Cerame-Unie The European Ceramic Industry Association

CERAME-UNIE'S VIEWS ON RESOURCE EFFICIENCY & THE CIRCULAR ECONOMY PACKAGE

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The European Commission published its Communication (COM(2014) 398), *Towards a circular economy: a zero waste programme for Europe*, on 2 July 2014. In this context, Cerame-Unie would like to present its views on the circular economy package.

Cerame-Unie, representing the ceramic industry in Europe, stresses that resource efficiency requires a Life Cycle Assessment (LCA) approach that takes into account all stages of the product, including its durability, lifespan and reduction of resource consumption over the use phase. Cerame-Unie also highlights that the social and economic aspects of sustainability should always be considered in EU legislation.

To reach a circular economy in Europe, adequate access to raw materials as well as separation and processing of waste and a well-functioning market for secondary raw materials are needed. At the end of the paper, some best practice examples taking place in the ceramic industry are presented.

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1. Resource Efficiency and Life Cycle Assessment

LCA is a tool to assess and quantify the potential environmental impacts of products by collecting and characterising the inputs (product, material, and water or energy flows that enter a unit process) and outputs (product, material or energy flows that leave a unit process, and emissions) in all stages of the product's life cycle. The primary concept of the LCA methodology comes from the understanding that each product, process or activity generates impacts on the environment starting from the extraction of raw materials, throughout the manufacturing process and use phase, until the end-of-life of the product (reusing, recycling or disposal). This approach is termed cradle-to-grave LCA (see Figure 1).

Resource efficiency is not about "using less" but about "using better".

Cerame-Unie is concerned by the proposed lead indicator to measure resource productivity based on Raw Materials Consumption (RMC), as proposed by the European Resource Efficiency Platform (EREP) recommendation. Resource efficiency indicators should promote the optimal use of materials. Therefore, resource policy needs to take into account indicators which focus on *resource efficiency* instead of *resource consumption*. One of the main disadvantages of this proposed indicator is the net weight of the material which is not related to resource efficiency, i.e. RMC only considers the density of the materials and not the functionality or performance. Furthermore, it does not have a life cycle value chain perspective and neglects the direct and indirect environmental impacts of products on downstream industries and end users. Last but not least, RMC has the aim to account both for consumption in Europe as well as the consumption related to imported products. This approach including imports is supported in principle, however, accurate data on RMC for imports are hard to obtain, which will lead to an overestimation of the domestic material consumption.

Figure 1 – Generic life cycle of a clay product

LCA is the scientific approach recognised worldwide to assess the consumption of resources. The contribution of ceramic products to resource efficiency can only be appreciated with a holistic approach that takes into account the complete life cycle of the product, including its durability, lifespan and reduction of resource consumption over the use phase. Hence, resource efficiency only makes sense if a cradle-to-grave LCA approach is considered. Resource efficiency should not be confused with resource consumption.

2. Sustainable use of natural resources

The ceramic industry comprises a large number of SMEs dispersed across Europe, as well as many world leading companies. For this reason, the industry is firmly established at regional level and provides local jobs. The industry's raw materials, mainly of mineral origin, are mostly locally available. As a result, the ceramic industry directly employs 200,000 citizens, and indirectly supports over 600,000 local jobs in Europe. This contributes to the social development and economic growth of the European Union.

Sustainability is not only about the environment. Social and economic aspects should always be considered in EU legislation.

Ceramic construction products

In the scientific paper "*A view on the sustainable use of natural resources*", T. A. Harrison and D. Collins from the University of Dundee (UK) propose a new indicator to measure the availability of different raw materials for future generations. This indicator takes into account the estimated residual life (in years) of natural resources. Thus, the study provides a list of estimated residual lives of a number of natural resources, including clay for the production of bricks with an estimated residual life of over 5500 years.

Nevertheless, such indicator reflecting the scarcity/abundance of raw materials is lacking in relevant standards and methods such as EN 15804, which establishes common rules and guidelines for developing Environmental Product Declarations (EPDs) for construction products. The European Commission introduced the *sustainable use of natural resources* into the Construction Products Regulation (CPR) as the Basic Work Requirement 7 (BWR7). At this stage, DG Enterprise and member states are discussing the possibility of fulfilling the BWR7 with EPDs, which are a standardised way to communicate the environmental impacts of products on the basis of a LCA methodology. The horizontal European standard EN15804 was created in CEN/TC350 and it defines a list of mandatory environmental impact indicators to be declared in EPDs, but it only makes mandatory a cradle-to-gate approach in EPDs. The declaration of other stages remains voluntary.

For the construction sector, Cerame-Unie proposes to add a new indicator to relevant standards and methods that better takes into account the availability of raw materials to future generations. This indicator should be used together with existing LCA environmental impact indicators when assessing the environmental performance of products and buildings.

This document explains in greater detail the sustainability/resource efficiency during the different stages of the life cycle for the wide range of different ceramic products: from access to raw materials over the use phase to the end of life stage.

3. Access to raw materials

The main raw material for most ceramic sectors is clay. Depending on the product, different kinds of clay are used. Most fine ceramic sectors, such as floor and wall tiles, tableware or sanitaryware, make use of kaolin or plastic clays whereas for the more coarse ceramic products, such as bricks and roof tiles, local sources of clay are used, keeping the environmental impacts of transport very low and avoiding dependence from imports from countries outside the EU. Other ceramic sectors, such as refractories, technical ceramics and abrasives, depend mainly on industrial minerals which may often not be sufficiently available within Europe.

SECTORS	Bricks & roof tiles Clay pipes	Table & ornamentalware Sanitaryware Wall & floor tiles	Refractories Technical ceramics Abrasives
RAW MATERIALS	Clay	Kaolin & plastic clay	Industrial minerals
SOURCES	Local	Mainly European	European & imports from worldwide markets

To ensure long-term raw material supply and to encourage ongoing investment in the sector, the extraction of clay and other minerals must be carefully planned. The industry would benefit from improved framework conditions especially with a view to shorten the procedure to open new quarries and clarify issues of competing land use.

During and after extraction, most quarries and riverbanks are restored and returned to their natural state, creating new habitats and improving biodiversity. By restoring clay extraction sites and promoting biodiversity, the ceramic industry plays an important role in providing green spaces in local communities. In particular cases, manufacturers of clay construction products provide the obsolete quarries to the local waste deposit authorities, which they can use to deposit local waste. In these waste deposits, biogas can be generated, which can in turn be used by the ceramic manufacturers.

Ceramic industrial products

A number of ceramic products are used mainly in industrial applications, such as refractories, technical ceramics and abrasives. These products are characterised by their high performance, enabling the customer industry to achieve its goals. This performance is based on technical knowhow and the use of high quality raw materials, which are difficult to substitute and often not or not sufficiently available in Europe.

The most important of these minerals are high quality grades of magnesite, bauxite, graphite and silicon carbide.

In the short term, the industry asks that the existing trade distortions are removed. In the medium term, measures should be taken to avoid further restrictions in the exploitation of existing European deposits, for instance magnesia. In the medium to long term, alternative raw materials sources and new deposits should be explored and responsibly exploited.

4. Use phase

This section addresses main features of ceramic products during their use phase, in terms of safety, durability, energy savings and impact on downstream users.

Safety
Safety considerations should be included in the holistic approach of the circular economy package.

Buildings are primarily used to provide shelter to occupants. Ceramic masonry walls play an important role in providing safety and security to the users of buildings. A ceramic masonry building provides a solid structure, is highly resistant to fire and supports resilience to climate change, for instance by protecting against summer overheating and thereby reducing the need for air conditioning. Ceramic building materials also protect buildings against natural disasters (e.g. hurricanes and floods).

Moreover, ceramic masonry products contribute to a healthy indoor climate as they are non-toxic, free of any volatile organic compounds (VOCs) and contribute to a mould-proof structure.

Durability
Cerame-Unie welcomes the new communication "Resource efficient opportunities in the building sector". Studies show that a brick house has an average life span of more than 150 years. Clay pipes have a similar durability and tiles for flooring and walls have a life span of up to 50 years, which is very high in comparison with alternative materials. Cerame-Unie believes that the durability of construction products is an important factor for the resource efficiency in buildings and should be reflected in the European policy appropriately.

> Ceramic construction products stand out with their high durability thanks to a lifespan of over a century and require little or no maintenance/replacement. Service life extension of the first use of products gives an important contribution to the circular economy.

Ceramic buildings in use – Energy savings
Relevant energy savings can already be obtained through a proper design of buildings. Thermal insulation and clay masonry products have an important role and are a logical first step in order to reduce the energy consumption of a building.

High thermal insulation ceramic blocks have been developed to mitigate the need for additional heating and cooling, thereby saving energy and costs. In addition, pitched roofs facilitate the use of photovoltaic cells, which in turn contribute to carbon-free energy generation. Today, the industry is constantly developing innovative solutions for energy-efficient buildings, such as ventilated facades, which can significantly improve the energy efficiency of a building. Innovative solutions also include new high thermal insulation ceramic blocks, filled with insulating materials.

Such blocks are frequently used in low-energy, passive and nearly-zero-energy houses. Adding a brick shield contributes to the good thermal performance of buildings. The thermal performance of a building is characterised by the heat loss rate through the envelope - the U-value. Walls of a typical single-family house from 1990 had a common U-value of 0.50 W/m^2K. Whilst retaining its appearance, the cavity is filled with insulation and current installations can easily achieve a U-value of 0.15 W/m^2K for walls. It leads to a significant improvement of the energy performance of buildings and consequently to less CO_2 emissions due to reduced heating or cooling demands.

Ceramic construction products provide good thermal insulation and high thermal mass. This helps to keep energy bills low and save money.

Impact on downstream industries and end users

Without the production of industrial ceramics such as refractories, abrasives and technical ceramics, there would be no cars, no planes, no trains, no gas or electricity. Refractories are crucial for all high-temperature processes, including the production of metals, cement, petrochemicals, glass and ceramics. The lining of each reactor, transport vessel or kiln uses a wide range of refractory products including bricks, monolithics and high temperature insulation wool. Without innovation in these industrial ceramics, the EU would deprive it of achieving its ambitious objectives in raw material and energy savings. At the same time, the production of some special metals and rare earth elements that are of particular importance for the development of high tech products, such as computers, mobile telephones, depend on ceramics.

Over the last decades, the lifetime of reactors lined with refractories has increased considerably resulting in significant resource savings in the downstream industries. Where in the 1960s 50 kg of refractories was needed to produce 1 tonne of steel, this has now come down to 10 kg of refractories. Given the high volumes of steel produced, this results in millions of tonnes of refractory products that have been saved annually compared to what would have been required to produce the same amount of steel in the 1960s. The amount of saved raw materials is even higher.

5. End-of-life (reuse/recycling)

In this section, we present a range of reuse/recycling activities taking place in the ceramic industry. Nevertheless, proper dismantling of buildings or furnaces is required. Most ceramic products can be recycled after the end-of-life stage, but Cerame-Unie highlights the need of having a good system for collection, sorting and separation of waste. By doing this, the quality of materials available for recycling will improve. Recycling is a relevant process for resource efficiency and thus should be properly addressed. However, due to the long lifespan of ceramic products and the fact that in some sectors over a third of the production is exported outside the EU, the quantity of secondary material available after the end-of-life stage is often insufficient. As a result, virgin material remains a requirement within the supply chain.

It is also important that the European Waste Framework Directive is implemented in a consistent way across the EU. For example, a secondary material can have value in one member state, but be considered as waste in another, which hampers the creation of a European market for these materials.

The Commission should focus on the creation of a market for secondary materials to reach the targets for construction and demolition waste.

Reuse of roof tiles

Roof tiles have a long life span and require little or no maintenance. Thus, they can be easily reused. After the end-of-life stage of a building, roof tiles can be removed, transported to a storage site and then reused in a new building.

Recycling ceramic construction products

After a building is demolished, ceramic construction products (e.g. ceramic masonry products, ceramic tiles for flooring and walls and ceramic sanitaryware) can be crushed and then used as secondary raw

materials for different applications, including road construction (sub-layer), cement clinker production, agriculture, embankments, tennis courts, substrate for green roofs and concrete aggregates.

Crushed ceramic masonry units coming from the demolition of the building can also be used to replace primary raw materials in the manufacturing of an equivalent ceramic masonry unit.

Figure 2 – Recycled ceramic aggregates. Source: Silvestre, R. et al., 2013

Recycling of refractories

Recycling of refractories at the end of their use phase has become state of the art in Europe. Over 80% of all European refractory products are recycled, reused or consumed.

Nearly 100% of non-infiltrated scrap, is reused as secondary raw material thanks to the selective breakout and separation of reusable materials from the infiltrated parts. The remaining cannot be similarly treated currently because of economic or regulatory constraint. The latest development is a heat treatment of the infiltrated parts, which purifies the material. This step creates secondary raw material out of waste, which could not be reused so far.

6. Resource efficiency: best practice examples

Resource efficiency is at the heart of the ceramic manufacturing. It is a prerequisite to remain competitive. The ceramic industry is continuously investing in innovation to further improve the resource efficiency, as is shown in the examples below:

Roof tiles production

In Belgium, a manufacturer of ceramic roof tiles has demonstrated that granite powder can be used as secondary raw material in the production of ceramic roof tiles. By doing this, the mechanical strength of the roof tile improves and the manufacturer produces a much thinner tile. This contributes to a reduction of primary clay and sand use, and reduced energy consumption in production, transport and packaging. Consequently, there are less CO_2 emissions per m^2 of roof.

Clay block production

One German manufacturer uses crushed clay roof tiles, which were collected at the end-of-life of a building, for the production of clay blocks. These crushed tiles were added to the raw material mixture without losing the technical properties of the blocks. As a result, the manufacturer uses less virgin material in the production process.

Thinner facing bricks and wall and floor tiles

In Europe, some manufacturers are resizing their products to an optimised slimmer format. Thus, these manufacturers will use less primary raw materials in the production stage. For example, thinner facing bricks allow to increase the thickness of the insulation material without expanding the thickness of the wall or losing space in the building. This improves the energy efficiency of buildings.

Cradle-to-cradle vitrified clay pipes

Inspired by nature, a manufacturer of vitrified clay pipes has introduced a cradle-to-cradle approach in the production of clay pipes. The manufacturing process has energy reduction programs and all the electricity used comes from renewable resources (wind, sun and water). Additionally, there is no material loss in the production stage, i.e. 100% of broken pipes are crushed and reinserted into the production process. The vitrified clay pipe is composed of 30-40% secondary raw material, including broken clay pipes and floor and wall tiles. During the use stage, these pipes have little or no maintenance and a life span of over a century. Last but not least, after the end-of-life stage, clay pipes can be removed from the soil and recycled for the production of new clay pipes or for a different application (e.g. construction of new roads).

Clay pipe manufacturer – restored land

A clay pipe manufacturer in the UK has recently used the restored land at one of their clay quarries to provide hives for 3 million bees. The honey is sold in the local community.

The European ceramic industry covers a wide range of products including abrasives, bricks & roof tiles, clay pipes, wall & floor tiles, refractories, sanitaryware, table- & ornamentalware, technical ceramics and porcelain enamel. The industry generates over 200,000 direct jobs and a production value of €25 billion within the EU.

Cerame-Unie aisbl
Rue de la Montagne 17 – 1000 Brussels
Tel: +32 28 08 38 80 – Fax: +32 25 11 51 74 – E-mail: sec@cerameunie.eu
www.cerameunie.eu twitter.com/CerameUnie