calls for competition dedicated to the procurement of hard covering products could indeed be found though, especially relating to paving works and supplies.

The main environmental hotspots all focused on the production stages, but differed depending on the sub-product in question. For natural stone, significant environmental impacts were associated with the upstream production of quarry blocks. With precast concrete, upstream impacts were even more significant, related to cement or lime production. With agglomerated stone and ceramic/fired clay production, hotspots were associated with the core processes, as this was where most energy was consumed. Impacts associated with upstream production of resin for agglomerated stone could not be investigated due to a lack of data.

To conclude, the EU Ecolabel criteria considered most appropriate for use in recommended EU GPP criteria are as follows:

- Energy consumption and CO_2 emissions (TS based on energy inventories and reduction plans where benchmarks could not be easily set, or on direct benchmarks).
- Emissions to air (TS based on dust for all sub-categories, but also on SOx and NOx when combustion processes were major sources of life cycle impacts, and also HF in the case of ceramics) to minimise effects on local and regional air quality, to reduce acidification potential and to protect human health.
- Process waste reuse (TS based on waste inventories and benchmarks set for all process waste or just for process scrap in the case of natural stone) to ensure that wastes are collected and sorted to maximise recycling and recovery potential and reduce demand on virgin materials.

Any hard covering products carrying the EU Ecolabel can be automatically assumed to comply with all of the EU GPP criteria recommended in this report. Other ISO 14024 type I ecolabels may also demonstrate proof of compliance with some or all of the recommended EU GPP criteria but these need to be carefully checked.

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List of abbreviations and definitions

AC	Award Criterion/Criteria
CPV	Common Procurement Vocabulary
EC	Exclusion Criterion/Criteria
EMAS	Eco-Management and Audit Scheme
EPD	Environmental Product Declaration
GDP	Gross Domestic Product
GECA	Good Environmental Choice Australia
GPP	Green Public Procurement
ISO	International Standards Organisation
NOx	Nitrogen Oxides
REACH	Registration, Evaluation, Authorisation and restriction of CHemicals
SC	Selection Criterion/Criteria
SME(s)	Small and Medium Enterprise(s)
SOx	Sulphur Oxides
SVHC	Substances of Very High Concern
TED	Tenders Electronic Daily
TS	Technical Specification
VOC(s)	Volatile Organic Compound(s)

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Table 7. Screening of EU Ecolabel criteria for suitability in EU GPP criteria

EU Ecolabel criterion	Relevance to subject matter	Ease of verification without EU Ecolabel	Environmental relevance	Recommendation for use in EU GPP criteria
Horizontally applicable to all sub-types of hard covering products				
1.1 Industrial and construction mineral extraction	Directly related – these raw materials all end up in the final product in one form or another.	Would need cooperation of third-party suppliers and intermediate actors. Very difficult if coming from non-EU sources. The more raw materials and sources used, the more difficult to verify.	Relevant to land use and biodiversity impacts of the hard covering product manufacture.	Not recommended as a priority criterion. Could be included as an award criterion.
1.2. Restricted substances (a) SVHCs and (b) defined CLP hazards	Directly related – about hazardous substances remaining in the final products.	Possible to verify (a) on SVHCs thanks to requirements of REACH Regulation Articles 7(2) and 33, but requires information from many suppliers. Very difficult to verify, requires detailed information from suppliers on chemicals used and estimates of how much remains in the final product.	Not considered an environmental hotspot or related to circular economy objectives for this particular product group.	Not recommended to be prioritized for use in EU GPP criteria.
1.3.VOC emissions	Directly related – about emission from the final product.	Can be tested by third party laboratories according to EN 16516.	Not considered an environmental hotspot and a minor issue for these types of material, except maybe for agglomerated stone.	Only recommended if explicitly purchasing agglomerated stone.
1.4. Fitness for use	Directly related – about the technical performance of the product	Quite straightforward as it refers to a paperwork on legal conformity with the construction products regulation and internal quality management.	Not considered an environmental hotspot or related to circular economy objectives.	Could be used in normal public procurement criteria, but not "green" as such.
1.5. User information	Directly related – about how to install or maintain and dispose of the product.	Can be easily verified by receiving a copy of the user information.	Has some indirect environmental relevance if it reduces wastage during installation and encourages proper maintenance and disposal at end-of-life.	Not recommended as a priority EU GPP criterion.
Applicable to natural stone hard covering products				
2.1. Energy consumption at the quarry	Directly related – but at the upstream level. All natural stone	Verification is straightforward if the producer of the final product also runs the quarry as they will have	Energy consumption at the quarry is a significant environmental hot spot.	Only recommended if explicitly purchasing natural stone and only as an

EU Ecolabel criterion	Relevance to subject matter	Ease of verification without EU Ecolabel	Environmental relevance	Recommendation for use in EU GPP criteria
	products are ultimately coming from a quarry.	the data to make the inventory. More complicated if quarry is run by another entity.		award criterion, since it requires going to upstream supplier.
2.2. Material efficiency at the quarry	Only indirectly related – about efficiency of extraction and result is influenced by fate of by-products to other sites/processes.	Verification is straightforward if the producer of the final product also runs the quarry as they will have the data to make the inventory. More complicated if quarry is run by another entity.	Of high relevance to the overall environmental impact of the product. The criteria fit well with circular economy objectives.	Only recommended if explicitly purchasing natural stone products.
2.3. Water/wastewater management at the quarry	Only indirectly related – about site management where the stone was quarried.	Verification is straightforward if the producer of the final product also runs the quarry as they will have the data to make the inventory. More complicated if quarry is run by another entity.	An important environmental issue that is often poorly managed or overlooked.	Only recommended if explicitly purchasing natural stone products.
2.4. Dust control at the quarry	Only indirectly related – about site management where the stone was quarried.	Verification is straightforward if the producer of the final product also runs the quarry as they will have the data to make the inventory. More complicated if quarry is run by another entity.	An important environmental issue that is often poorly managed or overlooked.	Recommended as an EU GPP criterion – can be applied to all four sub-products too.
2.5. Personnel safety and working conditions at the quarry	Not related. About staff conditions at the upstream quarry.	Verification is straightforward if the producer of the final product also runs the quarry as they will have the data to make the inventory. More complicated if quarry is run by another entity.	No environmental relevance. A social issue.	Not recommended to be used in EU GPP criteria.
2.6. Quarry landscape impact ratios (optional)	Rejected because it is an optional requirement to gain more points in the EU Ecolabel. EU Ecolabel is thus no guarantee of compliance.			
2.7. Energy consumption at the transformation plant	Directly related. The energy used to convert a quarry block into the final product.	Verification is straightforward since it relates to the energy management system and data of the producer.	Energy consumption at the transformation plant is a significant environmental hot spot.	Recommended as an EU GPP criterion – can be applied to all four sub-products too.
2.8. Water/wastewater management at the transformation plant	Directly related – about water consumption and treatment when making the final product.	Verification is straightforward since it relates to the water management and wastewater treatment system of the producer.	Water consumption is not an environmental hotspot.	Not recommended to be prioritized for use in EU GPP criteria.
2.9. Dust control at the transformation plant	Directly related – about dust emissions and abatement when making the final product.	Verification is straightforward since it relates to the dust control system of the producer.	Dust emissions are an important issue for the health and safety of workers.	Recommended as an EU GPP criterion – can be applied to all four sub-products too.
2.10. Reuse of process waste from the transformation	Directly related – about the management of waste produced	Verification is straightforward since it relates to the waste management system and data of the	An important environmental issue that is often poorly managed or overlooked. Of	Recommended as an EU GPP criterion – can be applied to all four sub-products

EU Ecolabel criterion	Relevance to subject matter	Ease of verification without EU Ecolabel	Environmental relevance	Recommendation for use in EU GPP criteria
plant	when making the final product.	producer.	particular relevance to circular economy objectives.	too.
2.11. Regionally integrated production at the transformation plant (optional)	Rejected because it is an optional requirement to gain more points in the EU Ecolabel. EU Ecolabel is thus no guarantee of compliance.			
Applicable to agglomerated stone hard covering products				
3.1. Energy consumption	Directly related – the energy consumed to convert the raw mineral materials and resin into a final product.	Verification is straightforward since it relates to the energy management system and data of the producer.	Energy consumption at the agglomerated stone factory is a significant environmental hot spot.	Recommended as an EU GPP criterion – can be applied to all four sub-products too.
3.2. Dust control and air quality	Directly related – about dust emissions and abatement when making the final product.	Verification is straightforward since it relates to the dust control system of the producer.	Dust emissions are an important issue especially for the health and safety of workers (and especially with crystalline silica).	Recommended as an EU GPP criterion – can be applied to all four sub-products too.
3.3. Recycled/secondary material content	Rejected because no minimum recycled/secondary material content is guaranteed by this criterion (linked to optional points). EU Ecolabel is thus no guarantee of compliance.			
3.4. Resin binder content	Directly related – resin has a high specific environmental footprint and remains in the final product (in a reacted form).	Verification is straightforward since it relates to the mix formulation used by the producer. This information is often provided on data sheets too.	Can have a significant impact on the overall environmental footprint of the agglomerated stone product.	Only recommended if explicitly purchasing agglomerated stone.
3.5. Reuse of process waste	Directly related – about the management of waste produced when making the final product.	Compliance is straightforward since it relates to the waste management system and data of the producer.	Of particular relevance to circular economy objectives.	Recommended as an EU GPP criterion – can be applied to all four sub-products too.
Applicable to ceramic and fired clay hard covering products				
4.1. Fuel consumption for drying and firing	Directly related – the energy consumed to convert the raw materials into a final product.	Verification is straightforward since it relates to the energy management system and data of the producer.	Energy consumption at the ceramic factory is the major environmental hotspot.	Recommended as an EU GPP criterion – can be applied to all four sub-products too.
4.2. CO_2 emissions	Directly related – the CO_2 emitted when converting the raw materials	Verification is straightforward if the producer is already recording CO_2 emissions. Allocation to	Related to energy (natural gas) consumption, CO_2 emissions are a major	Only recommended if explicitly purchasing ceramic or fired clay

EU Ecolabel criterion	Relevance to subject matter	Ease of verification without EU Ecolabel	Environmental relevance	Recommendation for use in EU GPP criteria
	into a final product at the production site.	different products requires extra work.	environmental hotspot.	products.
4.3. Process water consumption	Directly related – about water consumption when making the final product.	Verification is straightforward since it relates to the metered water data of the producer.	Not an important environmental hotspot.	Not recommended to be prioritized for use in EU GPP criteria.
4.4. Emissions of dust, HF, NOx and SOx to air	Directly related – about emissions of pollutants to air and their abatement when making the final product.	Verification is straightforward in the sense that it relies on data from the producer. But allocation of emissions to different products is complicated.	Emissions to air are a significant environmental hotspot, especially regarding acidification potential.	Recommended as an EU GPP criterion – can be applied to all four sub-products too.
4.5. Wastewater management	Directly related – about the treatment of wastewater generated when making the final product.	Verification is straightforward if a zero wastewater discharge system is used or if wastewater is treated onsite. Complicated if treated in a third party operated wastewater treatment plant	Not an important environmental hotspot.	Not recommended to be prioritized for use in EU GPP criteria.
4.6. Reuse of process waste	Directly related – about the management of waste produced when making the final product.	Verification is straightforward since it relates to the waste management system and data of the producer.	Of particular relevance to circular economy objectives.	Recommended as an EU GPP criterion – can be applied to all four sub-products too.
4.7. Glazes and inks	Directly related – glazes are added to the product and remain in it.	Verification should be straightforward if Safety Data Sheets can be obtained.	Of particular relevance to circular economy objectives because the presence of lead or cadmium could present barriers to recycling.	Only recommended if explicitly purchasing ceramic or fired clay products.
Applicable to precast concrete or compressed earth-type hard covering products with a hydraulic binder (i.e. cement or lime)				
5.1. Clinker factor	Rejected because it is an optional requirement to gain more points in the EU Ecolabel. EU Ecolabel is thus no guarantee of compliance.			
5.2. CO_2 emissions	Directly related – about CO_2 emissions from cement production, which remains in the final product (in a reacted form).	Verification relies on cooperation of the upstream cement supplier. CO_2 emissions estimated at factory level - difficult to allocate CO_2 emissions to individual cement formulations when multiple formulations made at same site.	A highly relevant environmental hotspot.	Only recommended if explicitly purchasing precast concrete products.
5.3. Emissions of dust, NOx and SOx to air	Directly related – about dust, NOx and SOx emissions from cement production, which remains in the final product (in a reacted form).	Verification relies on cooperation of the upstream cement supplier. Expected to be very difficult to get this data even for factory level emissions, let on for emissions allocated to the individual cement	A highly relevant environmental hotspot.	Recommended as an EU GPP criterion – can be applied to all four sub-products too.

EU Ecolabel criterion	Relevance to subject matter	Ease of verification without EU Ecolabel	Environmental relevance	Recommendation for use in EU GPP criteria
		product.		
5.4. Recovery and responsible sourcing of raw materials	Directly related – about the management of waste produced when making the final product.	Verification is straightforward since it relates to the waste management system and data of the producer.	Of particular relevance to circular economy objectives.	Recommended as an EU GPP criterion – can be applied to all four sub-products too.
5.5. Energy consumption	Directly related – the energy consumed to convert the raw mineral materials and cement into a final product.	Verification is straightforward since it relates to the energy management system and data of the producer.	A potentially relevant environmental hotspot.	Recommended as an EU GPP criterion – can be applied to all four sub-products too.
5.6. Environmentally innovative product designs (optional)	Rejected because it is an optional requirement to gain more points in the EU Ecolabel. EU Ecolabel is thus no guarantee of compliance.			

Annex 2. Indicative information about the equivalent requirements established by selected ISO 14024 type I ecolabels schemes that are relevant to the EU GPP criteria recommended in this report

Table 8. Equivalent requirements established by selected ISO 14024 type I ecolabels schemes that are relevant to the EU GPP criteria recommended in this report

Proposed GPP criterion	EU Ecolabel criteria for hard covering products [27]	Blue Angel for concrete products containing recycled aggregates for outdoor flooring [28]	GECA criteria for hard surfacing [29]	GECA criteria for cement, concrete & concrete products[30]
TS1.1: Energy consumption and CO_2 emissions for natural stone products	An energy inventory needs to be kept that systematically monitors and records specific energy consumption and specific CO_2 emissions (i.e. energy consumption and CO_2 emissions per unit of final product). There also needs to be plan established that aims to reduce the specific energy consumption and CO_2 emissions to optimal levels. This inventory and plan should have been established for at least 12 months prior to the deadline date of being awarded the EU Ecolabel. This means that anyone with the EU Ecolabel already has at least 12 months of inventory data.	Not applicable to scope.	Can be considered as almost fully equivalent (only doubt is on the 12 months of data). A part of criterion 24 states that "*Tenderers shall undertake an energy audit including all energy flows in the production process for the purpose of informing future energy efficiency improvements*". And criterion 28 states that: "*The tenderer/ manufacturer shall have and implement a formal environmental management system, based on ISO 14001 that [...] include energy management and CO_2 emissions related to the production of the product.*"	Not applicable to scope.
TS1.2. Energy consumption for agglomerated stone products	A specific electricity consumption limit of 1.1 MJ/kg must be complied with. This data can be based on batch or production line-specific data due to the options with metering electricity. If grinding of raw material is carried out onsite, it should be reported to, but not included in the limit, since this could	Not applicable to scope.	Can be considered as partially equivalent (main doubt is on converting to kg). In criterion 24, a specific energy consumption limit of 100 MJ/m^2 of product is set. Unfortunately, a direct comparison of this limit cannot be made, even if assuming a common density, because the thickness of the slab or tile will greatly influence the comparison. But for	Not applicable to scope.

[27] Commission Decision (EU) 2021/476 of 16 March 2021 establishing the EU Ecolabel criteria for hard covering products OJ L 99, 22.3.2021, p. 53–72, available at: https://eur-lex.europa.eu/eli/dec/2021/476/oj
[28] Blue Angel criteria for "Concrete products containing recycled aggregates for outdoor flooring" DE-UZ 216, version 1, January 2021. Available online here.
[29] GECA (Good Environmental Choice Australia) "Hard Surfacing" standard No. HS v2.0i-2019. Available online for free upon request at: https://geca.eco/standards/hard-surfacing-hsv2-0i-2019/
[30] GECA Good Environmental Choice Australia) "Cement, concrete & concrete products" standard No. CCCP v1.0iii-2021. Available online for free upon request at:

Proposed GPP criterion	EU Ecolabel criteria for hard covering products [27]	Blue Angel for concrete products containing recycled aggregates for outdoor flooring [28]	GECA criteria for hard surfacing [29]	GECA criteria for cement, concrete & concrete products[30]
	easily be outsourced.		products of known dimensions, equivalence can be checked. It appears that only onsite grinding of raw material would also be counted for the GECA assessment.	
TS1.3. Energy consumption and CO_2 for ceramic and fired clay products	The specific fuel energy consumption and CO_2 emissions for drying and firing processes shall not exceed the relevant mandatory limits defined below. - Spray dried powder (if used): 1.8 MJ/kg powder & 84 kgCO2/t - Ceramic tile individual product: 4.1 MJ/kg and 280 kgCO_2/t - Ceramic tile family of products: 5.5 MJ/kg and 360 kgCO_2/t - Fired clay pavers: 3.5 MJ/kg and 192 kgCO_2/t. The choice of whether the limit applies for an individual product or a family of products refers to the length of time the energy and CO_2 emission data covers during production. Calculations of energy consumption are based on fuel metering and production output (which may require conversion factors). The methodology for CO_2 emissions is set out in EU Regulations and includes mineral decarbonation during firing.	Not applicable to scope.	Can be considered as partially equivalent (no fixed limits on CO_2, plus need to convert units for energy consumption limits).In criterion 24, specific energy consumption limits of 50 and 70 MJ/m^2 of ceramic tile are set depending on whether the specific density of the tile is >19 or <19 kg/m2. A limit of 60 MJ/m^2 is set for clay tiles. Unfortunately, a direct comparison of these limits cannot be made, because the thickness of the slab or tile will greatly influence the comparison. But for products of known dimensions, equivalence can be checked. A further deviation becomes apparent when reading the methodology in Appendix B, where it states that only fuels used during kiln firing will be counted. The EU Ecolabel criteria count fuels for both the kiln and the ware dryer. And criterion 28 states that: "*The tenderer/ manufacturer shall have and implement a formal environmental management system, based on ISO 14001 that [...] include energy management and CO_2 emissions related to the production of the product.*" But this cannot be considered as equivalent to the hard limits set in the EU Ecolabel criteria.	Not applicable to scope.
TS1.4. Energy consumption and CO_2 for precast	<u>*At the precast concrete plant:*</u> An energy inventory needs to be kept that systematically monitors and records specific energy consumption and specific	Equivalent to EU Ecolabel. Criterion 3.4 on energy efficiency and purchasing of green electricity states that: "*The applicant shall produce an energy*	Not applicable to scope.	Can be considered as partially equivalent (limits set, but they do not match and approach is quite different).

Proposed GPP criterion	EU Ecolabel criteria for hard covering products [27]	Blue Angel for concrete products containing recycled aggregates for outdoor flooring [28]	GECA criteria for hard surfacing [29]	GECA criteria for cement, concrete & concrete products[30]
concrete and CO_2 emissions from cement production	CO_2 emissions (i.e. energy consumption and CO_2 emissions per unit of final product). There also needs to be plan established that aims to reduce the specific energy consumption and CO2 emissions to optimal levels. This inventory and plan should have been established for at least 12 months prior to the deadline date of being awarded the EU Ecolabel. This means that anyone with the EU Ecolabel already has at least 12 months of inventory data. *For cement/lime production:* The specific CO_2 emissions shall not exceed the relevant mandatory limits defined below: - Grey Portland cement clinker: 816 $kgCO_2$/t clinker - Lime: 1028 $kgCO_2$/t hydraulic lime - White Portland cement clinker: 1063 $kgCO_2$/t clinker - Alternative cements: 571 $kgCO_2$/t cement Calculations of energy consumption are based on fuel metering and production output (which may require conversion factors). The methodology for CO_2 emissions is set out in EU Regulations and includes mineral decarbonation during firing. Due to a lack of direct CO_2 emissions, an embodied CO_2 calculation for alternative cements is considered for these products in line with ISO 14067.	*statement that includes information on the energy consumption at the plant for the manufacture of the concrete products and the parameters used to control energy consumption. The applicant shall monitor and control the processes with the aim of maintaining the most stable operation of the plant with a low energy consumption. The applicant shall maintain an organisational structure to enable a continuous improvement in energy efficiency.*" Other requirements on green electricity, and EPD and on carbon offsetting can be considered as superior to the EU Ecolabel requirements.		Criterion 15 sets a limit for 605 $kgCO_2$/t cement and that the cement should effectively have a clinker factor of less than 0.70. Criterion 16 states that the manufacturer should have an Environmental Management System in accordance with ISO 14001. Although the criterion did not explicitly mention precast concrete energy management and inventories, this could be implied. These two requirements cover the same areas as the EU GPP criteria recommendations but cannot be accepted as equivalent or better without further verification.

Proposed GPP criterion	EU Ecolabel criteria for hard covering products [27]	Blue Angel for concrete products containing recycled aggregates for outdoor flooring [28]	GECA criteria for hard surfacing [29]	GECA criteria for cement, concrete & concrete products[30]
TS2.1. Dust control for natural stone or agglomerated stone production	A series of dust control measures need to be included that will help to minimize emissions of dust. Regular health checks for employees are also stipulated.	Not applicable to scope.	Can be considered as partially equivalent (both look at dust emissions, but source of dust emissions is not the same, nor sampling points nor specific measurement units). Criterion 22 sets a dust emission limit for natural stone transformation plants and agglomerated stone production facilities of 300 mg/m^2. This criteria covers the same basic concern, and may promote the use of similar dust control measures, but cannot be considered as legally equivalent to the EU GPP criteria. Given the diffuse nature of dust emissions in natural stone transformation plants, it is unclear how such a number would ever be verified.	Not applicable to scope.
TS 2.2. Control of dust, HF, NOx and SOx emissions at ceramic and fired clay production sites	Limits of emissions from kiln exhaust gases are set at: Dust (kiln): 50 mg/kg as per EN 13284 HF (kiln): 20 mg/kg as per ISO 15713 NOx as NO_2 (kiln): 250 mg/kg as per EN 14792. SOx as SO2 (kiln): 1300 mg/kg as per EN 14791.	Not applicable to scope.	Can be considered as almost fully equivalent (only doubt is converting the units). Criterion 22 sets the following limits for kiln emissions from the production of ceramic and clay tiles: Dust: 200mg/m^2 (ceramic tile) or 250mg/m^2 (clay tile). SO2: 1500mg/m^2 (ceramic tile) or 2000mg/m^2 (clay tile). NOx: 2500mg/m2 (ceramic tile) or 3000mg/m^2 (clay tile). F: 200mg/m^2 (for bother ceramic and clay tiles). Direct comparisons with EU GPP requirements are complicated by the need to know the density of the tiles in kg/m2. A typical density is 20 kg/m^2 would mean that GECA is fully equivalent.	Not applicable to scope.
TS 2.3. Control of dust, NOx and SOx emissions at	Limits of emissions from kiln exhaust gases are set at: Dust (kiln): 34.5 g/t clinker or hydraulic lime.	No similar criteria. Although cement is an integral part of the concrete product, there are no cement-specific criteria.	Not applicable to scope.	Criterion 16 states that the cement producer should have an Environmental Management System in accordance with ISO 14001. Although the criterion did not explicitly

Proposed GPP criterion	EU Ecolabel criteria for hard covering products [27]	Blue Angel for concrete products containing recycled aggregates for outdoor flooring [28]	GECA criteria for hard surfacing [29]	GECA criteria for cement, concrete & concrete products[30]
cement or lime kilns for cement or lime used in precast concrete products	NOx as NO_2 (kiln): 1472 g/t clinker or hydraulic lime. SOx as SO2 (kiln): 460 g/t clinker or hydraulic lime.	At some level, these types of emissions would have to be accounted for when doing the EPD required under criterion 3.3, but it does not specify any limit and the final result of EPDs do not reveal the specific emissions behind the impact category results.		mention NOx emissions, and did not mention limits for any emissions to air, at least the measurement of these emissions could be implied. However, these requirements cannot be considered as proof of compliance with this EU GPP criteria recommendation.
TS3.1. Reuse of process waste from natural stone, agglomerated stone and ceramic/fired clay production.	A process waste inventory needs to be kept for at least 12 months and a distinction made between "process scrap" and "process sludge" – the latter being more difficult to recycle. The following limits are set: 80% for process scrap from natural stone transformation plants. 70% of process sludge+scrap from agglomerated stone production. 90% of process scrap+sludge from ceramic or fired clay production. Reuse shall be considered as reincorporation into the same production process or recycled into other sites and processes.	Not applicable to scope.	Can be considered as partially equivalent (both look at waste but cannot compare details since the GECA criteria are quite vague). Criterion 26 requires all manufacturers to have "functioning procedures" to divert recyclable and reusable materials from waste streams and to recover wastes that can be used in other processes. Waste is to be recovered or diverted from landfill when "technically possible". These measures address the same issues as the EU GPP criteria recommendations, but cannot be considered as legally equivalent.	Not applicable to scope.
TS3.2. Reuse of process waste from precast concrete production	Procedures must be in place at the precast concrete plant that ensure: - Recycled directly into new concrete batches which are cast prior to the returned/rejected concrete hardening; or - Recycled as aggregate in new batches after returned/rejected concrete hardening: or - Recycled offsite either prior to or after hardening as part of a contractual arrangement with a third party.	Can be considered as almost fully equivalent (would need to know more details to be sure). Criterion 3.1.2 refers to a minimum recycled/residual material content of 30% and that claims can be justified by keeping records of material flow analysis. The requirement implies that all process waste would be reused onsite, but this would need to be confirmed, since it is not explicitly stated in the criterion. If the optional criterion 3.5 on a take-back	Not applicable to scope.	Can be considered as almost fully equivalent (would need to know more details to be sure). Criterion 32 refers to an Environmental Management System and that includes waste management, without specifying more details. Criterion 33 states that concrete producers must have a scheme to take back off-cuts and waste from installation.

Proposed GPP criterion	EU Ecolabel criteria for hard covering products [27]	Blue Angel for concrete products containing recycled aggregates for outdoor flooring [28]	GECA criteria for hard surfacing [29]	GECA criteria for cement, concrete & concrete products[30]
		scheme is complied with, this would increase the likelihood of equivalence with the EU Ecolabel requirements.		

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