

## **Abstract**

### **CO<sub>2</sub> Emissions and Energy Consumption of Granulated Blastfurnace Slag**

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During the last years the discussions on the environmental impact of energy intensive industries, such as the production of iron and steel, chemicals and cement, and the discussions on a potential man-made climate change have increased.

The annual production of about 1690 Mt cement in 2001 caused about 9 % of all CO<sub>2</sub> emissions world-wide. The specific CO<sub>2</sub> emissions depend from the type of cement. In Germany the production of 1 t Portland cement causes about 1.011 t CO<sub>2</sub>, the production of 1 t blastfurnace slag cement containing 75 wt.-% ground granulated blastfurnace slag (GGBS) causes only 0.300 t CO<sub>2</sub>. These data include the calcination process, emissions from fossil fuel burning, and the use of electricity. Only the decarbonisation of the raw materials during the clinker production causes about 0.5 t CO<sub>2</sub> for each ton clinker. Cement is the most energy-intensive part of concrete. Therefore the substitution of Portland cement by slag cement or GGBS reduces the energy use for a typical ready-mixed concrete by about 40 %. So it is evident that both common ways to use granulated blastfurnace slag, the production of slag containing cements and the use of GGBS as a concrete admixture, lead to a significant diminution of the primary energy content of building products.

World-wide it can be assumed that 68 Mt blastfurnace slag are not granulated. If this tonnage would be granulated and used as a cement or concrete constituent, every year about 11 Mt coal equivalent (321 PJ) primary energy would be saved and 64.5 Mt CO<sub>2</sub> would be avoided. Also the mining of raw materials like limestone, clay or sand would be decreased by more than 100 Mt yearly.

In the beginning of GGBS utilisation first of all the reduction of energy costs, afterwards the technical advantages of slag cements were the centres of interest. But based on the discussions during the "Earth Summit" in Rio de Janeiro 1992 more and more the environmental benefits and the need of a sustainable development are recognised and initialised a lot of activities. The WBCSD Sustainable Cement Project and the voluntary self-obligation of the German cement industry (reduce of its energy-induced specific CO<sub>2</sub> emissions by 28 % between 1990 and 2012) are relevant examples.

In contrast to "hot air" trading within the flexible mechanism "Emission Trading" the use of GGBS is a well-established method to realise a real significant decrease of CO<sub>2</sub> emissions and energy consumption.

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