

Sustainable Sourcing of Sand and Glass Recycling at the heart of the European Glass Container Circular Economy



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EXECUTIVE SUMMARY

Sand is a very important resource to produce glass containers. However, the European Container Glass industry is highly committed to reduce its use wherever possible by replacing it with recycled glass and to ensure that when it is used, sand is sustainably and locally sourced.

Sand used in the container glass production is abundant in nature, locally and sustainably sourced.

- The industrial sand used for glass production must comply with very strict technical specifications in terms of chemical purity and dimension. This is different from low quality sand taken from beaches or riverbanks generally used for construction which contains too many impurities.
- The industrial sand is abundant in nature and it represents less than 1% of the 50 billion tonnes of sand extracted per year.
- Its extraction is strictly regulated by EU, national and local legislation and by no means it can be object of illicit trafficking. Extraction permits guarantee its sustainable sourcing as well as the rehabilitation of the quarries at the end of the extraction period.
- We privilege the proximity of supply to the European producing plants so that we can avoid long-distance transport and minimise environmental and cost impacts.

Glass is a permanent material, endlessly recycled in a closed loop and therefore main resource of its own production.

- Recycled Glass is the main raw material used by the industry. One ton of recycled glass replaces 1.2 tons of virgin sand and other virgin raw materials.
- Today on average, in the production batch we put 52% of recycled glass, avoiding the depletion of more than 7 million tons of virgin sand per year.
- Technically glass bottles may be produced with up to 95% of recycled glass. The only limit to its use is availability and quality.

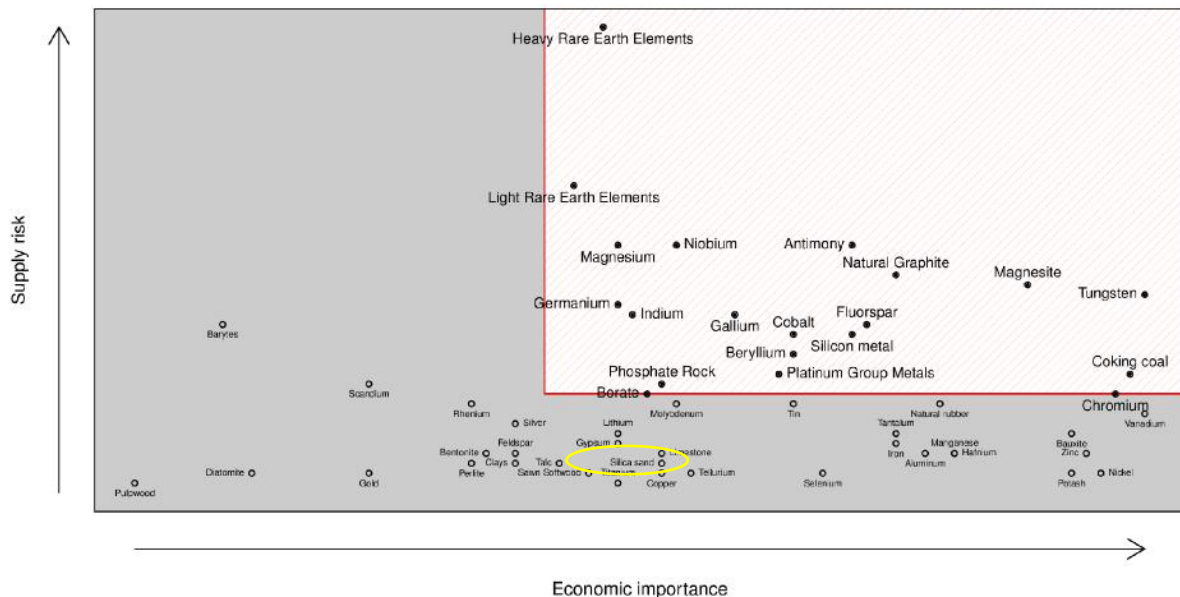
BACKGROUND

Since a few years, there has been growing concerns (in the press or in TV reports) about **illegal sourcing and scarcity of sand**.

Even a UN report¹ published in 2019 addresses the issue, stating that “*The increasing volume of aggregates extracted, **often illegally**, from riverine and marine ecosystems results in river and coastal erosion, threats to freshwater and marine fisheries and biodiversity*”.

This scarcity of sand might sound paradoxical as Silicon (Si, the main constituent of silica sand) makes up 27.2% of the Earth's crust by weight². But sand is a generic term encompassing different minerals, in terms of composition, types of impurities, sourcing locations, applications...

In the EU at least, silica sand is not listed as a critical raw material, based on its supply risk and economic importance³ as illustrate in the picture below:



In this paper FEVE explains which type of sand is used in the container glass industry and how it is sourced.

¹ Sand and Sustainability: Finding new solutions for environmental governance of global sand resources. Published by the United Nations Environment Programme (UNEP), February 2019.

<https://owncloud.unepgrid.ch/index.php/s/ck7D7KmsBITbYM4#pdfviewer>

² <https://en.wikipedia.org/wiki/Silicon>

³ REPORT ON CRITICAL RAW MATERIALS FOR THE EU - Report of the Ad hoc Working Group on defining critical raw materials - May 2014

WHAT IS SAND?

Let's first start by clarifying some words:

- **Silicon** is a chemical element with the symbol Si and atomic number 14. It is the second most abundant element in the Earth's crust (about 28% by mass) after oxygen
- **Silica** is an oxide of silicon with the chemical formula SiO_2 , most commonly found in nature as **quartz**
- **Silicates** are any members of a family of anions consisting of silicon and oxygen, usually with the general formula $[\text{SiO}_4^{-x}]_n$, where $0 \leq x < 2$
- **Sand** is a granular material composed of finely divided rock and mineral particles. It is defined by size (typically in the range 0.0625 mm to 2 mm), being finer than gravel and coarser than silt. The composition of sand varies, but the most common constituent of sand is silica (silicon dioxide, or SiO_2), usually in the form of quartz. The second most common type of sand is calcium carbonate, for example, aragonite, which has mostly been created, over the past half billion years, by various forms of life, like coral and shellfish.
- **Silica sand** is a sand composed mainly of silica (quartz)

In the context of this paper, (silica) sand needs to be understood as a granular material composed of finely divided rock and mineral particles, whose main constituent is silica (silicon dioxide, or SiO_2).

Sand is used for a huge range of applications by many industries (construction, electronics, cosmetics, glass-making,...). On a global level, nearly 50 billion tonnes of sand are extracted every year.

However, two big categories need to be distinguished:

1. **construction sands**, which are used for their physical properties alone, **represent more than 99% of the 50 billion tonnes sand extracted.**
2. and **industrial sands** which are used for a mix of their chemical and physical properties. The chemical properties may include a high proportion of silica content in the form of quartz, very low levels of impurities (clay, iron,...). **Industrial sands are mainly used in the glass industry, in the oil and gas sector, in foundries and in the chemical industry and represent less than 1% of the 50 billion tonnes sand extracted.**

SAND USED IN THE GLASS INDUSTRY

The sand used in the glass industry belongs to the category "industrial sand" and needs to comply with strict technical specifications in terms of:

- chemical purity, which is the primary determinant of colour, clarity, and strength of the glass produced (e.g. iron content must typically be in the range 0.04% - 0.2%)
- granulometry (typically between 0.075 mm and 1.18 mm)

There is a marked difference between industrial sand used in the glass industry and the sand typically associated with illicit trafficking and shortages:

- the latter is typically 'young' sand taken from beaches and riverbanks for use as **low-quality** ingredient in aggregates for local construction. It is generally used as extracted (no further processing) and doesn't comply with the technical specifications from the glass industry.
- industrial silica sand (quartz) is plentiful on a global scale, but extraction depends on its **quality** and **proximity to customers and needs to comply with the above technical specifications for glass making**. Industrial silica sand contains a high proportion of silica (>95%) and is used for other applications than construction aggregates. **Sand from desert of riverbanks cannot be used as industrial sand because it contains generally too many impurities and a lower level of silica**. Industrial sand needs also, once extracted, to be further processed (cleaning, sieving, removal of impurities,...).
- moreover, **access rights** must be secured before quartz extraction can take place, under the form of an extraction permit delivered by competent authorities. In the EU, the permit sets how much sand can be extracted and imposes rehabilitation work at the end of the permit validity.

Sand quality is critical to ensure the quality of the glass we produce. We cannot use sand sourced from deserts, beaches or riverbanks because these sources contain too many impurities. Only sand which comes from professional extraction from authorised mining operations can meet our strict requirements. Therefore, glass manufacturers have a close relationship with industrial sand suppliers and are able to accurately trace the source of the sand that we use.

Furthermore, sand being a cheap raw material, it cannot be transported over large distances. The sand used in the glass industry is generally locally sourced. An LCA study conducted by FEVE in 2016 showed that silica sand is transported on average for 84 km by train (only intra-EU), 48 km by boat and 159 km by truck.

SUSTAINABLE SOURCING AND GLASS ENDLESS RECYCLING : BEST ANSWERS TO SAND SCARCITY

There is today no indication that we are heading towards a shortage of industrial sand.

However, accessing industrial sand deposits with the right requirements mentioned above is not straightforward for our suppliers, it implies a careful management of natural resources and the environment. Sourcing silica sand in a responsible way involves a long identification process, acquisition of operational permits, sustainable management planning of the identified areas, sustainably-sound extraction operations and rehabilitation practices of the quarries. Most sand producers own extraction permits for decades of production and have interest in setting multi-year management plans.

Glass has also a wonderful advantage when it comes to recycling, namely it is a **permanent material that can be endlessly recycled**, without any loss of its main intrinsic properties. Once glass is produced from sand for the first time, it can stay productive forever in our economy.

Permanent materials like glass are perfect to maintain a true circular material loop and therefore avoids depletion of additional natural resources.

When glass is produced with virgin raw materials only, sand represent about 72% of the batch (the rest being composed of soda ash and carbonates).

However, the increasing share of recycled glass used to produce new bottles makes it possible to reduce the extraction of materials from the earth's crust. Today, the EU container glass industry produces about 22 million tonnes of glass bottles and jars per year. Some 16 million tons are put on the EU market and 76% of them are collected. Most of this collected glass is brought back to production of glass bottles and replaces the batch virgin ingredients at the height of **52%**. This equals to saving 7 million tonnes of sand from extraction in the EU per year. The use of recycled glass allows also for other major environmental savings in energy and emissions.

Glass recycling up by 139% in the last 15 years. The industry is today committed to further increase the availability and quality of recycled glass (or cullet) to produce glass bottles and jars. •

Technically glass bottles may be produced with up to 95% of recycled glass. The only limit to its use is availability and quality.

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