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REGULATING MINERAL AND ENERGY INDUSTRIES: A CHALLENGE FOR DEVELOPING COUNTRIES

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ABSTRACT

This paper will attempt to bring out the challenges of regulating mining and energy industries in a developing country like Zambia whose economy has depended heavily on mining since 1930s. The mining industry in Zambia has gone through major changes the last decade and thereby bringing in a range of challenges for the regulators. The challenges are political, technical, economical and social in nature.

The paper will also discuss the energy industry challenges under similar themes.

The Environmental Council of Zambia is a regulatory body formed in 1992 under an act of parliament called Environmental Protection and Pollution Control Act of 1990. Under this Act the institution is charged with environmental management in the country on behalf of the government. The mandate includes coordinating all other institutions that take care of specific aspects of the Environment.

Keywords: Spontaneous combustion, Long term limit, Sulphur dioxide

1.0 INTRODUCTION

Environmental management in Zambia is governed by the provisions of the Environmental Protection and Pollution Control Act (EPPCA) of 1990, which forms the basis for Environmental Council of Zambia (ECZ) as a regulatory body. The EPPCA also recognizes the other pieces of legislation that take care of specific aspects of the environment such as the Forestry Act, which was passed much earlier than EPPCA.

Regulating the mineral and energy sector in a developing country like Zambia has a lot of challenges due to a wide range of reasons. Under mining, the paper will focus on copper smelting at Mufulira smelter in Mufulira, Zambia. However, the situation there is very similar to the one prevailing at Smelterco in Kitwe. The focus will be on Air pollution though Smelting activities have various other environmental impacts which are equally significant.

On the other hand, the main sources of energy in Zambia are hydroelectricity, thermal electricity, petroleum, wood fuel (firewood and charcoal) and coal. These

contribute to air pollution in varying proportions. For instance about 69% of the total energy supply comes from wood fuel with most of it being for domestic purposes.

2.0 MINING

Zambia is a developing country whose economy has been heavily dependent on copper and cobalt mining since 1930s. Furthermore, the mines have been and are still the second largest employer after the Civil Service. In the past, the mines provided a lot of social services like water, electricity and medical services to their employees. The same applies for Maamba colliery which is the only coal mine in Zambia. In this paper, Maamba Colliers, being the major coal producer in Zambia and unique, will be used as a case study.

2.1 Air Pollution from Smelters

The particulate and SO_2 emissions from the point sources at Mufulira smelter are way above the Zambian limits as seen in table1and table 2 below:

Table 1 Particulates

Point Source	**Zambian Limits/ mg/Nm^3**	**Actual emissions mg/Nm^3**	**Pollution load Kg/hr**
Drier Cyclone	150	6314	175
Electric Precipitator outlet (1)	150	2709	317
Precipitator outlet (2)	150	4460	441

ECZ: 2001

Table 2 Sulphur Dioxide

Point Source	**Zambian Limits/ mg/Nm^3**	**Actual emissions/ mg/Nm^3**	**Pollution load Kg/hr**
Electric Precipitator outlet	1000	13146	709

ECZ: 2001

The technology currently used at Mufulira Smelter for dust cleaning is a combination of cyclones and electrostatic separators (ESP) with no provision for reducing SO_2 emissions into the environment. The cyclones and ESPs are meant to remove the particulates but even with them in operation, the emission levels are more than 20 times the statutory limits as shown in the table above. In addition, infrastructure is run down and has lost the effeiciency. The converter section has never had any air pollution abatement equipment. However, a sulphuric acid plant is currently under

construction adjacent to the smelter in Mufulira. When completed, SO_2 will be captured and made into sulphuric acid thereby reducing the amount of SO_2 to be emitted into the atmosphere. This is a capital investment.

2.2 Air pollution from Coal mine

Coal represents 6 % of the total national energy consumption (Energy policy, 1994). This is extracted by open pit mining in Sinazongwe district situated about 350 km south of Lusaka. The removal of topsoil exposes the underlying carbonaceous material to oxygen in the air resulting in spontaneous combustion. The emissions emanating from this activity are unquantifiable as they occur.
The only means of controlling the emissions is by rehabilitating the mined areas so as to deprive the carbonaceous material of oxygen. This is a very expensive venture, as it requires heavy-duty machinery. The government currently owns the mine such that with the current economic situation, both the mining and rehabilitation has slowed down. .

Even with all this pollution from both the Smelter and coal mine, ECZ has not shut them down as stipulated in section 91D of the EPPCA (see the extract) as doing so would have consequences. Instead, ECZ adopted a long-term limit approach.

Extract from section 91D (1) of the EPPCA

An inspector can by way of an ex-perte application, apply to a court for an order in respect of any premises on which an offence is suspected of being committed under this act to:

a) To prohibit the carrying on of a process or operation causing pollution or is likely to cause or is likely to cause significant damage to human, plant, animal health or environment;
b) To prohibit the use of machinery, plant, equipment or appliance whose use is causing or is likely to cause significant damage to human, plant or animal health or environment

After having given the owner or occupier seven days notice of the intention to make the application to court.

3.0 CONSEQUENCES OF SHUTITNG DOWN THE SMELTERS AND COAL MINE

i) There can be a major drop in the revenue for the government
ii) An increase in unemployment
iii) Increase in poverty
iv) Increase in secondary effects such as crime and prostitution among the directly affected communities
v) Political instability

4.0 CHALLENGE IN REGULATING THE SMELTER AND COAL MINE:

4.1 Smelter

The major challenges in regulating this sector are as follows:

i) The rehabilitations of the smelter require huge investment in terms of new technology and equipment. With current economic situation in Zambia coupled with lowering of the copper prices at the world market, this remains a challenge as investing in the infrastructure. Therefore, the smelters cannot meet the limits in a short time. So the Environmental Council of Zambia adopted what is known as an intermediate limit approach, which requires that, the company measures it's emissions. The initial measurement will become its intermediate or temporary limits. Thereafter, the Company puts in place an environmental management plan (EMP) to control these emissions as it works towards achieving the statutory limits also referred to as long-term limits.

ii) According to the Air Pollution Control (licensing and Emissions Standards) regulations of 1996, the limit for SO_2 is 1000mg/Nm^3. This does not give a clear indication on the pollution loads and can easily be distorted by dilution. Therefore, there is need to incorporate the pollution loads in the legislation in the forth coming review under the Copperbelt Environment

iii) Fugitives cannot easily be quantified rendering it difficult for ECZ as a regulator to quantitatively assess the improvements

iv) A lot of polluting facilities do not have the equipment and the technical know-how in order for them to monitor their own air emissions. As a result, most companies are not submitting the retains in time for ECZ to do the trend analysis. In the absence of data, an accurate inventory of emissions can not be produced

v) So far, there is only one consulting firm in the country that suitable equipment to do the measurements iso-kinetically according to ECZ requirements. The rest are using other methods that do not easily attain iso kinetic conditions such as cegrit, thereby rendering their data unreliable

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4.2 Coal Mine

At Maamba collieries, air emissions come from the spontaneous combustion of the carbonaceous material. The carbonaceous material occurs naturally in the ground just above the coal layer but below the overburden. To extract the coal, the overburden and the carbonaceous material is removed and placed aside. When this carbonaceous material is exposed to air, it burns resulting in the formation of sulphur dioxide, carbon monoxide, and Nitrogen oxides (NO_x)

The following are the major challenges associated with regulating this industry:

- The emissions occur more like fugitive emissions thereby making it difficult to quantify the pollutants
- Establishing the sustainable means to monitor regularly as ECZ does not have the equipment that would monitor continuously. Besides, the maintenance costs for such equipment are prohibitive

5.0 ENERGY

In Zambia, wood fuel is the largest source of energy followed by petroleum products, electricity and coal. Some of these are discussed below:

5.1 Fire Wood and Charcoal

Wood fuel (firewood and charcoal) is the principal source of energy in most households and also the nation's largest source. In the rural areas wood fuel is mainly consumed in form of firewood while in urban areas, both firewood and charcoal are used. The permits for cutting down tree are issued under the forestry act by department of forestry in the Ministry of Tourism, Environment and Natural Resources. The forestry act has been in place since the 1940s. The table below shows a break down of consumptions pattern as at 1990:

Table 3 Energy Supply and consumption by energy source in 1990

Energy Source	Primary Supply		Final Consumption	
	Quantity	Percent	Quantity	Percent
Fuel wood	2500	43	2500	58
Charcoal	1900	33	480	11
Electricity	580	10	520	12
Coal	260	4	260	6
Petroleum	570	10	570	13
Total	5800	100	4400	100

Source: Department of Energy 1990

Table 4 A break of consumption by sector.

Year	Sector	Firewood	Charcoal	Wood for charcoal production	Total wood consumption
1990	Household (Rural)	5331.14	78.66	393.3	5724.44
	Households (Urban)	534.45	514.24	2571.2	3105.65
	Agriculture	222.86	0	0	222.86
	Industry	668.01	27.16	135.80	803.81
	Mining	0.25	1.49	7.45	7.70
	Total	6756.71	621.55	3107.75	9864.46

Source: Department of Energy, Unpublished

5.2 Petroleum

As at 1999, petroleum accounted for 8% of the total national energy supply in the country. However, this figure could be reflective of the supply problems experienced after the destruction of the Indeni refinery by fire in May 1999. As at January 9 companies had obtained licenses to import refined petroleum products following the issuing of the statutory instrument no. 119 of 1999 by the Government of the Republic of Zambia (GRZ) opening the way for marketing companies to import Crude oil. This is imported from the Middle East mainly and refined at Indeni Refinery in Ndola, Zambia. The refinery is not designed to process pure crude oil and so the quality of the feed has to be monitored closely. The sources of crude oil may differ from time to time and this in turn influences the impact on the environment. The Energy Regulation Board (ERB) monitors the quality of this crude oil.

The major challenges for ECZ in this sector are:

i) Quantification of emissions from mobile sources such as cars. The emissions from the refinery are monitored regularly.
ii) Development of regulations for mobile sources; these are expected to be developed by end of 2007 under the Copperbelt Environment Project
iii) Limited capacity to enforce the regulations for mobile sources especially at national level due to insufficient resources

6.0 ENVIRONMENTAL CONCERNS ASSOCIATED WITH WOOD FUELS

The following are the environmental concerns with wood fuels:

6.1 Deforestation

The trees (in forests or woodlands) are being cut down at a rate greater than their replacement. Therefore the sustainability of this source is threatened. Besides would cause major upsets in the climatic patterns.

The table below shows gaseous emissions from charcoal and wood fuel as at 1990:

Table 5 Gaseous emissions in Zambia, 1990

Emission	Quantities, 000 tonnes		
	Emissions from Charcoal burning (Central Zambia) 000 tonnes	Emissions from other Sources 000 tonnes	National total 000 tonnes
Carbon dioxide CO_2	535	32,965	33500
Sulphur dioxide SO_2	0.048	199.952	200
NO_x	2.9	3.6	6.5
Volatile Organic Compounds	54	-	-

Source: Hibajene et al, 1993

Zambia has no capacity at the moment to effectively regulate these emissions.

6.2 People's health

The table below shows average concentrations of respirable suspended particles (RSP) and Carbon monoxide (CO) during cooking with different fuels.

Table 6 Average Concentrations of RSP and CO

Fuel Users	Emissions concentrations	
	Particulates (micro grammes RSPM)	Carbon monoxide (ppm)
Fire wood users	890	8.5
Charcoal users	380	13.0
Electricity users	240	2.1

Ellegard & Egneus, 1992, in Hibajene et al, 1993

As seen from the table above, the levels of CO are highest for charcoal users. This explains the prevalence of CO poisoning in during the cold season when people keep braziers in doors to keep themselves warm while windows are closed.

With all the environmental impacts associated with charcoal and firewood, stopping the use of these fuels is impossible if an alternative is not provided.

Even with all these known setbacks, regulating air pollution as charcoal and firewood remains a challenge.

6.3 BUSH FIRES

These are common especially in rural and peri urban areas and contribute significantly to the air pollution in Zambia. In most cases, the people that start the fire are not known.

The challenges are as follows:

i) Accurate quantification of these emissions
ii) Limited capacity for ECZ to enforce the existing regulations on open air burning

7. RECOMMENDATIONS

The following are the recommendations if the regulating of both mining and energy industries is to be improved in Zambia:

i) There will be need to harmonise legislation.
ii) The Air Pollution Control (Licensing and Emissions Standards) will need to be reviewed to incorporate pollution loads as these will be easier to monitor
iii) There is need to develop regulations for mobile sources.
iv) ECZ should further strengthen it's ties with other already established regulatory bodies to enhance the operations especially for combating deforestation
v) Government should support the development of cheaper alternatives to charcoal or firewood
vi) The government should consider giving incentives for using more environmentally friendly fuels

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