

## Life Cycle Datasets for the Ornamental Stone Sector

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**Abstract :** The environmental impact related to ornamental stones (such as marbles and granites) is largely debated. Starting from the industrial revolution, continuous improvements of machineries led to a higher exploitation of this natural resource and to a more international interaction between markets. As a consequence, the environmental impact of the extraction and processing of stones has increased. Nevertheless, if compared with other building materials, ornamental stones are generally more durable, natural, and recyclable. From the scientific point of view, studies on stone life cycle sustainability have been carried out, but these are often partial or not very significant because of the high percentage of approximations and assumptions in calculations. This is due to the lack, in life cycle databases (e.g. Ecoinvent, Thinkstep, and ELCD), of datasets about the specific technologies employed in the stone production chain. For example, databases do not contain information about diamond wires, chains or explosives, materials commonly used in quarries and transformation plants. The project presented in this paper aims to populate the life cycle databases with specific data of specific stone processes. To this goal, the methodology follows the standardized approach of Life Cycle Assessment (LCA), according to the requirements of UNI 14040-14044 and to the International Reference Life Cycle Data System (ILCD) Handbook guidelines of the European Commission. The study analyses the processes of the entire production chain (from-cradle-to-gate system boundaries), including the extraction of benches, the cutting of blocks into slabs/tiles and the surface finishing. Primary data have been collected in Italian quarries and transformation plants which use technologies representative of the current state-of-the-art. Since the technologies vary according to the hardness of the stone, the case studies comprehend both soft stones (marbles) and hard stones (gneiss). In particular, data about energy, materials and emissions were collected in marble basins of Carrara and in Beola and Serizzo basins located in the province of Verbano Cusio Ossola. Data were then elaborated through an appropriate software to build a life cycle model. The model was realized setting free parameters that allow an easy adaptation to specific productions. Through this model, the study aims to boost the direct participation of stone companies and encourage the use of LCA tool to assess and improve the stone sector environmental sustainability. At the same time, the realization of accurate Life Cycle Inventory data aims at making available, to researchers and stone experts, ILCD compliant datasets of the most significant processes and technologies related to the ornamental stone sector.

**Keywords :** life cycle assessment, LCA datasets, ornamental stone, stone environmental impact

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