

# Example of essay on sustainability of cement in construction industry

[Education](#), [Sustainability](#)



Cement is an integral material in the construction industry and apart from infrastructure and building construction; cement has its vital role in economic development of the nations. The consumption and production are on the increase due to rapid population growth and fast industrialization. As a matter of fact, that industry is facing numerous challenges in the context of energy resources and environmental issues in the form of greenhouse emissions during the process of production. In addition, its production is associated with differently economic activities and it is predicted to grow even with a faster rate in the future years. Hence, it is necessary to evaluate the sustainability in production and mechanism of the process, as well as its environmental impact.

The term “ sustainability” is being used as a principle in the construction industry all over the world especially in developed nations like UK and United States. The construction industry is referred as the one of the huge sources of carbon emissions at the globe that account about 39 percent of CO<sub>2</sub> emissions during production of materials related to the construction industry. Almost 13-15 percent of concrete consists of cement as concrete as compared to other materials having less carbon footprint. However, the larger amount of concrete usage as construction material has increased energy consumption and environmental loadings. Cement is considered to be responsible for 70-80 percent of the global industrial energy use, 5 percent of global anthropogenic CO<sub>2</sub> emission, 3. 4 percent of the global carbon dioxide emission (Ghaz, 2013). Uwasua et al. (2014) evaluated statistical data to determine cement production of different countries. They applied econometric techniques to observe cement production based on per

capita converges in China by assessing available data during the period of 1978-2007. Cement production per capita used to vary across countries and developed a U-shape relationship between per capita GDP and cement production as presented in Figure 1. As far as, environmental impact is concerned, they argued to control excessive cement demand and implementation of green technologies.

Figure 1 Graphical relation between cement production and rate of development (Source adopted: Uwasua et al. (2014)

Almost more than three billion tons of raw materials per annum are manufactured for building products that contribute 40 to 50 percent of the economy at the globe. It is processed, transported and ultimately disposed of after using in construction. The whole phenomena contributed in adverse impacts on the environment during manufacturing and transportation. On the other hand, sustainable performance in construction is essential to achieving long-term development. This is a myth behind sustainable and green buildings that demand reduced consumption of water as well as energy in the context of selection of suitable construction material including cement that should be environment friendly and sustainable (Ekincioglu, 2013).

## **Material Production Methods**

Cement is the main ingredient in almost every construction material.

Generally limestone is used to produce Portland cement as presented in Figure-2.

Figure 2 Schematic presentation of materials involved in cement production

There is a wide range of cement production method, and some of them are

<https://assignbuster.com/example-of-essay-on-sustainability-of-cement-in-construction-industry/>

elaborated and process diagram for cement production is presented in Figure 3.

## **Co-Processing Method**

Co-processing in the cement industry is a good method to extract energy and material from waste. This method offers a safe solution for the environment, society and the cement industry itself by allowing non renewable resources to be substituted with societal waste under controlled conditions. This method also helps in reducing dependency on fossil fuel along with the lowering the emission of carbon dioxide. Usage of alternative raw materials also has benefits as well like reduced dependency of quarrying and improved environmental footprints. Substitution of clinker in cement is the best example of this method.

## **Blended Cement**

Blended cements have been in use for decades. It is manufactured by blending various amount of clinker or grinded with one or more additives, as fly ash, natural pozzolans, slag, silica fume and so forth. Blended cement reduces the amount of energy used as well as carbon dioxide emissions. It also gives added advantages as increased production capacity and recycling of additives (Naik, 2008).

## **Dry Process Technology**

Wet cement production process must be replaced with dry process technology. In this process the limestone and silica-rich sand or rock is quarried and crushed, before transportation to storage stock piles close to

the kiln for process known as pre- blending. The powder made of silica and limestone is fed into the kiln where heat accelerates the necessary chemical reaction. The exhaust gases generated from kiln that are effectively used to dry the raw material. The usage of water can be eliminated in this process, and that make it referred as dry process and is used in modern cement production plants (Naik, 2008).

## **Construction Methods**

The construction industry is contributing about 4 percent of particulate emissions, water pollution, and noise pollution per annum. It has a tendency to pollute the soil, but the major concerns are the air, water and noise.

Mixing of materials irrespective of the type of mixer should be continued until the cement and water are evenly distributed throughout, and uniform mixture is achieved. Cement has higher thermal heat capacity than other building materials.

## **Thermal Active Slabs**

Many researchers have analyzed and evaluated different construction methods for developing new concept for heating and cooling buildings using thermal active slabs. This method uses embedded pipes in pre-cast concrete elements that consequently serve to heat and cool any building. For heating purposes, hot water at 30 degree centigrade is circulated through the pipes and for cooling purposes, cold water at 17 degree centigrade is circulated through the same pipes.

Figure 3 Sketch of typical cement production process

## **Durability of Cement and End Life Considerations**

The quality of cement can minimize consumption amount of energy for heating and cooling during construction of a building and its life time. Cement being the major component used in most of the construction projects, if used in the proper mix with other materials, generates a long lasting and durable buildings. To design materials, structures and building systems that improve the durability and sustainability of constructed buildings are becoming a challenge for the engineers. Application of the principles of the sustainable development requires consideration of durability over entire service life, involving quantified modeling of the various modes of deterioration and detailed analysis of the environment. Materials are key elements in manufacturing of durable cement designs.

Many researchers and engineers are of the view that such materials must be used for construction that is sustainable in their process of extraction, manufacturing, transformation, degradation along with recyclability. Cement is now being developed with latest technologies in which the raw material use is ensured. Thus, this makes this product a high environment friendly if manufacturer uses those particular methods. The life cycle for cost of the constructed building must be analyzed. There is a mechanism called life-cycle cost analysis, in which the energy use and the environmental impact during the whole life span of the product, process and/or activity is evaluated. This process includes the detailed analysis of the extraction and processing of raw materials, manufacturing, and transportation, maintenance, recycling, and returning to the environment. In this process, the cost and benefits are evaluated and monitored as well as recycled

cement is utilized as well.

For the effective durability and life of cement, water is always used in very less amount and more blended cement is used in most of the buildings these days. The overall design of buildings using cement must not contribute in atmospheric degradation, and this has to be kept in view by the engineers. The stakeholders involved in cement industry must evaluate ozone depletion and issues like global warming throughout the handling, manufacturing and delivery of the cement. The environment could be made safe by using blended cement rather than Portland cement in order to minimize global warming. Water is another source that is being contaminated by various sources. Portable water should be conserved only to serve life-sustaining needs instead of infrastructural needs. Rainwater and surface run-off water can be used to recycle water by using it for construction purposes. Gray water can also be used for cement production especially concrete production. However, dry cement production method is the best way to conserve water as it utilizes very minimal water during the whole process (Githachuri & Alexander, 2013).

## **Conclusion**

Conclusively, cement is an essential material for economic development, but its production is associated with enormous energy consumption and may cause extreme pollution problem by elevating emission levels of carbon dioxide and sulfur dioxide (Uwasua et al., 2014). As pollutants that emitted during the production had deteriorated the atmosphere in the past significantly, so it is imperative to analyze and keep sustainability in the

production by minimizing energy consumption and impact on the environment.

Although cement is manufactured using many different techniques, but the techniques that could manufacture sustainable cement should be followed as those methods would bring up an efficient building material using the cheap raw material which are also environment friendly. Energy conservation, soil, water, air, environment conservation and reduction in carbon dioxide emission only make a sustainable material. Methods have been mentioned in this report for the production of cement are more environments friendly and durable having long sustainable life. The life and durability must be monitored time to time and maintenance should be done to keep structures and buildings durable for longer times. For this purpose, different testing and analysis techniques are there for the engineers to perform right before and after the construction of the structures and buildings. This will help in elevating the importance of sustainable cement production and its use among public in a more efficient way.

## **References**

- Ekincioglu, O., Gurguna, A. P., Engin, Y. Tarhan, M. and Kumbaracibasi, S. (2013). Approaches for sustainable – cement production: A case study from Turkey, *Energy and Buildings*, Vol. 66, pp. 136–142.
- Githachuri, K., and Alexander, M. G.( 2013), “ Durability–performance potential and strength of blended– Portland limestone cement concrete,” *Cement & Concrete Composites*, Vol. 39, pp 115–121.
- Ghaz, M. P. 2013, “ Sustainable– infrastructure materials: – Challenges and



Opportunities," Int. Jr. of App. Ceramic Technology, Vol. 10, No. 4, pp 584-592'

Naik, T. R.( 2008), " Sustainability of concrete construction", Practice periodicals on structural design and construction, pp 98-103

Uwasua, M, Hara, K. and Yabar, H.(2014). World cement production and environmental implications," Environmental Development, Vol. 10, pp. 36-47.