

The Cement Industry in Ethiopia

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(Received 15 August 2018, Revised 14 September 2018, Accepted 17 September 2018)

Abstract

The cement industry is one of the rapidly growing industry in Ethiopia. The average per capita cement consumption of the country has increased from 39kg to 62kg. However, this is still way below than the global average per capita consumption of 500kg. The Ethiopian government is planning to expand its cement industry by upgrading the current cement plants and also opening of new cement plants in order to meet the future demand of the country. Currently, the number of cement plants in Ethiopia has reached to 20. By the year 2025, per capita cement consumption is expected to increase to 179kg. Recently, Ethiopia has become one of Africa's largest market for the cement industry. In addition, Ethiopia has become the major exporter of cement in the Sub-Saharan African region. The Ethiopian cement industry is highly dependent on the use of imported energy sources for its production. This situation has a significant amount of impact on the high production costs of the industry. This paper will try to review the history, production, available resources, the technologies and energy use of the Ethiopian cement industry.

Key words : Cement industry, Demand, Production, Resources, Energy use, Ethiopia

1. Introduction

Cement is one of the most consumed construction material. The production of cement is accountable for 5% of global carbon dioxide emissions. The cement industry is one of the most energy consuming industry. However, the cement demand around the globe is increasing in a rapid phase. Cement production is dependent on factors like social, economic and geographical. And the other features of cement production is that cement plants are not uniformly distributed[1].

Ethiopia is located in the Eastern part of Africa and it is one of the Sub Saharan African countries. Ethiopia is the second most populous nation in Africa next to Nigeria. The current population of

Ethiopia is estimated to be around 100 Million. In recent years, Ethiopia has been registering double-digit economic growth and the country is expected to continue to sustain this impressive economic growth. And become one of the fastest growing countries in African Economies[2]. The cement industry is one of the rapidly growing industry in Ethiopia[2]. The construction of new mega-projects like the Grand Ethiopian Renaissance dam, several industrial parks, sugar factories, highway and railway roads, and private sector projects caused an increase in cement demand [3]. A lot is expected from the cement industry to fulfill all these demands in order to sustain economic growth of the country.

The Sub-Saharan African countries have the lowest per capita cement consumption compared to other African countries. But still, Africa has the lowest per capita cement consumption[4]. In Ethiopia, the per capita cement consumption is estimated to be

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62kg, which is way below than the global average per capita consumption of 500kg[5]. The cement demand in Sub-Saharan African countries is expected to increase by 50% from 2015 to 2025 [6]. There are only a limited number of resources and information on the cement industries in Ethiopia. This paper tries to review the cement industries in Ethiopia about its history, production, resources, technologies, and energy uses.

2. The History of cement industry in Ethiopia

In 1938, the first cement factory was built by the Italians in Dire Dawa town with 30,000 tons of yearly production. Two cement factories were built by the Ethiopian government in 1960's at Massawa (Eritrea) and Addis Ababa, with 70,000 tons each per year. In the year 1984 and 1991 two production lines were installed at Mughher with an installed capacity of 600,000 tons. From 2004 to 2012 there was a shortage of cement because of the boom in the construction industry. The construction of the Grand Ethiopian Renaissance dam which is one of the largest hydropower plants in the country, hous-

ing projects, and private investments has increased the cement demand in the country. Furthermore, it has caused an increase in the price of cement. In order to overcome this situation, the government has allowed the private sector to import cement. Even though the government allowed to import cement, but the shortage of foreign currency and other factors made it impossible to fulfill the cement demand in the country. Following these situations, new cement factories were built and there were expansions of existing factories. Due to this, the annual cement production has increased from 2.7 million tons to 10 million tons and the average per capita cement consumption has increased from 39kg to 62kg. As of 2010, the Ethiopian government has banned the import of cement to the country[7][2][5].

3. Cement production and available resources in Ethiopia

3.1 Cement production in Ethiopia

The cement industry in Ethiopia has changed from being an importer of cement to be an exporter of cement to its neighboring countries like to South

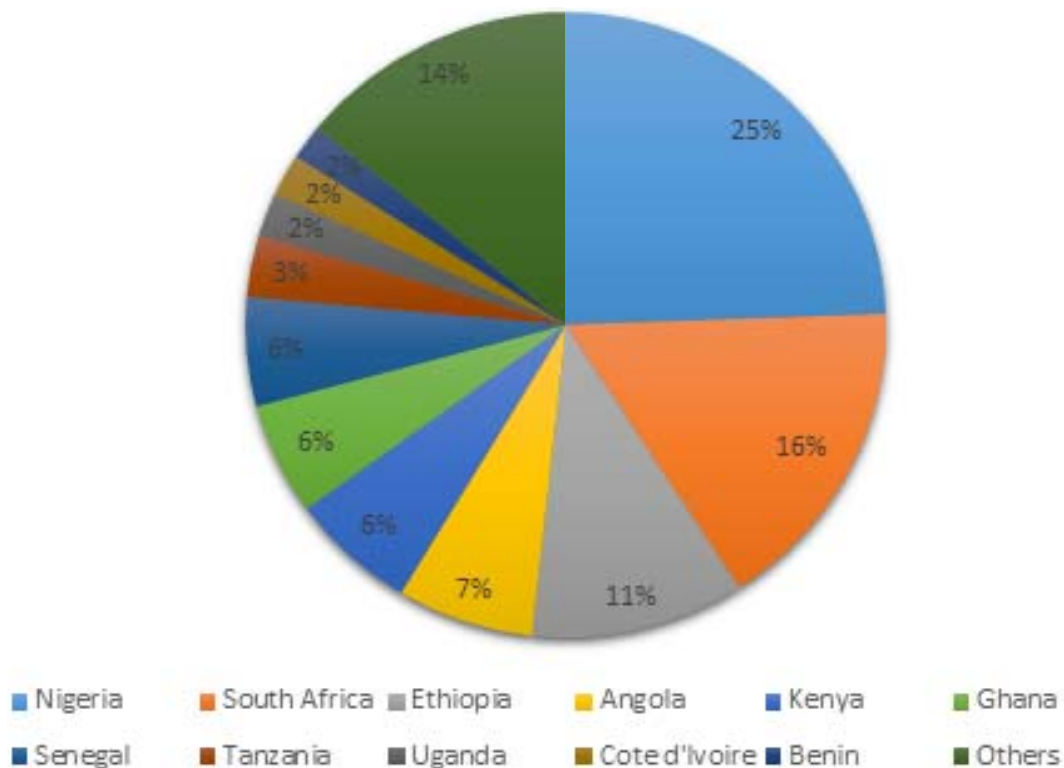


Figure 1 Sub-Saharan Africa's leading cement producers market share % [10]

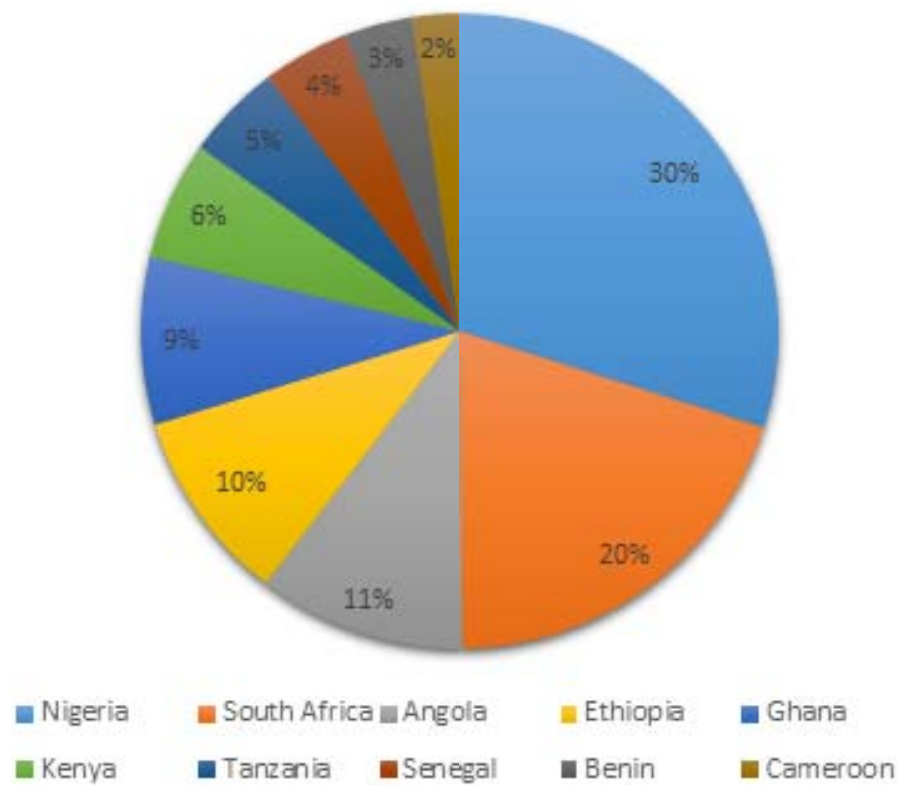


Figure 2 Sub-Saharan Africa's leading cement consumers market share % [10]

Sudan, Djibouti, Somalia, and Kenya [8][7][2]. The past few years, Ethiopia's cement production has shown an increase in its production capacity because of the opening of new cement companies and also upgrade of the old cement factories. Ethiopia has become one of Africa's largest market for the cement industry following Nigeria, Tanzania, and South Africa [9].

The number of cement factories in Ethiopia has increased to 20 from which 16 are integrated plants and the rest are grinding plants. At the end of the 2014, Ethiopia's cement factories have a total capacity of around 12.6 million metric tons per year [11]. In 2017, Ethiopia has produced 10 million tons of cement and by 2020 it is expected to produce 12 million tons of clinker per year [6]. The table shows the list of cement factories and their respective clinker production capacity in Ethiopia.

For the period of 2015 to 2025 the Federal Democratic Republic of Ethiopia (FDRE) Ministry of Industry has developed new strategies to guide the growth of Ethiopia's cement industry. The cement consumption of the country by the end of 2025 is projected to be 19.97 million tons, whereas

the capacity that is required is projected to be 25.16 million tons. This indicates that by the end of 2025 there will be some additional capacities of 8.01 million tons. By the year 2025, per capita cement consumption is expected to increase from 62kg to 179kg. One of the strategic plans by the government is to improve the Ethiopian cement industry by promoting the production of green cement [5].

3.2 Availability of cement raw materials in Ethiopia

Generally, limestone deposits which are the major ingredients for the production of cement are common in Africa [10]. Ethiopia has a huge amount of reserve of raw materials for the production of cement. The major raw materials for the production of cement are limestone, clay, silica sand, gypsum, and pumice. The reserve amount of limestone, clay, silica sand, gypsum and pumice is 171,000,000 metric tons, 21,600,000 metric tons, 3,400,000 metric tons, 57,400,000 metric tons and many million tons respectively [12].

Table 1 Cement plants in Ethiopia[2]

Plant	Year of Operation	Clinker capacity (ton/day)
Muger Cement Enterprise	1984	2000
Mesebo Cement Factory	2001	2330
Huan Shang P.L.C	2010	860
National Cement S.C	1936	960
Abyssinia Cement P.L.C	2007	288
Jema Cement P.L.C	2008	100
Debresina Bussiness industries P.L.C	2009	288
Dejen Mini Cement Plant	2007	288
Mugher Cement Expansion project	2012	3000
Messobo Cement Expansion Project	2011	3300
National Cement S.C (new)	2014	2880
Derbadashen Cement Plant	2011	288
Jema Cement Plc.	2014	100
Derba MIDROC Main Cement Plant	2012	5600
Dangote Industries P.L.C	2015	4800
Habesha cement S.C	2016	3000
Ethio-Cement Plc.	2014	1340
East Cement Plc.	2011	1675
Pioneer Cement Plc.	2012	1000
EnchiniBedroc Cement Plc.	2012	667

4. Cement Technologies and Energy use in Ethiopia

In the past decade, the cement industry in Africa has risen by 5% per year. Ethiopia and Nigeria have become the major exporters of cement industry in the region. In Ethiopia, due to high investment and infrastructure growth, the cement demand has increased compared to other Sub-Saharan African countries. Ethiopia is one of the highest cement consumer nations next to Nigeria, South Africa, and Angola. Even if the cement consumption within the

regions is increasing the per capita consumption is way below than the global consumption average [10].

However, the cement production in Sub-Saharan African countries is growing but the total output production of cement in this region is only around 2.9% of the world total. This is because of the underutilized capacity and under investments of the sector; which is the major cause of high production costs. Due to this, the cement sector became unable to compete with the global cement market. This is one of the major challenges the Ethiopian cement industry is facing [10][5].

The current cement production capacity utilization rate in Ethiopia is only 50%. If it continues like this

for the next decade the cement industry is under a huge threat. The cement production in Ethiopia is known for its high energy costs[2]. The energy cost in Ethiopia is 50% to 60% of the total operational cost[2]. Due to the expansion and growth of the industry, energy consumption and CO₂ emissions are expected to increase. In the year 2010, 1.4Mt of CO₂ emission was recorded only from the production of cement in Ethiopia[2].

The vertical shaft kilns (VSK) and rotary kilns are the two types of kilns that are used in Ethiopia[2]. Majority of cement plants use the vertical shaft kilns. The use of obsolete technologies like the vertical shaft kilns (VSK) will result in high energy consumption, high operating costs, and low-quality products[2]. This is one of the major source of problem for the high production costs in the Ethiopian cement industry. If all the cement plants in Ethiopia used rotary kilns instead of vertical shaft kilns (VSK), 16% of fuel and 4% of energy could be saved [2]. Furthermore, this will decrease the amount of CO₂ emissions to the environment.

The Ethiopian cement industry is highly dependent on the use of imported energy sources for its production[2][5]. This situation has a significant amount of impact on the high production costs of the industry. The substitution of imported energy sources with locally available resources and the use of alternative energy sources will have a positive impact on the reduction of operational costs of the cement industry.

5. Conclusion

Majority of the cement plants in Ethiopia use a vertical shaft kiln (VSK) for their clinker production. The use of such kind of obsolete technologies not only consumes a high amount of energies but also have an environmental impact. The Ethiopian government should ban the use of vertical shaft kilns for the new cement plants that are going to be constructed in the future. The other challenges in the Ethiopian cement industry is the use of imported energy sources for its production. The use of imported energy sources has a huge impact on the high production costs of the industry. In order to overcome this problem, the industry shall try to replace the use of imported energy sources with locally available and alternative energy sources. To compete with the

global market, the Ethiopian cement industry should encourage and promote the production of green cement.

Acknowledgements

This research was supported by the National Strategic Project-Carbon Mineralization Flagship Center of the National Research Foundation of Korea (NRF) funded by the Ministry of Science and ICT (MSIT), the Ministry of Environment(ME) and the Ministry of Trade, Industry and Energy (MOTIE) .(2017M3D8A2084752).

References

- [1] A. p.-S. n. G. F. n. E. Alfonso ArandaUsón n, "Uses of alternative fuels and raw materials in the cement industry as sustainable waste management options," *RenewableandSustainableEnergyReviews*, p. 242-260, 2013.
- [2] E. W. Gudise Tesema, "Energy efficiency improvement potentials for the cement industry in Ethiopia," *Energy*, pp. 2042-2052, 2015.
- [3] Y. Jemaneh, "AllAfrica," 25 03 2017. [Online]. Available: <https://allafrica.com/stories/201703270481.html>. [Accessed 18 09 2018].
- [4] L. W. T. M. H. d. C. Raluca Ionita, "Climate Technology & Development:Energy efficiency and GHG reduction in the cement industry Case study of Sub-Saharan Africa," *Climate technology & development*, 2013.
- [5] F. M. o. Industry, " Ethiopian Cement Industry Development Strategy 2015-2025," Addis Ababa, 2015.
- [6] "Use of Alternative Fuels in the Cement Sectorin Ethiopia: Opportunities, Challenges and Solutions," World bank group & Korea Green Growth Trust Fund, Washington, DC, 2017.
- [7] T. Reporter, "Anomaly in the cement industry," Addis Ababa, 2015.
- [8] T. G. C. Rreport, "Ethiopian cement industry faces persistent challenges," 2018.
- [9] B. Intelligence, "Africa's cement industry is expanding fast," 08 04 2016. [Online]. Available: <https://www.bloomberg.com/professional/blog/africas-cement-industry-is-expanding-fast/>.
- [10] E. B. T. P. A. Bank, "Middle Africa Insight Series | Commodities | Cement," 2014.

- [11] T. R. Yager, "The Mineral Industry of Ethiopia," U.S. Geological Survey (USGS), 2017.
- [12] E. I. Agency, "Investment Opportunity Profile for Manufacturing of Cement in Ethiopia.," 2008.