Plastic waste, Refuse derived fuels (RDF) and cement kilns -2024

Date: 30/09/2024

Name of NGO: Eco Ethics - Kenya

Background:

The shift to a circular economy, the production and use of refuse-derived fuels (RDF) is becoming increasingly important. Refuse-derived fuels can be extracted from industrial and commercial waste, and even from some household (residual) waste. RDF is a high-calorific-value fraction of municipal solid waste (MSW), obtained by conventional separation systems (Bocken et al., 2016).

More often, recyclable plastic is used for RDF. It is normally channelled through significant pre-processing steps such as screening, ballistic separation, air classification and separation of glass/metallic materials. This results in producing fuels of grain size that is in form of pellets. These pellets are then changed into homogenous material that are substitutes for fossil fuels in lime plants, cement plants and coal plants. RDF sometimes serves as a reduction agent in furnaces (Srivastava, 2023)

A replica of RDF is in the form of Solid Refuse Fuels (SRF). It is an alternative to fossil fuel produced from commercial waste such as plastic, paper, wood, card and textiles. SRF goes through multiple processing stages such as sorting and shredding to homogenise the material and average the moisture content of wastes. It boasts of a stronger calorific value than RDF and is used in cement kilns and boilers (Srivastava, 2023)

According to IPEN, (2024) one approach that has been taken by a number of countries, including Australia is to manufacture, use and export Refuse Derived Fuel (RDF) which is a mix of plastic waste (about 35% - 55%), timber waste, textiles (of which 60% are plastic), paper and other combustible material. The implication of exporting plastic waste as RDF is that it is often categorized as a 'fuel product' and not a waste thereby avoiding the regulation of the Basel Convention. This implies that RDF may be finding its way into Kenya under the guise of imported fuel and destined for cement manufacturing industries. Burning of RDF in cement kilns has serious environmental ramifications, more so, it leads to increased emissions of heavy metals but potentially also dioxins, PAHs and PFAS.

Co-Processing in Cement Kilns in Kenya

In Kenya, the building and construction sector is rapidly growing at an average rate of 14.2% which is highly correlated to a country's economic performance (Eshikumo and Odock, 2017). The growth is associated with increased affordable housing projects and overall housing

construction including funded housing development projects, the commercial construction boom from foreign investment and government, donor-funded spending on the country's mega infrastructure projects and the entry of new cement producers and extensive capacity expansion by existing players in response to increasing competition.

Fig. 1: One of the recent cement factories along the Kenyan coast which was part of the study.

Studies by Eshikumo and Odock, (2017) indicate that cement production expanded at an average rate of 11.6% from 2.41 million tons to 4.09 million tons in 2011, 5.19 million tons in 2014 and 5.23 million tons in 2015. As at now, the local cement industry includes cement companies with mines concentrated in several sites across the country: Bamburi Cement Limited; Rai cement limited; Ndovu cement limited; Athi River Mining Limited; East African Portland Cement Company Limited; National Cement Company Limited; Mombasa Cement Limited and Savannah Cement Company.

Project Outcome:

1. Abstract – A summary which may be used to describe the report on the ipen.org website if this activity includes a report (please make a maximum of 350 words, covering introduction, activity and significant findings/highlights)

The use of RDF as an alternative source of fuels extracted from industrial and commercial waste, and even from some household (residual) waste. RDF is a high-calorific-value fraction of municipal solid waste (MSW), obtained by conventional separation systems (Bocken et al., 2016). We designed a brief descriptive research design to depict the situation as it is on the ground. This was augmented by secondary design through obtaining relevant information from publications in journals. The target population were all the cement manufacturing

companies in Kenya. The companies were put into strata according to ownership (Devki group of companies, Holcim, Barak Asset Recovery, Rai Cement Limited, Tororo Cement Limited). Through simple random sampling the researchers obtained a sample of five factories for the study namely: Bamburi cement, Mombasa cement Vipingo; Savanna cement Athi River; East African Portland cement Athi River and National Cement Company Kaloleni. Primary data was obtained from a questionnaire that sought to obtain information on all the aspects captured in the objectives. In all the five cement factories prior visits were made to seek permission to collect data.

Results indicate that from a sample of five cement factories, one was outrightly using RDF as sources of alternative fuel - complementing the main electricity power from the national grid. The other was contemplating developing a division that could be tasked with generating energy from biomass as its alternative source of fuel. The latter, had been engaged by both the local and national government in burning contraband goods, counterfeits and expired items in its kilns as sources of fuels - ironically it was charging a small fee for this service. The rest of three were reclusive, and were very hesitant to release information relating to the use of RDFs or any forms in their factories. The truth could be that they are using it in their kilns.

Going forward, it is critical that the concept of RDF is made known to the government authorities and policy makers. Equally, the detrimental side of the RDFs, need be made apparent even to the owners of the factories currently burning or those that intend to burn as alternative fuel sources. Moreover, policies need be explicit on the use of RDFs particularly their importation into the country. At the moment it is not very clear and even though we got HS codes at the customs they were largely for tax purposes and their environmental effects were silent or unknown to a majority of people including government regulatory bodies.

2. Were you able to determine how much RDF is either imported to or manufactured in your country and if so, how much per year?

We held several discussions with five cement factories in Kenya, namely; Bamburi cement, Mombasa cement Vipingo; Savanna cement Athi River; East African Portland cement Athi River and National Cement Company Kaloleni. Of these five companies three (Bamburi, Mombasa and Sima Cement in Kaloleni) were along the Kenyan coast albeit with subsidiaries up-country. Two (Savanna cement Athi River; East African Portland cement Athi River) were within the vicinity of the capital city of Nairobi. It was quite clear that one of the factories within (Savanna) close by Nairobi city has been and on the path to increase use of RDF (see table 1)- although they did not provide exact figures.

Table 1: Sources of Energy Used in Cement Factories

Company Name	Bamburi Cement	East African Portland	Savanna Cement	Mombasa Cement	National Cement Company
Name of Group	Holcim	Holcim	Barak Asset Recovery (PKF Kenya)		
Where alternative energy is sourced, the components and exporting country	Both local and imported, the exporting countries are classified.	Alternative energy sourced locally and also imported. The exporting countries are classified	Alternative energy is obtained locally and also imported. Imported energy is classified while local ones are obtained from private waste collectors, arrangements with farmers and county government. Materials include biomass, chemical wastes, used oils, wax suspensions, paint waste, oil sludge, used tyres, rubber residues, plastic residues, battery cases and diapers		
Availability of plans to manufacture alternative energy and the materials to be used	Plans are at advanced stage to generate alternative energy from municipal waste especially plastic waste	There exists on site plans to manufacture alternative energy as waste generated fuel	By partnering with private waste collectors plans are at an advanced stage of manufacturing refuse derived fuel from municipal waste, biomass agreements with farmers and private firms and plastic refuse		
Quantity of alternative fuel used annually	Annual usage of alternative fuel is classified	This is classified	Quantity is not quantifiable owing to classified records		
Perceptions on alternative fuel and economic implication on energy use	Alternative fuel use is harmful to the environment and human health but inevitable in cement manufacturing. The future of energy in cement factories rests with alternative fuels hence it shouldn't be banned Economic implications are in real time	In view of the costs incurred on electricity and also on importation of coal the company is ready to embrace solid refuse fuel. Its cost effective and sustainable in the long run	The future is refuse derived fuels due to challenges with existing energy sources		

	analysis of gases, measurement from external labs for heavy metals and biomass toxicity				
Future plans for energy use and reduction of carbon emissions	Going meso scale on solar energy and geocycle. More production from biomass and optimization of process through engineering controls.	They plan to diversify to green energy 60%.	Future plans are to diversify green energy sources and put in place energy efficiency engineering interventions such as modernization of the cement clinker kilns.		

3. What is your government policy on RDF use? Does it provide incentives (carbon credits, subsidies, renewable energy credits etc) for burning RDF

Most of the policies and legislations reviewed addressed collection of waste from the point of generation. Notable among these are the National Sustainable Waste Management Policy (NSWM) Policy 2021, which calls for the counties to provide a well-managed central collection for materials that can be recovered for purposes of reuse or recycling.

Besides, Kenya has several policies and legislations to curb the plastic menace and comply with the deliverables in the Basel declaration on plastic waste management, it is suspected that plastic waste in form of RDF and in other disguised forms is finding its way into the Kenyan space. More so, it is hypothesised that apart from plastic waste in RDF being imported for utilisation to fuel cement kilns, a number of cement manufacturers could be generating their own RDF behind the scenes. The Kenyan policies do not spell out any specific incentives for the use of RDF.

4. Does your government track RDF imports and if yes what HS codes do they use?

We tried to get customs officials to answer some of our questions but this was not possible. However, we got some HS codes from the customs to show that there were some sort of tracing but mostly for the purposes of paying taxes. The investigation identified specific commodities related to Refuse Derived Fuels imports and their harmonized system codes, namely:

a) HS code 381220 and 390110: raw and finished plastic respectively
b) HS code 4810: for paper products
c) HS code 3824: for waste paring and scrap of plastics
d) HS code 1701: for cane or beet sugar and chemically pure sucrose but in solid state

e) HS code 2619: for slag, ash and residues.

It was noted that the primary countries of origin of refuse derived fuels imported in Kenya include China, India, Italy and Australia.

5. How many cement kilns are there in your country that burn RDF or plan to burn RDF?

From the sample of five factories that we visited, one agreed out-rightly to use of RDF or related, one hinted their interest to burn biomass as a form of fuel. They also indicated that the government have on numerous occasions used their facility to dispose of contraband or expired products through burning in their kilns. Others were too cautious especially since they have been accused of air pollution in their vicinities. The table 2 below presents a simple analysis of policy and technical aspects noted from some of the key cement factories visited.

Table 2: Policy and Technical Aspects

Company Name	**Bamburi Cement**	**East African Portland**	**Savanna Cement**	**Mombasa Cement**	**National Cement Company**
Name of Group	Holcim	Holcim	Barak Asset Recovery (PKF Kenya)		
Policy on alternative fuel and emission reduction as well as cost reduction	There is a policy on alternative fuel with a component on carbon emissions and cost reduction.	There is a cost resilient alternative fuel/sustainable energy policy.	There exists a solid refuse fuel generation policy.		
Criteria for alternative fuel use in the policy	There are set annual targets with a subsidiary	Fully advocates for alternative fuel generation within the legislative realm	Classified		
Decision making in relation to alternative fuel	Vested with environmental /energy officer	Vested with environmental officer	Energy officer		
Type of kiln used	Pre heater plus pre calciner kiln	Precalciner kiln	Precalciner		
The kiln technology in use and efficiency	Improvement of burner and installations such as transfer systems for biomass and other engineering solutions up to 50%	Engineering adjustments to support alternative fuel use	Improved burner efficiency		
Kiln thermal requirements	1450 degrees celcius	1500 degrees celcius	1450 degrees celcius		
Safety regulations in case of overheating	There are bricks installed with refractory properties to withstand heat up to 2000 degrees celcius. There are automation systems and temp sensors	Classified	Classified		

6. Outreach to Stakeholders: What stakeholders and sectors, including authorities were engaged in this activity, and what is the follow-up plan to advance the relationships with these stakeholders?

We reached out to those working in the factories, solid waste handlers that constitute the bulk of those who could sale them the wastes, as well as a number of environmental civil societies, customs officials among others. Going forward, it would be desirable to engage in civic education - the mention of just RDF does not ring a bell to many a people. In fact, quite a number of people believe that burning plastic related wastes at high temperatures should be less deleterious to the environment. So basically we need serious awareness about RDFs and their effects and propose some of the alternative options of disposing of materials like tyres and municipal solid wastes.

7. Communication efforts and project outputs: describe communication efforts, include high resolution photos (attached to the report), and list outputs (such as: reports, flyers, photos, posters, articles, etc.)

At this point we restricted ourselves to seeking information about use of RDFs and we did not want to highlight the nature of the research since that could have blocked free flow of information. Indeed, many factories we visited were not at peace discussing use of RDF with those outside their factories.

Once RDF awareness is out, policies against their use can be enacted and factories forced to disclose and reduce if not eliminate RDF as their potential sources of fuel.

8. Overall outcome: How did this project help reach the objective of the project (from strategic guidance)?

Overall, this is was a successful project, at least two out of the five cement factories we visited confirmed use of RDFs. It could also be that even the rest that did not give as audience were equally involved as well. By this realization most of the objectives of the project were met.

9. Conclusions and Recommendations

9.1 Conclusions

1. There are indicators of RDF usage in cement kilns disguised as imported fuel and classified. Companies are not willing to divulge much information on the same.

2. The burning facilities are majorly cement kilns with engineering controls to burn both imported and locally produced.
3. Most factories have active future plans to manufacture RDF from municipal waste and private firms. Some are co firing in cement kilns modified as incinerators.
4. Most factories have policies on RDF generation for cost reduction in energy usage.
5. Literature on RDF use in Kenya is scanty if not **clasified** by cement companies.

9.2 Recommendations

1. To meet the thermal substitution rate set up in the national strategy of mixed energy, restrict and limit the production of RDF only from organic waste and biomass.
2. To reduce the risks and increase safety in operation, there is a need for enhanced enforcement by NEMA (the Kenya National Environmental Management Authority).
3. For public health safeguard, no RDF processing plant allowed to be built near residential areas.
4. Information sharing by cement factories needs to be up scaled.
5. Creation of awareness about RDF amongst the public complete with avenues for resisting the use of RDFs should be fostered.