Chapter 4

Industry, Energy and Mining

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4.0 Introduction

According to GoM (2010: 48), energy sector comprises of five main sub-sectors which are electricity, biomass (fuel wood), petroleum products, coal, and other renewable energy sources whereas industry sector is broadly classified into three industrial sectors such as primary, secondary and tertiary. The primary sector deals with the extraction of primary products from the natural resources through activities such as agriculture, mining, quarrying, forestry, fishing, and hunting. Mining, under this primary sector, is an activity that involves excavation of the surface and subsurface for the purpose of exploiting and processing minerals which are for economic and industrial development in local and foreign markets. The secondary sector involves value addition to primary production by conversion activities that include manufacturing, processing and packaging. This sector includes such important areas as textile, food processing, brewery and bottling, smelting, metal fabrication, chemical processing, ship building and construction industry. Finally, the tertiary sector utilizes primary and secondary products to produce services such as banking, tourism, restaurant, hotel and power utilities.

In this report, the state of industry, energy and mining in Rumphi district will be outlined. Secondly, the environmental impacts in respect of these three (industry, energy and mining) will be discussed using an integrated environmental assessment approach, particularly the DPSIR framework. For purposes of limitations and relevance with respect to Rumphi district, the energy sector will cover only three of the five main sub-sectors which are biomass (fuel wood), coal and electricity because they are the ones relevant in Rumphi district. Whereas, the industry sector will cover mainly the primary sub-sectoral industries that include: mining, quarrying, wood production and processing (furniture making works), tobacco processing (flue-cured tobacco) and weaving, among others.

4.1 State of Industry, Energy and Mining in Rumphi

4.1.1 Mining Activities in Rumphi District

Rumphi district is one of the potential mining districts in the country. It is the largest coal mining district in the country. There are currently a total of seven registered coal mining companies operating in the district. These are: Mchenga Coal Mines Ltd; Kaziwiziwi Coal Mines Ltd; Rukuru Coal Mines Ltd; Mean Jalawe Coal Mines Ltd; Majighatuwa (David Duwe Nyirenda) Coal Mines Ltd; Thekero Coal Mines Ltd and Chiweta Coal Mines Ltd.

Mchenga and Kaziwiziwi Coal Mines Ltd companies are the two largest coal mining companies in Malawi. The main mining site of Mchenga Coal Mines Ltd Company is located at Mchenga along the Mzuzu-Karonga M1 road. The company has another small mining site at Phoka near Kaziwiziwi in T/A Kachulu. Whereas Kaziwiziwi Coal Mines Ltd company is located at Kaziwiziwi, about 8 km away from Livingstonia township along the Rumphi-Livingstonia road.

All the seven coal mining companies are within the Livingstonia coal field, the largest country coal field, with probable reserves of over 2-5 million tones and proven reserves of 4 million tons of coal with ash content of 17 %, a sulphur of 0.5 % and a calorific value of 6,800 kcal /kg. This

Livingstonia coal field is a 90 km^2 stretch in Rumphi district in the Northern Region of Malawi (Maneya, 2012), thus covering a significant amount of geographical space subject to various environmental impacts as a result of the mining activities.

In terms of mining methods, most of the district coal mines use only/mainly the Opencast mining method to extract coal minerals from the underground soils in the district except Mchenga and Kaziwiziwi coal mines which use both Opencast and Adit shaft mining methods. Thus there are extensive mining impacts on the environment around the mining sites in the district as a result of more mining companies using opencast which is more destructive in terms of environmental/land space as compared to the Adit shaft (deep) mining method. For instance, at Kaziwiziwi and Rukuru (Chombe) coal mining sites, large cleared land areas for extracting the mineral are visible.

The production of coal in the district has currently decreased by almost half, that is, from 5,967 metric tones of produced coal per month during the years prior 2010 to the current total production of 2,770 metric tones of produced coal per month (Malema, 2014). This production is against the total monthly coal production in the district which is estimated at 7,800 metric tons of coal production per month when operating at full capacity (GoM, Annual Economic Report, 2012: 42; Malema, 2014). This reduction in production would imply a decrease in mining operations thus minimized impacts on the environment.

For instance, MCML (CPL-Mchenga) alone is currently producing on average 2,500 metric tons of coal per month (Malema, 2014). With this current production, there is a 55 % decline in coal production compared to an average monthly production of 5, 500 metric tons during the first 12 years of its operations. At full capacity, the mining company can produce an average of 7,500 metric tons of coal per month from within its sized location. CPL- Mchenga coal mines alone has probable reserves of about 1.5 million tons of coal with ash content of 17 %, a sulphur content of 0.5 % and a calorific value of 6.8 kcal / kg (Maneya, 2012). Whereas, Kaziwiziwi coal mine is currently producing, on average 65.45 metric tons of coal per month (Malema, 2014). With this current production, there is a 162 % increase in coal production compared to an average monthly production of 25 metric tons during the first 5 years of its operations. At full capacity, the mining company can produce an average of 2,100 metric tons of coal per month from within its sized location. The coal at Kaziwiziwi has good calorific value and an ash content averaging less than 15 % (Kevin, 1986 as cited in Malema, 2014). It is therefore clear that from these two companies alone, there are a current total of 2,565.45 metric tones of produced coal per month against the estimated monthly full production capacity of 7,600 metric tones of coal less by almost half from the total of 5,525 metric tones of monthly produced coal during the past five years prior 2014.

While there is tremendous increase in coal production at Kaziwiziwi currently (whose production account for about 12 % of the total monthly coal produced in the district), the district total coal production, on average is still decreasing. This is because the coal production at the district largest coal mining company, Mchenga, whose production account for more than 80 % of the total monthly coal produced in the district (i.e. from all the seven district coal mining companies) is decreasing. The rest 8 % of monthly produced coal is a contribution from the other five remaining coal mining companies in the district.

In terms of expanding the mining activity in the district, there is more likelihood for the mining sector to expand both in terms of its existing mineral extractions and other new minerals likely to be discovered/explored and reported following the 2014 National Geophysical survey. In this case, the existing and other new investors in the mining sector may want to expand their mining

activities and/or register more other mineral extracting licenses to operate in the district since registration for exploration and mining is an on-going process.

The other commonly known mining related activities in the district are the production of quarry stones and sand mining (sand harvesting) for construction. These are usually produced in smaller scale in some parts within the district and along rivers around Rumphi Boma respectively. Quarrying, that is, breaking of bigger stones into small sized stone particles, for construction is done mostly in the urban areas at places such as Mayembe and Jaghala areas around Rumphi Boma and at Kanyerere area, north-east of Bolero township. River sand harvesting is extensively done along Mawerewere River that runs through Rumphi Boma from the hills to Lunyina River, the local name for South Rukuru River. There is also a lot of Dambo/river sand harvesting along the Lunyina River where it passes through places such as Kawaza, Nkhozo, Chikwawa etc.

4.1.2 The Energy Sector

The Government of Malawi recognizes, in the MGDS II, that a well-developed and efficient energy system is vital for industrial, mining and tourism development. This is because energy is a crucial input into any industrial processing and serves as the life-blood for any economy. As such, a focus on increasing the generation, transmission and distribution of electricity and promotion of other energy sources with the aim of improving service delivery and increased output in the economy will remain one of the Government's key priorities.

Rumphi district has viable opportunities for energy development especially from the hydropower sources, which are partly exploited or not yet exploited. The two mainly used sources of energy in the district include: biomass (fuel-wood) and electricity. Biomass is used in the form of firewood, charcoal or agricultural residues mainly for cooking purposes in many households in the district and also in the tobacco industry where it is used to burn flue-cured and chikopa tobacco. Solar is the other used energy source but in smaller quantities by few population individuals. Coal as one other energy source is produced but not used in the district. It is just extracted and transported to cities of Mzuzu, Lilongwe and Blantyre where it is used in the heavy industries for production processes. The mineral is also exported to some neighbouring countries such as Tanzania and others.

The production of biomass, coal and electricity is done in the district locations as shown in table 4.1 below.

Table 4.1: Production Locations of the Energy Sources (Biomass, Coal & Electricity).

Sub-sector	**Concentrated Production locations**
Biomass (Fuel Wood- firewood and charcoal)	Mphora hills (Hewe), Bond, Buwira, Mujuma (Kanyerere), Bawa, Chankhalamu, Chisyema (Ng'onga), Bale and Kamphenda.
Electricity (Hydro-power)	Kaziwiziwi mini hydro-electric power station along the Phoka river
Coal	Livingstonia Coal field Areas[1] (see 4.1.1 above)

The biomass production locations indicated in the table are not the only places where charcoal and firewood are being produced, used and sold but they are the ones from which the production is more concentrated as compared to other areas in the district where the two forms of fuel-wood are also produced. The rate at which forest is being depleted in these areas is relatively greater than the rate it is being replaced. This is likely to have an impact on the environmental outlook in the next two to five years as they will be more and more bare grounds as compared to forested areas in the district. For details on the deforestation, see chapter 12.

There is mini hydro-electric power station at Kaziwiziwi dam on Kaziwiziwi River. The power station was built by Kaziwiziwi coal Mines Ltd Company. It has a maximum capacity of producing 350 kilowatts/hour (KW/h) of electricity. Finally, the district has other potential places of untapped resources for power generation that would amount to substantial kilowatts/megawatts to be produced. Manchewe falls at Livingstonia is one of such potential places of untapped resources for electricity generation.

Whereas for coal production as a third energy sub-sector, the district as indicated above, has the largest coal field in Malawi. The Livingstonia coal field with probable reserves of over 2-5 million tones and proven reserves of 4 million tons of coal with ash content of 17 %, a sulphur of 0.5 % and a calorific value of 6,800 kcal /kg. Livingstonia coal field is a 90 km^2 stretch in Rumphi district in the Northern Region of Malawi (Maneya, 2012).

4.1.3. The Industrial sector

In this report, the industrial sector covers mainly the primary sub-sectoral industries that include: mining, quarrying, wood production and processing (furniture making works), tobacco processing (flue-cured tobacco) and weaving, among others.

Mining which is an activity that involves excavation of the surface and subsurface for the purpose of exploiting and processing minerals is one of the primary sector heavy industry that is undertaken in the district, whereas as, quarrying is a type of light primary sector industries (see 4.1.1 above for details).

In the late 1960s, Government planted nearly 12 hectares of pine trees at Chelinda Camp- top of Nyika plateau, trees which were preserved until early 2010s when Government decided to cut down and replace them. As such, there has been a lot of wood processing for the past four years with the commencement of the activity to fell down those matured trees for timber processing and furniture making. This resulted into the growth of wood processing businesses within the furniture making category at Rumphi Boma (ie selling timbers for construction and furniture making). As of now, 9 of the 12 hectares of trees have been felled down / cleared remaining with a balance of 3 hectares.

The work of tobacco growing has expanded steadily in Rumphi since the realization by most Rumphi small scale farmers that tobacco is a major cash crop with greatest opportunity of income generation for their families as compared to that of any other commercial crop. This has resulted into many farmers venturing into the business of tobacco farming (growing). These farmers range from individual farmers to those of corporative societies (Tobacco growing clubs). This is a good development for Malawi`s economic growth since it is a profitable economic activity. Currently, tobacco growing is being concentrated in the three TAs of Chikulamayembe, Mwankhunikira and Mwahenga. These are probably the three greatest TAs with largest population figures as compared to other 8 TAs in the district (see chapter 2) for population details). The commonly types of tobacco grown in such areas are the barley, Chikopa and flue-

cured tobacco. While barley is grown everywhere in the district, flue cured tobacco is grown in few specific places such as Kamphenda, Lusani, Mphompha, Kasenga, Nkhomboli and Ntchenachena.

In terms of weaving industry, the river banks and dambos in Chisimuka area in TA Katumbi (Hewe) are full of the growing natural reeds (matete) which are major sources of raw materials for the weaving industry in Rumphi district. Reeds are the fast growing renewable type of plants that are replaceable annually. This weaving industry produces for various markets both in and out of the districts, products such as baskets, mats (mphatsa), among others.

4.2 Impacts of Industrial Activities on the Environment

The industry of tobacco growing in the district causes deforestation among others. This is because the majority of the industrial processing operations, in cases of flue-cured and chikopa types of tobacco, use a lot of fuel wood as a source of energy for drying, thereby accelerating deforestation. For instance, in places such as Kamphenda, Lusani, Mphompha, Kasenga, Nkhomboli and Ntchenachena where flue-cured and chikopa types of tobacco are grown, a lot of tree logs are prepared and burned to provide heat for drying tobacco leaves. Note that alternatives to dry tobacco in such places are not yet identified by the majority tobacco farmers except some few large scale tobacco farming companies which are seen to be transporting tree logs from Chikangawa to their farming places in Rumphi district for processing their flue-cured/chikopa tobacco. In addition, the processing of tobacco from the nursery to the point when it is graded and sent to the market (auction floors) for sale, use a lot of resources from the environment. For instance, cut grass is used to cover tobacco nursery beds until germination of the seedlings. Plucked tobacco leaves are dried in the shades constructed using trees and grasses.

Deforestation is also caused as a result of huge demand for biomass products by the increased population as a source of energy for cooking and heating. The increase in population growth results into increased demand for firewood and charcoal for household consumption i.e. for cooking and heating. Secondly, connected to this population growth, deforestation has also come about due to people's demand over more land for settlement and farming. Further consequences are that soil erosion has resulted in some parts where forest cover has been cleared thereby destroying soil fertility that would have supported the growth of plants/crops. The lost land/soil fertility leads into increased use of farming chemicals such as fertilizers and other forms of organic manure which translate into huge farming costs on part of human beings thus a situation that has potential to cause hunger (food insecurity in the long run in the events where farming has failed due to high costs of fertilizers to address/improve the infertile soils. Furthermore, the left bare land is not protective enough to those crops at a risk to be washed away by flooding water during heavy rains. Thus multiple consequences of climate change leading into erratic rains into the area may also be a result of such deforestation later on. Only if human settlements and farming activities are controlled with use of proper/good and effective policies as well as institution of effective and working bans/measures on the production of charcoal and use of firewood is when the problem of deforestation can be addressed.

Furthermore, the industry activities result into land degradation. This happens because activities such as tobacco nursery preparations are done along the perennial rivers of Lunyina, South Rukuru and Rumphi rivers where there is an assurance for steady supply of water to nursery beds. As a result, land degradation is caused since the making of nursery beds involves land tilling and others. Such activities are done along the rivers banks despite the fact that these are

the protected areas from farming according to the National Environmental Protection Policy of 20… which stipulates that …. Unless such illegal human farming practices and the usage of such environment resources for tobacco processing is regulated, there would be a continued loss of soil fertility through land degradation and loss of forest trees (deforestation) in forms of cut logs for use into the tobacco processing activities.

The mining leads to the displacement of people, land use changes, dust and noise pollution as well as to depletion of mineral resources. For instance, the continued activity of coal mining will result into depletion of coal as a non-renewable mineral resource. Thus the future generation in the area would not benefit from the depleted resources. The method of coal mining which is mostly the open shaft (in case of some coal mining sites in Rumphi) as compared to the deep underground mining method is much more destructive to the surrounding environment (tree cover) as more open land would be cleared to pave way for the open mining processes. This will result into displacement of people, land use changes, dust and noise pollution as is the case with the mining at Kaziwiziwi; Rukuru; Mean Jalawe; Majighatuwa; Thekero and Chiweta Coal Mines where open cast method is mostly/mainly used as compared to the adit (deep) shaft mining method. Unless the mining land settled human beings are being compensated accordingly, there would be settlement problems as well as scarcity of farming land for such inhabitants following the mining associated displacements. While the mining activity has brought some positive impacts into the surrounding areas through corporate social responsibilities, it has also brought in some negative impacts such as the displacements of human beings over their lands; occurrence of some mining related illnesses/diseases such as lung TB and others.

While the mining activities would lead into depletion of mineral resources such as coal and displacement of people and land use changes etc, the non-well regulated mining activities would cause water/air pollution within the mine surrounding environment and beyond. Coal production and processing result into usable products (the needed coal) and by-products as well as coal effluents (the unwanted coal products) which are usually disposed as waste. For instance, coal dusts being drained into small surrounding rivers around the coal processing/crushing plant at Mchenga along the MI road are visible. Similarly, chemicals such as used oils are also discharged and thus pollute the water, making it toxic to humans and animals. These are likely to result into water/air pollution in absence of proper treatment of such coal effluents and by-products thereby endangering human beings using such water and air for their day to day dependence. Furthermore, the polluted water is also harmful to aquatic life especially when a large amount of such water is contaminated with coal dusts and once it flows into the Lake Malawi, for example, with fish that eat from within the water and the same fish which is caught and consumed by human beings. Diseases would also arise which would complicate health problems and thus increase health service costs. All these effects are in addition to the problem that mining activity close to water bodies can lead to siltation as is shown in this picture of the Kaziwiziwi river and its dam near the main Kaziwiziwi coal mining processing/crushing bay.

Finally, small scale industrial activities taking place at or around Rumphi Boma such as brick making along the river banks, the practice that is currently increasing at a fast rate, and sand harvesting if left unchecked and unregulated are very destructive to the environment and in the long run will contribute to problems of river flooding and loss of fertile soils along the river banks.

4.3 Strategies for sustainable energy, mining and industrial development in Rumphi District.

Based on the discussed state of the environment in respect of the mining, energy and industry for

Rumphi district in this chapter and the associated environmental impacts, the following are the drawn conclusions and recommendations for the sustainable energy, mining and industrial development in Rumphi District.

4.3.1. The district population continues to grow. The scramble/pressure for land to settle and to cultivate will also be increasing with the increasing population. Thus forest clearing particularly cutting down of trees is likely to continue. In addition, while the population continues to grow, demand for fuel wood (i.e. firewood and charcoal will take an increasing trend). Based on this, it can therefore be concluded that the current reported environmental state of deforestation in the district, will likely take an increasing trend for the next coming years from now unless interventions are put in place to reverse the situation. In order to address the situation as concluded, it is recommended that in the short and medium terms, the District Council authorities should intensify awareness and/or sensitization campaign programmes to the general public, put in place some by-laws on issues of environment; introduce and implement some more aforestation programmes and to empower the grassroots through their traditional leaders to value and to take lead in protecting their environment. This should be a focus in the short and medium terms while the District Council authorities, in particular, and the Malawi government, as a whole, should be preparing to put in place the revised relevant and effective policies and laws to regulate all those activities posing threats to the environment as long term solutions.

For instance, the District Council should be providing some incentives to those traditional leaders (Chiefs and Village heads) who can excel in the management of local forests within their jurisdictions. The Council should also put in place by-laws to ensure that human settlements and farming are done according to the correct land use. People should not be allowed to cultivate in or along the slopes of some hills and that they should not be allowed to settle in areas which are protected forests. Furthermore, alternatives to the use of biomass should be explored and identified as suggested in some government policies on energy use and development issues and that the tobacco growing industry should be regulated to have economical activities that are user-friendly to the environment.

4.3.2. People are always working hard in order to survive. They do this by undertaking various economical activities to generate proceeds for their survival. Therefore, the reported state of people doing small scale businesses of quarry stones production, sand harvesting and brick molding is likely going to continue as long as such activities remain viable income generating activities to those trading in them. Since the activities are reported to be very detrimental to the environment both in terms of short and long term impacts, there is need for effective laws including by-laws to be put in place to regulate such local business industry. For instance, the industrial activity of brick molding along and inside the river banks, areas where such practices are not supposed to be done, clearly indicates that there are inadequate laws (both national laws and by laws) to regulate such small industrial activities or else there is inadequate of law enforcement if at all such laws are already in place. Note that all these industrial businesses are some of the entrepreneurial businesses that are promoted by government as evidenced in the MGDS II, as such, people doing such businesses need not to be discouraged but rather to be encouraged and supported through the adoption of clean practices for doing business which can only be learnt and thus be possible when their industry is well regulated.

4.3.3. Finally, having shown that the mining activity is likely to expand (through the issuance of new more mining and exploration licenses, and with the national conducted 2014 Geophysical Survey with likelihood to have revealed more minerals and having discussed and shown that Mining activity have great impacts on the environment especially in terms of displacement of

human settlements changing of land use and causing water/air pollution among others, it can be conducted that the devastating impacts are likely to continue in the next five years or so. As such it must be recommended that there is need to promote local industrial technological skills amongst people in the district especially those around the mining companies so that they engage with their respective mining companies to be maximizing/utilizing some mining by-products through various technological means to produce some other useful products for their use in their communities. This would be one way of minimizing some of the mining negative impacts on the environment.

4.5 REFERENCES

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Sustainable Development Goals document; 2014 Geophysical Survey report; and Rwanda SEO report to be added on the reference list.

Note/ The yellow shaded text may be removed/deteled during discussions. The green shaded text will need to be edited to have correct references to be in line with other compiled chapters. And the underlined text may be repositioned within the chapter. Finally 3 more full references of SDGs GSR & Rwanda document report will be added.