



Bioenergy in Cement Manufacturing in Nigeria

SUMMARY

Nigeria, Africa's most populous country, went from being a significant net importer of cement in the early 2000s (producing nearly 4 million tonnes [Mt] p.a. while importing nearly 20 Mt p.a.) to being one of Africa's largest cement producers (nearly 50 Mt capacity in 2018)¹ and exporting nearly a quarter of its output.

Cement production is now Nigeria's leading manufacturing industry. It is also Nigeria's largest greenhouse gas (GHG) emitter in its industrial sector.²

This turn-around was mainly the result of a far-sighted strategy called the Backward Integration Policy (BIP). The BIP transformed a system that rewarded companies who imported cement to one that promoted investment in local production. It also focused on quality as much as quantity, encouraged energy efficiency, supported investment in state-

of-the-art equipment and ensured access to international capital and technical support. This has encouraged innovations such as the adoption of alternative fuels,³ including bioenergy, to substitute for fossil fuels in cement production.

Lafarge Africa was established in 1959 as the West African Portland Cement Company (WAPCO). It has taken the lead in the adoption of alternative fuels for cement production in Nigeria and four of its five factories in Nigeria now use bioenergy, at a growing scale. Other Nigerian cement producers are watching them closely, with Dangote planning to scale up their use of alternative fuels (old tyres, MSW, etc.) possibly to test bioenergy.⁴

This briefing paper analyses the policy, legal and regulatory frameworks governing the cement sector in Nigeria, and examines the policies required to encourage increased use of bioenergy in cement production.

SECTOR OVERVIEW

Cement production in Nigeria is dominated by three companies: Dangote Cement, Lafarge Africa and the BUA Group.

These companies produced around 61%, 22% and 18% of Nigeria's cement, respectively, in 2019. While being a more recent entrant to cement production, Dangote is now, by far, Nigeria's top producer.

Lafarge Africa is Nigeria's second largest producer. It is a subsidiary of the Holcim Group⁵, the world's largest cement company, and has five plants at four sites: Ewekoro and Sagamu in Ogun State (Figure 1), Mfamosing in Cross River State, and Ashaka in Gombe State.

Nigeria's cement industry has traditionally used natural gas, imported and domestic coal, and some domestic petroleum⁶ to supply heat for co-processing limestone into clinker, the main ingredient of cement. While fossil fuels are plentiful in Nigeria, Lafarge Africa has taken the lead among Nigeria's cement companies to increase use of bioenergy to supply their process heat. This drive has been led by Lafarge Africa's alternative fuels subsidiary, Geocycle⁷, which is now co-processing biomass (oil palm residues and rice husks) with fossil fuels at four of its five plants.

Lafarge began substituting natural gas with locally-sourced biomass for cement processing at its Ewekoro and Sagamu plants (Ogun State) in 2014.⁸ This was driven by a combination of unreliable gas supplies⁹ and a commitment to reduce greenhouse gas emissions from burning fossil fuels.¹⁰ The aim was to shift as much as possible to sustainable, local energy supplies, reducing emissions and stimulating rural development through local sourcing. Among the alternative fuels trialled, oil palm residues have now replaced almost half of previous natural gas consumption at Ewekoro, while rice husks meet an increasing share of Lafarge Africa's energy needs at the Ashaka plant.



¹ 'Cement in West Africa', Global Cement, 1 Oct 2018, <https://www.globalcement.com/magazine/articles/1079-cement-in-west-africa#:~:text=Nigeria%20has%20by%20far%20the,yr%20of%20capacity%20when%20completed.>

² Nigeria's Third National Communication (TNC) to the UNFCCC, June 2020, p. 10.

³ Alternative fuels explored by Nigerian cement companies include various bioenergy sources (wood and oil palm residues), municipal solid waste (MSW), old tyres, plastics and hospital waste, among others.

⁴ Dangote Cement Plc Annual Report and Accounts 2020

⁵ Holcim Group became the official name of the LafargeHolcim international cement company in May 2021

⁶ Nigeria is Africa's largest oil producer and second largest natural gas producer.

⁷ Geocycle is an international special purpose vehicle (SPV) set up over 30 years ago to provide international support

for industrial, agricultural, municipal and other waste management services to Holcim's own cement operations and to other public and private entities around the world. Its bioenergy supply model has been successfully adopted in a number of other Holcim cement plants in Sub-Saharan Africa (SSA).

⁸ The palm oil belt is highlighted on the map due to its importance for sourcing oil palm residues.

⁹ An interruption of fuel supply to a cement kiln can stop production and significantly impact clinker production and quality.

¹⁰ Cement production generates more than 5% of global GHG emissions. www.iea.org/reports/cement See Lafarge Africa's Annual Reports (2018 and 2019) and Sustainability Reports (2017, 2018 and 2019).

INSTITUTIONAL FRAMEWORK OF THE CEMENT SECTOR

The key stakeholders in Nigeria’s cement sector are government ministries and agencies at federal and state level, as well as private sector manufacturers and non-government actors such as industry associations (Figure 2).

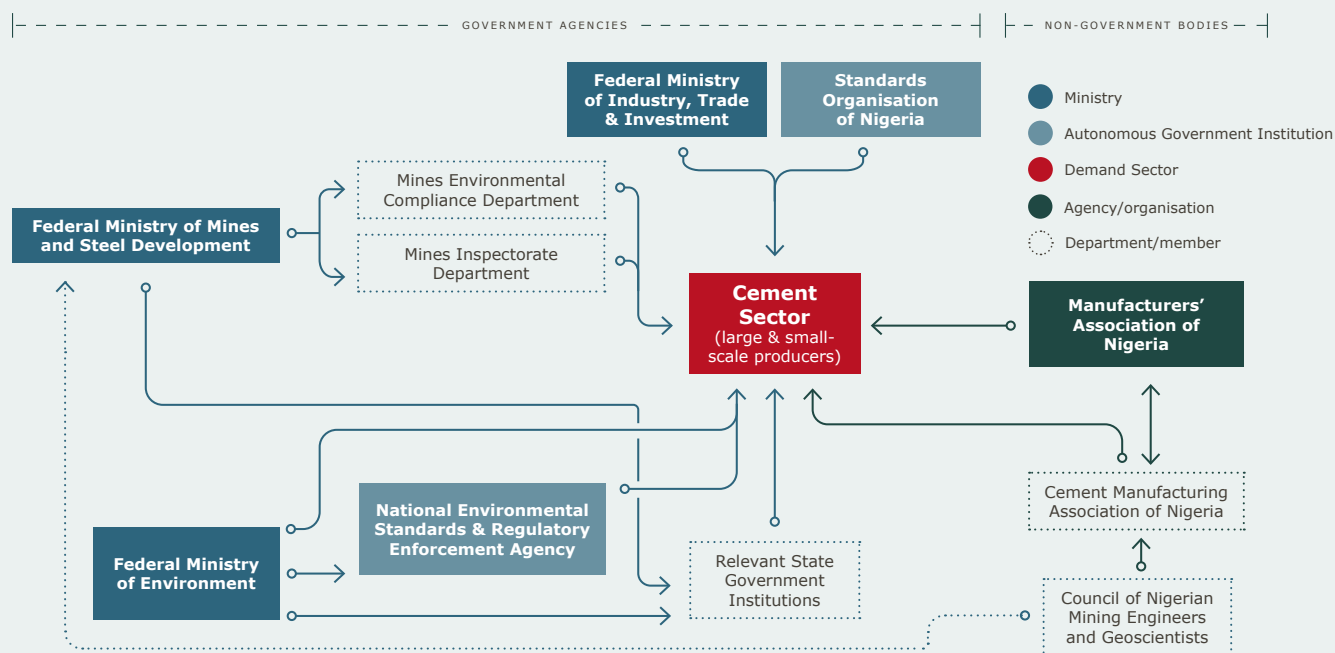
The institutional framework for the industry is led by the Federal Ministry of Mines and Steel Development (MMSD), which licenses and oversees limestone extraction through its Mines Environmental Compliance Department and Mines Inspectorate Department. The Standards Organisation of Nigeria (SON) sets and enforces standards for cement production, which has stimulated significant local investment. The Council of Nigerian Mining Engineers and Geoscientists (CNMEG) advise the MMSD and sets the professional standards of mining in Nigeria.¹¹ The Federal Ministry of Industry, Trade and Investment (MITI) has been a champion for the expansion of the cement sector. The MMSD and MITI see cement as

an important industrial sector, a significant rural employer and an important foreign exchange earner. They have supported Nigerian and international businesses to expand cement production and exports.

State governments in the main cement-producing States of Ogun, Gombe, Ebonyi, Benue, Cross River and Sokoto have environmental protection agencies, departments of environmental conservation and resource management, departments of mines, lands, water, industries, roads and other infrastructure support agencies.

The Council of Nigerian Mining Engineers and Geoscientists advises both federal and state governments on technical aspects of cement production. The Cement Manufacturers’ Association of Nigeria is currently dormant, but the Manufacturers’ Association of Nigeria provides support and advocacy to cement companies.

Figure two: Nigeria cement institutional framework



INSTITUTIONAL FRAMEWORK OF THE CEMENT SECTOR POLICIES AND REGULATIONS GOVERNING THE CEMENT SECTOR'

As noted, above, the Backward Integration Policy (BIP) of 2002 helped transform Nigeria from being a net importer in the early-2000s, to what it is today Africa’s largest cement producing country.

Dangote invested in its first cement factory in 2000. Today it is the world’s 10th largest cement producer

with investments in 8 African countries. The Minerals & Metals Policy (2008) provides strategic guidance on the management of mineral resources and metals, with special emphasis on expansion of the cement sector, as does the Roadmap for the Growth and Development of the Nigerian Mining Industry (2016).

¹¹ Council of Nigerian Mining Engineers & Geoscientists Act, Act No. 40, 1990, 30 December 1990, <https://laws.nigeria.placng.org/laws/C33.pdf>

The Minerals & Mining Act (2007) and Minerals & Mining Regulations (2011) regulate the quarrying of limestone and require cement companies to obtain a quarry licence from the MMSD. Cement companies may also buy limestone from quarries that they do not own.

Cement companies must carry out Environmental Impact Assessments and prepare an Environmental Protection Plan, for approval by the Mines Environmental Compliance Department.¹²

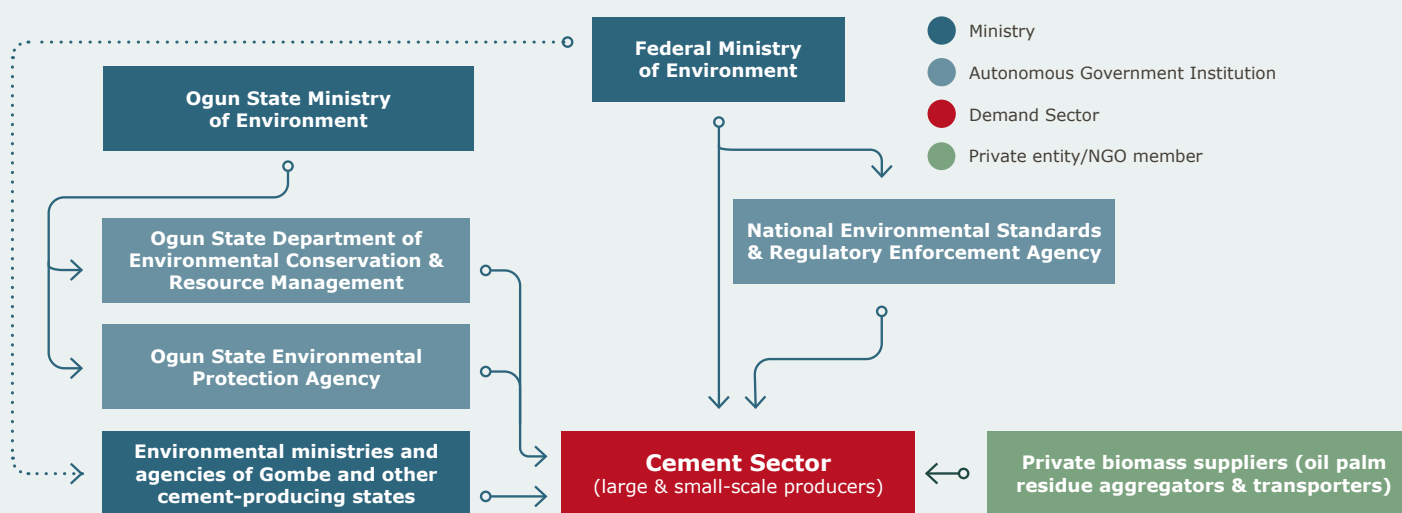
ENVIRONMENTAL FRAMEWORK FOR BIOENERGY USE

Bioenergy use by the cement industry falls under the jurisdiction of federal and state ministries and agencies dealing with environmental affairs (Figure 3).

The Federal Ministry of Environment (FMEnv), is responsible for national policies dealing with environmental protection,

conservation and management, including those related to bioenergy. It has supported efforts to replace fossil fuels with bioenergy in cement production. Since Ogun State is home to more than half of Nigeria’s cement plants, its state environmental agencies play a particularly important role in promoting bioenergy use by the cement industry.

Figure three: Environmental framework for bioenergy use in cement sector in Nigeria



POLICIES AND REGULATIONS GOVERNING BIOENERGY

Combustion of fossil fuels and biomass results in emissions of carbon dioxide, carbon monoxide and particulates during calcination (the production of clinker from limestone and small amounts of additives).

The National Environmental Standards & Regulatory Enforcement Agency (NESREA), an FMEnv parastatal regulator, sets maximum permissible levels of air, water, soil and other pollutants through the National Environmental (Non-metallic Minerals Manufacturing Industries Sector) Regulations of 2011.¹³ This sets maximum permissible levels of various airborne pollutants for various energy sources, including organic carbon (e.g. from burning biomass).

However, the most important focus of the regulations cover a key by-product of the calcination process, namely the production of cement kiln dust (CKD) which is released into the atmosphere and contains limestone dust, dust from

the combustion of other additives and particulates from biomass and other fuel combustion. If not captured, CKD can be dispersed over relatively large areas and pose airborne health hazards.

Lafarge Africa’s kilns are fitted with CKD recovery equipment which captures most of the CKD generated during cement production. The captured CKD is then recycled continuously in the kiln which not only reduces airborne pollution, but also improves the cement kiln’s efficiency by reducing energy consumption.

The management of CKD emissions and all other air pollutants (e.g. methane from natural gas transport and supply to the kiln) are measured by Lafarge Africa to comply with Nigeria’s National Environmental (Air Quality Control) Regulations, 2014 (Federal Republic of Nigeria 2014) which sets standards for air quality for all fuel and material

¹² The Policy, Act and Regulations place strong emphasis upon expanding cement production
¹³ Schedule IV (Regulations 11 & 32), 2011, Maximum Permissible Air Emissions Levels for Cement Manufacturing (Admin 2011)

combustion associated with the production of cement, which covers emissions associated with any bioenergy combustion. The Ogun State Policy on Environment (2013) also covers CKD and other atmospheric emissions associated with cement products to reduce negative environmental impacts from cement production.

The Policy also requires consistent assessment of the impacts of commercial and developmental projects on the environment.

Lafarge Africa works closely with state governments to ensure environmental compliance under the federal and state regulations. It works closely with the Ogun State Environmental Protection Agency (OGEPA) which is charged with protecting the environment in the State. It coordinates waste management (including for bioenergy), domestic and industrial pollution control and ensures compliance with environmental laws.

IMPACT OF POLICIES ON ADOPTION OF BIOENERGY WITHIN THE CEMENT SECTOR

The BIP provided easy access to credit and finance to cement companies, and supported modern, innovative cement production practices to reduce cement imports and stimulate Nigerian cement sector and overall industrial development.

This succeeded beyond expectations turning Nigeria into a net cement exporter with one of the most dynamic and innovative cement industries in Africa. While the top three Nigerian cement companies have proven very innovative in utilising some of the world's state-of-the-art production methods, there are no direct policy incentives for adopting bioenergy.

While federal and state regulations governing the cement sector are relatively light, both federal and state governments have placed increased emphasis on improving cement quality to improve building integrity and safety. Federal and state air, water and waste policies, and regulations are also

relatively light on cement, but there are strong local pushes for improved air and water quality. The three major Nigerian cement companies (Dangote, Lafarge Africa and BUA) comply with national and state environmental standards on particulate matter (PM), CO₂ and other gas emissions, noise and PM pollution associated with limestone quarrying and transport, CKD at factory sites and water pollution at quarries and factories.

Compliance of the big three cement companies with Environmental and Social Impact Assessments (ESIA) has been continuous at both federal and state levels. This highlights a key factor in terms of bioenergy use in cement production in Nigeria. Government at both a federal and local level is currently silent about bioenergy. Thus, the drivers for co-processing fossil fuels with bioenergy depends upon each company's view on whether bioenergy fuel use achieves economic, social, environmental or other benefits that are important to each company.

RECOMMENDATIONS

The following policy, regulatory and market changes would promote wider adoption of bioenergy for coprocessing in Nigeria's cement sector:

- Government should use Lafarge Africa's model to demonstrate to local and federal government authorities (particularly the MMSD and MITI), and to other cement companies and industries, the benefits of developing and utilising bioenergy to reduce fossil fuel consumption, improve energy reliability and support rural agricultural economies.
- Government should use national mining and industry legislation to provide a more supportive framework to encourage cement and other industries to develop commercially viable bioenergy supply chains, to replace fossil fuels partly or fully, such as improved licensing, tax holidays and rebates, access to foreign exchange for investment, reduced or zero tariffs/duties on imported bioenergy equipment for cement factories, among others.
- Government should put in place incentives (e.g. reduced taxes, reduced duties on equipment imports, etc.) for Nigerian cement companies who invest in switching from fossil fuels to bioenergy fuels. This would have a strong climate change benefit by reducing greenhouse gas (GHG) emissions, thus helping Nigeria achieve its ambitious targets set out for 2030 under Nigeria's Nationally Determined Contributions (NDC) under the UNFCCC Paris Agreement (2015). Further, as demonstrated by Lafarge Africa, the use of bioenergy is adding value to farmers' agricultural development by valorising a crop 'waste' and thereby stimulating rural economic development.
- Federal and State Governments should develop policies and incentives to encourage cement companies and other energy-intensive industries to engage smallholder farmers in bioenergy supply from oil palm, cocoa, cotton, groundnut and other agricultural residues, to stimulate local supply networks, increase smallholder farm revenues and stimulate new agricultural and rural investment.