

# THE CONTRIBUTION OF THE NIGERIAN CEMENT INDUSTRY TO GLOBAL WARMING.

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## ABSTRACT

The issues of global warming have taken the centre stage all over the world and its effects are manifesting every where especially in the sub-Saharan Africa. Industrialisation is the main cause of global warming. The highly developed countries that are highly industrialised are regarded as the main culprits in this menace. The developed countries have been at the receiving end of the negative effects of the global warming. With the modest development in industrialisation in the developing countries they are now gradually joining the league of green house gas emitters. In Nigeria the cement industry has made a considerable improvement in production capacity and development. This has resulted to an increase in cement production in Nigeria with its attendant increase in carbon dioxide generation into the atmosphere. Nigeria will be producing over 25million metric tonnes of cement annually and at the rate of one tonne of cement to one tonne of carbon dioxide, the country will likely be producing 25 million metric tonnes of carbon dioxide from cement production annually. The paper x-rayed this and showed the potential of the Nigeria cement industry in the contribution to global warming.

**KEY WORDS;** cement, carbon, global warming.

## 1.0 INTRODUCTION

The intensity of the solar radiation on the earth surface is moderated and reduced by the cover of the ozone layer and the re - radiation of the sun radiation back from the earth surface (Cook 1996). Therefore, the two possible ways by which the earth surface can be unnecessarily heated is by the depletion of the ozone layer and the re- absorption of the re- radiated heat from the earth's surface by gases in the form of the green house effect.

The production of cement entails the use of the following raw materials; limestone, marble, shale and gypsum. These raw materials are chemically made up of gases and compound that contain green house gases. These raw materials release carbon dioxide and sulphates into the environment as the process of cement production go on. Lime stone is over eighty percent calcium carbonate while marble and shale each is over fifty percent calcium carbonate and over forty percent magnesium carbonate (see tables 1 and 2). Gypsum has over fifty percent sulphate and about thirty percent calcium oxide (see table 3). Coal, gas and other petroleum products used in powering cement production are hydrocarbons which on heating release carbon which combines with oxygen to form carbon dioxide that is released into the air in the course of cement production. The carbon dioxide contributes in the depletion of the ozone layer which causes the warming of the globe. This paper therefore assesses the extent of the carbon dioxide emitted into the atmosphere from the Nigerian cement industry.

### **The depletion of the ozone layer**

The earth surface is enveloped and protected from the direct effects of the rays of the sun by layers of gasses in the form of the atmosphere which is made up of the lower atmosphere called the troposphere where most of the gasses including ozone gases and vapour exist in the atmosphere. After the troposphere is the stratosphere with a layer of ozone gases and traces of other gases. Above this is the ionosphere, the exosphere, and the universe which contain practically no gas or vapour. Thirty five percent of the sun's radiation coming to earth is intercepted and reflected back to space by these gases, clouds and air molecules thereby protecting the earth from the direct effects of these radiations. About fifteen percent of the radiation is absorbed by water vapour and other gasses into the blue sky. This makes it possible for only the remaining fifty percent to reach the earth (Areola etal 1990).

The only thing that will make it possible for more than the fifty percent of the direct radiation, to strike the earth surface will be the destruction or the depletion of these layers of gasses that envelope and protect the earth from the direct effects of the sun's radiation. The main part of these layers of gases that protect the earth's surface is the ozone layer of the stratosphere. The ozone gases in the stratosphere act as a crucial filter that

protects life on the planet from many of the harmful effects of ultraviolet radiation from the sun. However, the ozone gas in the troposphere is both a green house gas and in many polluted urban areas, a threat to public health (Mackenzie 1997).

Although the highly developed industrialized countries of the world are always accused as the highest emitters of gasses and other substances that deplete the ozone layer, poor and developing countries like Nigeria and other African countries are also contributing their quota in the release of the ozone layer depleting gasses. One way of doing this is through the emission of carbon dioxide in the production of cement by the cement industries.

## 2.0 Cement as a store of carbon.

Cement like other sources of green house gases is a store of carbon. Looking at tables 1 and 2 shows the constituents of cement and their carbon contents. The main minerals used in the production of cement in Nigeria are limestone in some of the plants and marble in other plants like the Okpilla cement plant. Both of these minerals are mainly carbonates of calcium and magnesium (see table 1 and 2.) The conversion of limestone into cement releases carbon dioxide as a waste product. This happens when limestone is burnt in the process of producing cement.

## 3.0 Limestone as a store of carbon.

Limestone as an industrial mineral is mainly composed of the carbonates of calcium and magnesium (see table 1). The main constituent mineral for the production of cement is limestone, which is mainly calcium carbonate ( $\text{CaCO}_3$ ) which contains carbon and oxygen. The carbon and oxygen in calcium carbonate could easily result to carbon dioxide as a by product in the production of cement. From table 5, cement is mainly calcium oxide. When lime stone which is calcium carbonate is burnt to turn to calcium oxide, carbon dioxide is released as a waste product. Wilson and Law (2007) described the making of cement as a greenhouse double whammy. This is because the conversion of limestone to cement generates carbon dioxide; the fossil fuel used in heating it also generates carbon dioxide.

TABLE 1: PERCENTAGE QUANTITY OF CALCIUM CARBONATE AND MAGNESIUM CARBONATE IN NIGERIAN LIMESTONE DEPOSIT.

Deposit	Total Calcium carbonate ( $\text{CaCO}_3$ ) (%)	Total Magnesium carbonate ( $\text{MgCO}$ ) (%)
Sokoto	81.20	2.80
Ewekoro	82.85	3.60
Kwara	89.00	traces
Makurdi	86.40	1.50
Yandev	94.80	1.30
Igumale	77.00	2.50
Nkalagu	84.20	1.40
Calabar	96.60	1.20

Source: Chemical analysis of major limestone and marble in Nigeria. (Raw material research and development council)

TABLE 2: PERCENTAGE QUANTITY OF CALCIUM CARBONATE AND MAGNESIUM CARBONATE IN NIGERIAN MARBLE DEPOSIT.

Deposit	Total calcium carbonate ( $\text{CaCO}_3$ ) (%)	Total Magnesium carbonate ( $\text{MgCO}$ ) (%)
Barum	55.40	41.70
Elebu	47.20	35.50
Igbetti	52.60	41.60
Kwakuti	70.50	23.00
Jakura	96.50	1.30
Ukpilla	91.60	4.60

Source: Chemical analysis of major limestone and marble in Nigeria. (Raw material research and development council)

## 4.0 Gypsum as a store of calcium sulphate.

Gypsum is mainly made up of hydrated calcium sulphate and calcium oxide (see table 3). Calcium sulphate being a greenhouse gas contributes to global warming. Nigerian cement industry consumes about one million tonnes of gypsum annually.

TABLE 3: PERCENTAGE QUANTITY OF SULPHATE AND CALCIUM OXIDE IN GYPSM

	Fika sele 3 par	Fika 2 Selenite	Fume 1	Fume 2	Dange	Post kum	Bura Rafa 1	Bula Rafa 2
Sulphate (SO <sub>4</sub> )	54.78	55.77	52.83	52.50	56.90	54.75- 55.77	53.21	51.89
Calcium oxide (CaO)	22.85	23.24	30.84	30.69	24.48	22.84- 23.24	31.04	31.12

Source: multi disciplinary committee report of the techno economic survey on Non-metallic section of Raw material research and development council. December 2003.

### 5.0 Other generators of carbon dioxide in cement production.

Coal and oil are the two other products that generate carbon dioxide in cement production (see table 4). In the production of cement, coal and oil are burnt to generate heat. This also releases carbon dioxide to the atmosphere. This carbon dioxide helps in warming the environment.

TABLE 4: PERCENTAGE CARBON CONTENT OF SOME OF NIGERIAN COAL AND PETROLEUM PRODUCTS.

Prime coking coal	Enugu coal	Ofugo coal	Lafia (Obi) coal		Gas	Diesel
			% washed	% unwashed		
%	%	%	%	%	%	%
89.5	79.3	76.01	87.6	68.0	76.5	78

Source: Aderibigbe 1989 Proceedings of the technical seminar on metal, iron and steel (Raw material research and development council 1989).

### 6.0 Generation of carbon dioxide in the production of cement in Nigeria.

Wilson and Law (2007) stated that for every tonne of cement produced about half a tonne of carbon dioxide is released excluding the carbon dioxide released from the energy needed in the process. In total, close to a tonne of carbon dioxide is released for every tonne of cement produced.

Anew Dangote plant at Ibeshe in Ogun state will be commissioned before the end of the year 2011. This was stated by the company's executive director for sales and marketing in July 2011. The Ibeshe plant has an installed capacity of six million metric tonnes of cement per annum (see table 5 below). Manufacturers and importers of cement in Nigeria are increasing their capacity to meet up both local and export demand (Adeyemi 2010). Lafarge (WAPCO) Nigeria PLC said it had put in place measures to increase its production from 2.5 million metric tonnes to 4.5 million metric tonnes per annum. Lafarge will do this by constructing a new cement plant at Ewekoro. It also said that they would construct a 4.7 kilometres long double conveyor belt to transport lime stone and shale between the quarry and the new cement plant and a clinker silo of 60 kilo tonnes capacity. The group envisages a consolidated cement production capacity of about 50 million tonnes per year within the next five years from 2011. This projection is based on its on going projects which are at various stages of completion. Local demand of cement alone currently is about 17 million metric tonnes per annum. Dangote has constructed an additional new cement line with a capacity of 3 million tonnes per year as well as two additional cement lines in Ibeshe in Ogun state with a total capacity of 6 million metric tonnes per annum. The Ibeshe plant will be powered by a 105 mega watt power plant that is run on natural gas and coal. Gas is supplied by a 22 kilometre long gas pipeline. Apart from the Ibeshe plant Dangote plans to boost local production of cement by 9 million metric tonnes by 2015. The group plan to increase the capacity in Obajana and Ibeshe by 6 million tonnes and 3 million metric tonnes respectively. Dangote cement alone will pump in 20.5 million tonnes of cement into the Nigerian market before the end of the year 2011. The table 5 below shows that Obajana cement plant will produce 10 million metric tonnes. Ibeshe plant will produce six million metric tonnes while Gboko plant in Benue state will produce 4.5 million metric tonnes.

- From table 5 Nigeria will be producing over 25 million metric tonnes of cement annually (Osagie 2011). From the research reported by Wilson and Law (2007) this implies that Nigerian cement industry will at the same time be releasing over 25 million metric tonnes of carbon dioxide into the environment annually. The issue presently is the effects of this local cement manufacturing boom to the environment. All stakeholders in cement business in this country comprising the government, the cement manufacturers association of Nigeria (CMAN) and others should be mindful of the effects of this boom on the climate change and global warming. It gladdens ones heart when Dangote reported that the plant at Ibeshe had low fuel consumption and the issue of reducing dust emission was taken seriously. It was reported that a total of 30mg/Nm<sup>3</sup> was the maximum target of dust to be generated which was about 10% of the federal government requirement of 300mg/Nm<sup>3</sup> benchmark for dust

emissions. It was also said that beyond reduction in dust emission using ultramodern equipment, there were also plans to recycle and reuse wastes generated. This is a good development to minimize environmental degradation and global warming from the nations local cement production. This is what this paper tries to highlight.

TABLE 5; INSTALLED CAPACITY OF NIGERIA CEMENT INDUSTRY

Companies	Plant Location	Installed capacity (metric tonnes)
Dangote cement plc	Obajana, Kogi state	10,000,000
Dangote cement plc	Ibeshe, Ogun state	6,000,000
Dangote cement Plc	Gboko, Benue state	4,500,000
Nigeria cement Plc	Nkalagu, Ebonyi state	600,000
West African Portland Cement.	Ewekoro, Shagamu, Ogun State	600,000 1,000,000
Bendel cement co	Okpella, Edo state	450,000
Calabar cement co	Calabar, Cross River	250,000
Cement company of Northern Nigeria Plc	Sokoto, Sokoto State	500,000
Ashaka Cement Plc	Ashaka, Gombe State	700,000
Benue Cement	Gboko, Benue State	900,000
Gateway Portland Cement LTD	Abeokuta, Ogun State	120,000

Source; Raw material research and development Council Technical brief on raw materials 2001.

Table 6: TYPICAL PERCENTAGE CONTENT OF THE OXIDES IN PORTLAND CEMENT.

Oxide	Composition in percentage
Lime CaO	.63.4
Silica SiO <sub>2</sub>	21.0
Alumina Al <sub>2</sub> O <sub>3</sub>	5.6
Iron Oxide Fe <sub>2</sub> O <sub>3</sub>	3.05
Magnesium oxide gO	1.5
Soda, Na <sub>2</sub> O	0.8
Potash, K <sub>2</sub> O	0.70
Sulphure trioxide, SO <sub>3</sub>	2.0

Source: Neville (1996).

## 7.0 CONCLUSION.

It has been shown that the cement industry which is fast growing in Nigeria is capable of generating a good chunk of carbon dioxide into the atmosphere. This paper is a wake up call to what this is likely to lead to in the future. The earth is warming up with its attendant negative effects. Interested stake holders are called upon to study the issues raised in this paper in order to contribute to the nipping of the effect of global warming in the bud.

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