ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT SUMMARY

Project Name: Rusumo Hydro Power Plant: Transmission Lines Component
Country: Multinational; Rwanda, Burundi and Tanzania
Project Number: P-Z1-FAB-016

1. Introduction

The following discussion presents a non-technical summary of the environmental and social impact assessment (ESIA) carried out for the Rusumo Falls High Voltage Transmission Line Project. It presents a description of the project including its justification and alternative analysis. It also presents the legal and policy framework that have guided the assessment. It also discusses the environmental and social baseline scenario as well as the potential impacts of the projects. A summary of proposed mitigation measures is also presented. A more detailed discussion of these issues is contained in the main ESIA report for the project.

2. Project Description and Justification

The regional Rusumo Falls Hydro-Electric Project includes the construction of three high voltage (HV) transmission lines running from the Rusumo falls towards the load centres of the national grid in Burundi, Rwanda and Tanzania. The erection of these three overhead lines (OHL) including the associated substations is referred to as “the Project” for which an Environmental and Social Impact Assessment (ESIA) has been carried out under the auspices of the Nile Equatorial Lakes Subsidiary Action Program (NELSAP).

The following line routing is planned:

1. 164 kilometers, 220 kV line between the Rusumo Falls power station and Gitega sub-station (Burundi) passing through (Tanzania and) the future high voltage station at Muyinga (Burundi);
2. 114 kilometers, 220 kV line between the Rusumo Falls power station and Shango (Kigali) substation (Rwanda);
3. 94 kilometers, 220 kV line between the Rusumo Falls power station and Nyakanazi substation (Tanzania).
Figure 1: Transmission Line Routing.
Substation Sites

In Burundi, the planned transmission line will be connected to the future high voltage Substation Muyinga and will end at the existing Gitega Substation. In Rwanda, the new Rusumo Falls Substation will be erected. This substation will be linked to the Rusumo Falls Hydroelectric generation plant and will be the starting point for the planned transmission lines in Burundi, Rwanda and Tanzania. The proposed transmission line in Rwanda will be linked to Bugesera Substation. The endpoint of the transmission line will be the new Substation Shango, which will also be the endpoint of the transmission line Gisenyi-Goma-Kigali. The new Nyakanazi Substation will be constructed as the endpoint of the planned transmission line in Tanzania.

Access tracks

Access tracks to the transmission line corridor, when needed, will be constructed at line sections where there is no access given yet. They will have a width of ±2.5 m. Their length shall be minimized and the Right of Way (ROW) shall be used where possible and they will be maintained to reach the towers or restored to previous conditions if they are not in use.

Right of Way (ROW)

The width of the Right-of-Way (ROW) will be 30 m for the 220 kV lines. The design was determined based on the estimated extreme sag of connectors due to maximum wind effect as well as the environmental limitations such as audible sounds, electric field and radio and TV interferences. The right of way was selected to comply with international standards for Electric and Magnetic Fields (EMF), which are clearly below international standards at 30m ROW and the need to minimize environmental and social impacts (especially resettlement and cutting of forests). A larger ROW would cause unnecessarily high social and environmental impacts. A 30m ROW corresponds with international standards and regional practice for 220 kV transmission lines.

Despite the fact that the area of tower base may reach 100 m² (10m x 10m), under normal circumstances, the sealed area is limited to four concrete legs of the base, that is, in total 6.25 m² (2.5 m x 2.5 m). On soils with lower bearing capacity, each base can be between 0.5 and 1.0 m larger.

For construction of every new substation a plot of 2.0-2.5 hectares land (about 2.3 ha on average) is necessary. The future substation sites will be sealed. Just as for the transmission lines, a maintenance program for substations is required. Transformers containing PCB shall not be used.

2.1 Project Justifications

The new high voltage transmission lines are supposed to be a precondition for rural electrification of the rural growth centres along the line corridors and promote the use of electricity in smaller development centres. The increased rate of access to electricity will contribute to achieving the objectives of the Strategic Development Plans of Burundi, Rwanda and Tanzania. Access to energy and, in particular, to electricity is seen as an essential driver for economic development. The Project
will bring about increased stability and safety in energy supply of Burundi, Rwanda and Tanzania and constitutes a precondition to speed up electricity supply in rural areas that are not served yet.

3. Policy, Legal and Administrative Framework

3.1 Burundi


On the international level, international conventions and treaties are other tools for managing the environment. Between 1990 and 2004 Burundi ratified all the major international agreements on the environment such as the three post Rio conventions, namely the Convention to Combat Desertification (1996), the Convention on Biological Diversity (1996) and the Convention on Climate Change (1997) as well as the RAMSAR (1996) and CITES (1988) conventions.

3.2 Rwanda

At the national level, there are several measures aimed at ensuring better living conditions for the population of Rwanda by means of a rational and sustainable management of the environment and the natural resources.


The Constitution of Rwanda and the Organic Law on Environment (2005) forms the legal framework, which governs the use of natural resources and the management of the environment. The ESIA must
meet certain requirements and follow specific procedures according to the Ministerial Decree No. 003/2008.

Rwanda has also ratified most of the major international conventions and agreements. The country has an institutional framework with a number of bodies dedicated to managing the environment. The main institutional players, amongst others, are the Ministry of Environment and Land (MINELA) and the Rwanda Environment Management Authority (REMA). These bodies implement the laws and regulations on the environment. The EIA process is coordinated by the Rwanda Environment Management Authority (REMA) and environmental permit attributed by Rwanda Development Board (RDB).

In the electricity sector, the main players are the Ministry of Infrastructures (MININFRA) and EWSA. MININFRA is responsible for policies and programs for developing infrastructures at national level; it is involved in the development of transmission lines and in rural electrification programs. EWSA is the national company responsible for the production, transmission and distribution of electricity and water.

3.3 Tanzania

The National Environment Policy (NEP, 1997) is the main policy document governing environmental management in Tanzania. The policy addresses environmental issues as both natural and social concerns, and adopts the key principle of sustainable development. The policy requires environmental impact assessment (EIA) to be mandatory for all development projects likely to have significant environmental impacts.

The Environmental Management Act (EMA, 2004) provides legal and institutional framework for sustainable management of the environment. For effective implementation of the National Environmental Policy objectives this Act has identified and outlined specific roles, responsibilities and functions of various key players including: The National Advisory Committee; Director of Environment; National Environmental Management Council (NEMC) under the Vice President’s Office (VPO); Sector Ministries, as well as Regional Secretariat; and Local Government Authorities (City, Municipal, District and Town Councils).


Tanzania is also a signatory country of numerous International Conventions related to the environment, the Convention on Biological Diversity of 5 June 1992, the Convention relating to Wetlands of International Importance Especially as Waterfowl Habitat, “RAMSAR Convention” of 1971, the Convention on Conservation of Wildlife Migratory Species (CMS), among others.

3.4 International Bank Policies and Guidelines

The ESIA is developed according to the general policies, procedures and guidelines of the African Development Bank (AfDB).

4. Description of the Project Environment

Environmental and Socio-Economic Baseline

The description of the environmental and socio-economic baseline for the project as presented in this summary is limited to a non-technical narrative of important features within the specific Study Area of the project. This Study Area covers the zone of the electrical networks for the three planned 220 kV transmission lines including the areas of the relevant substations. The width of the study area is at least 30 m for the entire length of the line corresponding to the ROW for the 220 kV transmission line. The enlarged study area includes natural and social features (i.e. Protected Areas, villages) of the area around the ROW as appropriate. More detailed information is contained in the main ESIA report.

Environmental Baseline:

4.1 Burundi.

The Study area is located in the Central Plateaus in the natural areas/ ecological zones of Kirimiro and Bweru which are known for their farming activities. It crosses three districts/ provinces, namely: Gitega, Karuzi and Muyinga, and more specifically, the following communes: Gitega and Giheta in Gitega District/ Province; Shombo, Buhiga and Gitaramuka in Karuzi District/ Province; and Muyinga and Butihinda in Muyinga District/ Province.

The study area features a tropical climate with a short dry season characterized by alternation of a dry season over 4 months (from June to September) and a rainy season recording maximum rains in November and especially in April. The average temperature is between 16 and 18 °C.

The air quality in this area is typical of rural areas and the atmospheric load of pollutants and noise is generally low. The average altitude of the Plateaus varies between 1,400 and 1,750 m.

The soil type is characterized mainly by undifferentiated ferralitic soils and orthotypical ferralites, the soil types are sometimes laterized at the hill tops with the slopes subject to erosion.

The study area is located in the Nile basin. It passes over streams and rivers including the Ruvubu and Ruvyironza in Gitega and Karuzi provinces. In Karuzi province, other rivers include Ndurumu River, namely Ndamuka, Karuri and Nyamugari rivers that are crossed by the study area. The study area crosses a series of swamps that are mostly used for crop cultivation.
The vegetation includes different areas with both natural vegetation dominated by *Dodonea viscosa*, *Parinari holstii* and *Acacia sp.*, and areas that have been affected by human crop and animal production activities. In these affected areas the dominant flora is composed of the savanna, *Hyparrhenia* and *Eragrostis prairie* or *Loudetia simplex prairie*. The project passes in the vicinity of forestry and agroforestry establishments.

With respect to fauna, it is important to note that the construction of overhead transmission lines may cause impacts on wildlife mainly due to the disturbance/destruction of habitats, noise. However, these impacts are local and temporary disturbance. On the other hand, permanent impacts from these projects are observed during the operation phase and they mostly associated with avifauna and the big mammals.

The study has identified several species in these groups whose habitats are in the vicinity of the project. In this respect, it is notable that the project passes in known natural habitats of green monkeys (*Cercopithecus aethiopicus centrallis*). Also, in the area crossed by the Study area, there are swamps and especially rivers are the habitats for different water bird species.

The Study area does not intrude into any protected area in Burundi. The only protected area located nearby (4km to 10 Km from the boundaries of the study area) is the Ruvubu National Park (Parc Nationale Ruvubu, RNP), which is also designated as Important Bird Area (IBA).

**Rwanda**

The study area is located in the extreme southern part of the country and extends from the Northeastern extension zone of the City of Kigali to the Tanzanian border at the Akagera River. The study area crosses Kirehe, Ngoma, Bugesera, Rwamangana, Kicukiro and Gasabo Districts.

This area belongs to the eastern bioclimatic region of Rwanda. Overall, the area has an equatorial climate tempered by altitude, characterized by cool and stable temperatures and moderate rains within a four-season cycle.

With respect to air quality, the atmospheric load and noise in rural areas of Rwanda, where most part of the study Area is located is generally low.

The geomorphology of the area has three main types of landscape: (i) the Alveolate depressions which are in general softly undulated, (ii) the appalachian landscape rich in quartzites or quartzite conglomerates which is characteristic of the rest of the hilly environment of the study area; and (iii) the abundance of lakes belonging to the Mugesera lacustrian complex and the area of alluvium shallow waters, that are often swampy, particularly in the large valleys of the Nyabarongo-Akagera systems.

The study area crosses major soil groups: one part of ferralsols of the Central Plateau, xero-ferralsols of the Eastern part and swampy soils of valleys.

Watersheds of the study area are drained by tributaries of the Nyabarongo-Akagera system that belongs to the Nile Basin. The distribution of drainage water is influenced by the Mugesera lacustrian and swampy complex in Ngoma district. At the border of Ngoma and Bugesera districts, the Study area is surrounded by a lacustrian network associated to the Mugesera and Rweru lake complex and the system of small-scale lakes and large floodplain swamps associated to it.
The Study area shows a diversity of vegetation types most often modified by farming activities: some prairies often with trees or serving as pasture land, woodland, swampy areas often in natural state, hill crops mixed with agroforestry species, etc. Inventories in the study area showed that dominant tree species include eucalyptuses among which 43.4 % were found in Ngoma district, followed by cypresses and pines. Eucalyptuses represented 93.2 % of the total tree species. Fallow areas of these swamps or submerged zones of wetlands in the area are generally covered by vegetation typical of low altitude fallsows.

Among the fauna taxonomic groups reported during interviews with the community or drawn from literature include large mammals like hippotamus, bush pig, bushbuck, carnivores as well as rodents. The most common species in the study area are notably rodents, primates lagomorphs and insectivores.

Among the bird species connected to the water bodies of the study area, there are many species of herons, ducks, geese and swans as well as ibises and spoonbills. Local endemic species are relatively insignificant but the study area has endemic species of the biome of Lake Victoria basin.

Several fish species, especially fluviatiles, found in surface waters of the study area are also present throughout the lacustrian and swampy complex associated with Nyabarongo River and include 22 species with the Cichlids, carps and minnows representing 68% of the identified species.

Notably, the Study area does not directly cross a legally protected area. However, there are wetlands that are crossed or are in the immediate vicinity of the study area and the Akagera National Park and some relic natural forests found in the wider region.

Tanzania:

The Study area is located in Kagera Region in the northwestern corner of Tanzania in Ngara District (TZ Section 1) and Biharamulo District (TZ Section 2).

The weather condition is typically that of warm tropical area with mean temperature around 17°C and 25°C. Relative humidity is about 70% and 80% and the evaporation rate is about 4.5mm/day.

The ambient air quality is typical of rural areas and the atmospheric load and noise are generally low and large parts of the study area which lies in altitudes between 1,300 m and 1,600 m, which is considered as moderately-high altitude.

The project area is largely characterized by fertile soil, though overuse in some parts of the region has led to soil exhaustion. Geological maps show that over 80 % is made up of layered rocks of either volcanic or sedimentary origin which differ in colour, hardness, permeability, grain texture and mineral contents over relatively short distances.

The major rivers draining the project areas include the Ruvubu River and Akagera River, the Ruiza River, Msega River and Mwisa River. These rivers empty their water into Akagera River and Burigi and Victoria lakes. None of these lakes and rivers are crossed by the Study area, large parts of the study area cross are over hills, valleys and mash land. The main land use types are upland agriculture, wetland agriculture, and livestock rearing. Other areas include woodland, bushland and grassland vegetations.
The project is in the vicinity of Burigi and Biharamulo game and forest reserves, though it does not directly intrude into these reserves. Different mammal species are found in these reserves including monkeys that can be potentially affected by the project. However, the population of these mammal species has been significantly affected by refugee influx into the area between 1994 and 1998. There are also Important Bird Areas (IBA) in the vicinity of the project which have been previously reported to host habitats for bird species including the Papyrus Yellow Warbler, Shoebills, Papyrus Gonorh, Great Snipe.

Socio-Economic Baseline Conditions

Burundi, Rwanda, and Tanzania are among the poorest countries of the world. While the socio-economic situation (included educational and health sectors) is comparable with many countries in sub-Saharan Africa, the per capita Gross Domestic Product (GDP) is much lower than average.

GDP in all countries increases steadily between 4% and 7%. But there is considerable lack of economic diversification. A persistent deficit of the balance of trade, high (but decreasing) inflation rates and the low productivity in the agricultural sectors are major development issues. Another fact is the poorly developed infrastructure in all three countries.

On the other hand, macro-economic policies especially in Burundi and Rwanda are promoting investments while governance performance is also improving. In Tanzania, macro-economic reforms have been applied. Volatile agricultural prices, inadequate investments, insufficient participation of the private sector but also increasing inequality in income, growing dichotomies, and land disputes remain major challenges.

Burundi, Rwanda and Tanzania are characterized by a high population growth. The population of the three countries adds up to more than 56 million inhabitants. These countries’ per capita GNP is below 300 US$, with 83 US$, 220 US$ and 270 US$ respectively for Burundi, Rwanda and Tanzania.

Access to electricity

In the region covered by the study, less than 10 % of the population has access to electricity, and yet the area has a vast reservoir of energy resources, including hydroelectricity which is still untapped. The access rate varies between 14 % for Rwanda and Burundi and 9-10 % for Tanzania. On the other hand, the region is characterized by small electrical power grids/ networks which are far from one another. Some trade has been taking place (at bilateral level), but on a quite modest level. This low level of development of national power grids hampers the utilization of these resources at affordable cost at the national level.
5. Project Alternatives

No-project Alternative

The “No-project Alternative” or “Zero-Alternative” considers that no interconnection line is built. This case should be especially considered if the hydropower plant would not be constructed. The no-project alternative would cause neither positive nor negative impacts from the line construction. However, the regional electricity grid would also not be extended.

Figure 4 Chosen line route, substations and alternatives
Routing Alternatives (2008-2009)

During pre-feasibility study following line routing alternatives have been discussed (see Figure 4):
Rwanda A: North route along the highway Kigali- Kibungo-Rusumo Falls Rwanda B: South route passing near the new Airport at Lake Gashanga; Tanzania A: North route along the Burigi Game reserve Tanzania B: Central Route via Muzani and along the west side of the main road Tanzania C: Central Route via Muzani and along the east side of the main road Tanzania D: South Route via Lusahunga and along the east side of the main road Burundi: Only one major alternative line routing Rusumo falls to Gitega

During the pre-feasibility study the following routes have been analyzed and discussed in detail:
The planned power transmission lines passes from southern Rwanda at the hydropower plant at Rusumo Falls through Tanzania to Burundi until Gitega, to Rwanda until Kigali and to Biharamulu in Tanzania. The line in Rwanda either may pass along the highway Kigali – Kibungo – Rusumo Falls or, as an alternative, will pass from Kigali to the planned airport to the west of Lake Gashanga and further to Kibungo.

6. Potential Impacts and Mitigation/Enhancement Measures

The Project will generate impacts during the pre-construction and construction phase as well as during the operation phase. Potential impacts of the decommissioning phase are also considered.

Positive-Negative Impacts

Positive impacts are especially the benefits for the local population in terms of generated employment and regional benefits of increased electricity supply in the national grids. Negative impacts are all environmental impacts and impacts related to loss of land, damages to crops and property as well as displacement of PAPs.

Direct-Indirect Impacts

Direct impacts are consequences of project activities as for example the felling of trees during the land survey. Indirect impacts are not directly caused by the Project but can be linked to one of the impacts as for example the increased availability of electricity for the population in rural areas.

Cumulative Impacts

Several other projects are planned in the Study area, which may create cumulative impacts with the foreseen Project:

- Rusumo Falls Hydropower Plant Project: Establishment of a hydropower facility, a water reservoir and a dam at the Akagera River.
- Rehabilitation works of the national roads RN 12 and RN 6 in Burundi. Construction of the Isaka (Tanzania)-Kigali (Rwanda) Railway Line in Rwanda.
• Realization of the future Kigali/ Bugesera International Airport in the Eastern province of Rwanda.
• One Stop Border Project Rwanda-Tanzania.
• Artisan mining activities around Lusahunga (north of Nyakanazi) together with other mining projects.

Temporary and Permanent Impacts

Temporary impacts are those impacts related to the construction phase of the planned transmission lines and substations, which will be extended over at least two years. They mainly include: dust and noise emissions; soil erosion; degradation of water quality; soil contamination by a bad waste management or accidental spilling of hydrocarbons; disturbance of wildlife.

Permanent impacts are related to the operational and maintenance phases of the transmission lines and substations. The main permanent impacts of the Project are: permanent land acquisition at tower locations, future substation sites and maintenance roads/ tracks (entire ROW in Tanzania); permanent loss of vegetation (trees and shrubs) in the ROW of the transmission lines and on the areas of future substations; destruction of terrestrial wildlife habitats; risks for birds’ collision with the wires and structures; permanent loss of small portions of wetland required for construction of towers; visual impacts on attractive landscapes. In addition, maintenance of the ROW requires regular clearing of vegetation.

Impact Significance/ Impact Importance

Criteria used in this study for assessing impact significance are extent, duration and intensity. Three classes of significance/ importance are used: minor, average or major. The more an impact is extended, durable or intense, the more it will be significant/ important. An assessment grid of impact significance is applied.

The final judgment of the significance of impacts includes the applicability of possible mitigation or compensation measures.

Environmental and Social Impacts

Impacts during Pre-Construction Phase

Impacts during pre-construction phase are mainly related to the design of the transmission line and the preparatory works. The major impacts are created during the land survey, when the ROW is demarcated and cleared from vegetation. Also the construction of access tracks starts in this phase.

The Project will affect a total of 18,600 trees (4,400 trees in Rwanda, 7,700 trees in Tanzania and 6,500 trees in Burundi) if all trees are cut in the 30 m ROW during the Land Survey. Additionally, the Project will affect 114 ha of banana plantations (53 ha in Rwanda, 26 ha in Tanzania and 35 ha in Burundi). With the use of GPS technology precision, the number of trees and banana plantations that would need to be cut is expected to be 30 %. The Land Survey will be closely monitored with regard to the minimization of impacts.
With respect to resettlement impacts, it is estimated that a total of 134 households (HH) in Rwanda, 82 HH in Tanzania and 166 HH in Burundi will have to be displaced (total 382 HH). The number of buildings affected amounts to 640 buildings (including kitchen, stables, toilets and other auxiliary structures).

**Impact on Land Space**

- A total of 1,041 towers will be erected for the entire line (334 Rwanda, 414 Tanzania, 293 Burundi) requiring 10.41ha of land for foundations.
- Additionally new substations will be constructed requiring 2.2785 ha of land each and 1 substation (Gitega in Burundi) extended all requiring a total of 12.39ha of land.
- Additionally, land of settlements within the line corridors will have to be expropriated. In Tanzania and Burundi, people will be able to rebuild their house next to the old house if suitable land is available. In Rwanda the project affected persons (PAP) will be relocated into grouped settlements. Land for the construction of relocated households will be 22.12 ha (9.86 ha in Rwanda, 7.06ha Tanzania and Burundi 5.2 ha).

However, agriculture shall remain possible within the ROW with a height limitation of more than 3 m.

The entire surface of the transmission line corridor (30 m ROW) of 1,115.7 ha will not have to be expropriated in Burundi and Rwanda. The entire ROW will be expropriated in Tanzania (448 ha) but agricultural practices shall be allowed to continue within the ROW.

**Disturbances**

Damages to crops during the construction process (erection of towers, access tracks and stringing procedure) are expected to be 5% of the agricultural surface of the ROW. Compensations will be paid in cash on the spot by the construction contractor in the presence of local administration and PAP representatives accompanying the construction process.

**Impacts during Construction Phase**

**Soil**

The total soil area to be sealed for towers and substations (about 13.5 ha) is relative low in all three countries. The main problem regarding impacts on soil during construction is the risk of erosion as soils in the ROW are sensitive or even prone to erosion.

A drainage and Erosion Control Plan shall be elaborated by the Constructor. If the mitigation measures as described are implemented, the significance of impact for the soils in Burundi, Rwanda and Tanzania will be minor.
**Ambient Air Quality**

Due to the limited time of the construction activities, the local importance and a variety of possible mitigation measures, the impacts of gaseous emissions and dust on the ambient air quality are assessed to be minor in all three countries.

**Surface Water and Groundwater**

Most impacts on surface waters and groundwater associated with possible pollution and siltation are short-term, local and of low intensity. Tower sites in wetlands will be avoided as far as possible. But, due to the presence of a multitude of watercourses and swamps in Burundi and Rwanda (Ngoma District) and a big sensitive wetland area in Tanzania mitigation measures are limited regarding the erection of towers. As avoiding of these wetland sites is not always possible adequate mitigation measures including a proper HSE construction site management, the use of well-maintained vehicles and a controlled disposal of hazardous waste are of great importance.

Due to the limited time of the construction activities it is concluded that the construction of the transmission lines has minor impacts on surface waters and groundwater resources if mitigation measures are implemented.

**Landscape**

Due to the limited duration of the construction at discrete line sections and the hilly character of the landscape the impact significance for the landscape is assessed to be minor in all three countries.

**Vegetation and Flora**

Mostly agricultural land not providing any specific habitat for endangered or threatened plant species will be affected by the Project (impact is of minor importance). The approximately 18,600 trees to be cut/ felled during land survey and construction (6,500 in Burundi, 4,400 in Rwanda and 7,700 in Tanzania) are mainly non-native Eucalyptus species with only a low ecological function.

The tower sites are not concentrated in one location but spread along the whole OHL, which makes the impact of sealing low in scale in a particular place. But, in all three countries construction will also affect valuable natural (forest) vegetation and at some places (in Rwanda and Tanzania) species with a precarious status (impact of major importance).

**Fauna and Wildlife Habitats**

Mostly agricultural land is affected by the Project not providing any specific habitat for endangered or threatened animal species (minor impact importance). The tower sites are not concentrated in one location but spread along the whole OHL, which makes the habitat loss by sealing low in scale in one particular place. But construction will also affect valuable habitats (e.g. wetlands) and species with a precarious status in all three countries (major impact importance).

Marshland and forest areas shall be excluded for erection of Muyinga Substation in Burundi. Due to the relative small area to be sealed for tower foundations and at substation sites the permanent habitat
loss for animal species is generally of minor importance if the proposed mitigation measures are applied.

**Impact of Noise on Fauna**

The limited time period and the limited extent of construction activities at discrete line sections lead to only minor impacts of noise generation on the fauna (e.g. for mammals and birds), especially when noise reduced vehicles and machines are used.

**Impact of Hunting**

A potential serious threat than the noise from construction vehicles may arise from workers from the construction camps wanting to improve their meat diet by poaching activities. The environmental management measures will include prohibition measures for such poaching activities.

**Protected Areas**

No area that has been legally designated as a protected area will be encroached on by the Project; this is as a result of a careful line routing. But, in view of the Mugesera/Rweru swamp complex (a potential RAMSAR site) in Rwanda, adequate mitigation measures regarding wetlands and birds are deemed necessary.

With respect to the Biharamulo Forest and Game Reserves in Tanzania, noise reduction measures and a building-site fence will be implemented.

If the proposed mitigation measures are applied and construction camps are located away from environmentally sensitive areas, no impact on protected areas is expected during construction of the Project in Burundi, Rwanda and Line Section 1 in Tanzania.

Minor impacts are expected to occur in Line Section 2 in Tanzania due to the location of Biharamulo Forest and Game Reserves in the Project’s vicinity.

**Generated Employment**

The construction of the transmission lines will generate employment. Not all workers for the construction task will be hired from the study area, as qualified staff will be needed. Especially for clearing of ROW, carrying tower parts and guarding, local staff will be employed, generating a substantial additional income for local people for a short time during the construction process. Men and women shall receive the same wages when employed for works related to the transmission line.
Impacts during Operation Phase

Soil and Groundwater

When implementing adequate mitigation measures, there will be no effects on soil or groundwater during operation.

Landscape

Without applying mitigation measures the visual impacts of the transmission lines and the referring substations and access roads would be of major importance. But, if the mitigation measures as described are implemented in the critical areas, the visual impact on the landscape is reduced to an average importance in all three countries.

Vegetation and Flora

Maintenance clearing of vegetation leads to perpetuation of the habitat fragmentation or habitat loss for native plants, induced during construction. Adequate mitigation and compensation measures have already been proposed for the construction phase. Mitigation of impacts on vegetation and flora during operation is possible through reducing the area to be cleared as far as possible. Most agricultural crops and low vegetation areas will be allowed to grow in the ROW again during operation. The significance of impacts is assessed to be minor in all three countries.

Fauna and Wildlife Habitats

Maintenance clearing of vegetation leads to perpetuation of the habitat fragmentation or habitat loss for animal species, induced during construction. Adequate mitigation and compensation measures have already been proposed for the construction phase. Further mitigation of impacts is possible through reducing the area to be cleared as far as possible.

An adequate design of the poles, conductors and insulators of the transmission lines is anticipated so that the risk of electrocution for birds is expected to be low. A certain risk remains both for big birds like vultures and migratory birds regarding collision with the conductors. Critical sections for birds have been defined in Burundi, Rwanda and Tanzania. The collision risk can be reduced by installing reflectors/bird diverters in the defined critical sections. Regular monitoring of threatened species (birds, monkeys) of the area shall be undertaken during operation.

When implementing the proposed mitigation measures, the overall impact on the fauna (especially on birds) during operation of the new transmission lines is assessed to be minor in all three countries.

Protected Areas

No legally protected area will be affected during operation of the new transmission lines. But, in view of the Mugesera/ Rweru swamp complex (a potential RAMSAR site) in Rwanda, adequate mitigation measures regarding wetlands and birds are necessary. Concerning Biharamulo Forest and Game Reserves it is strongly referred to the fact, that adequate mitigation measures (e.g. installation of bird
diverters) are necessary within the frame of the follow-up transmission line project in Tanzania (future power transport from the substation to Nyakanazi town).

If the proposed mitigation measures are applied, no impact on protected areas is expected during operation of the transmission lines in Burundi, Rwanda and Tanzania.

Disturbances

Damages to crops during operation / maintenance may occur if the land within the ROW is cultivated. The damages should be reduced to the minimum. Compensations for destroyed crops will have to be paid in cash on the spot by the operator in presence of local administration and PAP representatives. The involvement of local people in maintenance works (i.e. cutting of re-growing trees within ROW etc.) will reduce the potential impacts further.

Impacts during Decommissioning Phase

The expected lifetime of a high voltage transmission line may be estimated to at least 50 years. Decommissioning of such an infrastructure is not very likely, but rather a long-term repair or exchange of line components.

Decommissioning of technical installations comprises dismantling, decontamination of materials and site, shipment and final disposition of materials as well as site rehabilitation. Disposition of materials can take place either by selling, re-use or depositing. All metal components from the transmission line will be prone to scrapping. For substations a very careful dismantling, decontamination of materials and the soil to the deeper underground, shipment and recycling of hazardous material will be obligatory.

The sites of towers, access roads and substations will be rehabilitated including decontamination where necessary, re-planting of vegetation and land management planning (i.e. re-forestation, agricultural extension, public or private ownership) should the line be dismantled in a period of at least 50 years.

Mitigation Measures

Governmental institutions and local administration are involved in the implementation of the ESMP. Ministries in charge of environment, forestry and wildlife and their agencies (REMA Rwanda, the Ministry for Environment (MEEATU) in Burundi and the National Environment Management Council in Tanzania) as well as their decentralized units, will be tasked with ensuring regular control of activities and compliance with the standards.

Mitigation Measures during the pre-construction and construction phase will be implemented by the Constructor (line design, land survey, access roads, tower construction procedure, avian protection, compensation of disturbances, implementation of HSE management plan) and the national utilities in cooperation with district authorities (land valuation and compensation, resettlement, reforestation, maintenance by local residents).
Mitigation Measures during operation phase are implemented by Operators (EWSA, TANESCO, REGIDESO) who will also be responsible for all measures that will arise in decommissioning phase. An Environmental and Social Management Plan has been developed for the project. The ESMP describes the details of the mitigation measures for different phases of the project. These measures are summarized below;

- Implementation of a Reforestation/Re-Plantation Program, Establishment of landscape mitigation measures, Soil conservation measures

- Adequate site organization, provision of solid waste management measures, Oil products management, Protection of natural environment and vegetation, Wildlife protection, Water protection and management measures.

- Avifauna protection which will include the installation of visibility enhancement objects such as marker, balls, bird deterrents, or diverters. In addition insulators will be installed in energized parts that are close to sensitive areas and the power lines close to these areas will be spaced in-between and insulated.

- Mitigation of visual impacts by integrating the towers visual effects into the surrounding landscape.

- The sites of towers, access roads and substations need to be rehabilitated including decontamination where necessary, re-planting of vegetation and land management planning (i.e. re-forestation, agricultural extension, public- or private ownership) should the line be dismantled in a period of at least 50 years. For substations a very careful dismantling, decontamination of materials and soil to the deeper underground, shipment and recycling of hazardous material will be obligatory.

**Monitoring Program**

For implementation of the ESMP, a Monitoring Program has been developed. In accordance with AfDB procedures, such a program shall include two parts: surveillance and monitoring activities. Surveillance activities aim at ensuring the effective implementation of the proposed mitigation and enhancement measures.

Monitoring activities consist in following up and assessing the intended Project impacts on some environmental components during the construction phase.

Parameters of environmental surveillance and monitoring including information on standards, location, frequency, implementation and supervision are provided in the main ESIA report.

Roles and Responsibility in ESMP Implementation ESMP implementation is the responsibility of different stakeholders. Surveillance and monitoring will be carried out at several levels of responsibility. The constructors will retain an environmental officer as staff who will report to the Environmental Officer from regulatory agencies; MEEATU in Burundi, NEMC in Tanzania, REMA in Rwanda and maintain records of measures introduced
Regarding organizational responsibility, the implementation and ensuring of good functioning of the ESMP are the responsibility of the electricity companies in charge of infrastructure development (EWSA / TANESCO / REGIDESO).

In addition, the utility company in of each country concerned with the Project will recruit an Environmental Officer in order to check the implementation of measures and their efficiency, and determine if expected impacts indeed appeared. This expert will have to report on a regular basis to the Bank who will also conduct periodic supervision missions during the construction and operational phase of the project.

**Costs of the Environmental and Social Management Plan**

**Costs related to Construction**

Costs for the environmental mitigation measures during construction are summarized in the following table (Table 1). To avoid doubling of cost data, expenditures for information and awareness raising (16,246 USD for Burundi, 17,207 USD for Rwanda and 22,332 USD for Tanzania) as well as reforestation/re-plantation measures (50,000 USD per country) are not included in the cost calculation of the ESMP but in the cost calculation of the RAP, respectively.

Reforestation/replanting will be done with agro-forestry trees to be suitable for mitigating and compensating of both environmental and social impacts of deforestation.

Table 1  Cost estimate (USD) for environmental mitigation measures and monitoring during pre-construction and construction phases

<table>
<thead>
<tr>
<th>Component / Measure</th>
<th>Burundi</th>
<th>Rwanda</th>
<th>Tanzania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional studies on biodiversity</td>
<td>10,000</td>
<td>10,000</td>
<td>15,000</td>
</tr>
<tr>
<td>Additional studies on threatened species</td>
<td>42,000</td>
<td>32,000</td>
<td>58,000</td>
</tr>
<tr>
<td>Erosion control</td>
<td>25,000</td>
<td>25,000</td>
<td></td>
</tr>
<tr>
<td>Water quality analysis</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Installation of reflectors for birds</td>
<td>30,000</td>
<td>30,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Migratory birds observation camps</td>
<td>30,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementation of ESMP*</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Sub-Total</td>
<td>247,000</td>
<td>207,000</td>
<td>223,000</td>
</tr>
<tr>
<td>Administration</td>
<td>4,940</td>
<td>4,140</td>
<td>4,460</td>
</tr>
</tbody>
</table>
### Costs related to Operation

In addition to the above listed expenses during the construction phase, costs for monitoring during the operation phase will be incurred. These costs are for monitoring of threatened species (birds and primates) for a period of five years after start of the initial operation of equipments, on the one hand, and monitoring of biophysical aspects of the ROW on the other hand. Further costs are included for awareness rising for environmental conservation in the affected districts.

**Table 7 Cost estimate (USD) for monitoring measures and awareness raising during operation**

<table>
<thead>
<tr>
<th>Component / Measure</th>
<th>Burundi</th>
<th>Rwanda</th>
<th>Tanzania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness raising for environmental conservation in the Study area</td>
<td>10,000</td>
<td>10,000</td>
<td>15,000</td>
</tr>
<tr>
<td>Monitoring of threatened species / an</td>
<td>5,000</td>
<td>2,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Monitoring of erosion of slopes and river banks / an</td>
<td>2,000</td>
<td>2,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Monitoring of rehabilitation of degraded areas / an (campsites, borrow areas, etc.)</td>
<td>2,000</td>
<td>2,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Sub-Total / an</td>
<td>19,000</td>
<td>16,000</td>
<td>24,000</td>
</tr>
<tr>
<td>Administration costs (2%) / an</td>
<td>380</td>
<td>320</td>
<td>480</td>
</tr>
<tr>
<td>Contingence (10 %) / an</td>
<td>1,900</td>
<td>1,600</td>
<td>2,400</td>
</tr>
<tr>
<td>Sub-Total per country / an</td>
<td>21,280</td>
<td>17,920</td>
<td>26,880</td>
</tr>
<tr>
<td>Sub-Total per country / 5 years</td>
<td>106,400</td>
<td>89,600</td>
<td>134,400</td>
</tr>
<tr>
<td><strong>Total per 5 years</strong></td>
<td><strong>330,400</strong></td>
<td></td>
<td></td>
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</tbody>
</table>

Stakeholder consultation to support the resettlement and compensation process related to the construction of the transmission lines aimed to achieve the following objectives:

- to provide timely, relevant, understandable and accessible information about the Project and its potential impacts to the stakeholders;
- to communicate the resettlement processes and measures to be taken and address any associated issues;
- to provide opportunities for affected people and other stakeholders to express their views on Project risks, impacts and mitigation measures and to manage expectations and misconceptions;
- to explicitly take account of stakeholders views and concerns in the design of the Project and plans for its implementation;
- to receive and facilitate resolution of stakeholders concerns and grievances about the Project.

In order to understand the existing socio-economic environment and the vulnerability of the PAP households, a socio-economic census was undertaken 2008/2009 and 2011. The information and consultation process has already started during the Feasibility-Study. In November and December 2008, the consultative process with the population affected by Project activities was strengthened by the conduction of 40 focus group discussions in Burundi, 45 meetings in Rwanda and 25 discussions in Tanzania. Altogether, 110 group meetings have been organized and focus-group discussions carried out. The table below shows the total number of participants per country and the share of women in the meetings.

The consultation process of 2008/2009 in figures

<table>
<thead>
<tr>
<th>Country</th>
<th>Participants</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burundi</td>
<td>554</td>
<td>190 (34.3%)</td>
</tr>
<tr>
<td>Rwanda</td>
<td>574</td>
<td>251 (43.7%)</td>
</tr>
<tr>
<td>Tanzania</td>
<td>423</td>
<td>179 (42.3%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,551</strong></td>
<td><strong>620 (40.0%)</strong></td>
</tr>
</tbody>
</table>

Groups of business people as well as household members living within the Project area or in the rural centres earmarked for a potential electrification have been invited for discussions. These discussions were moderated in local language. The discussion was structured by a guideline of questions. Focal discussion points were the advantages of the Project, the advantages and disadvantages of the Project, categories of potential damages (permanent and non-permanent) with regard to immobile property and crops, costs and compensation procedures, institutional arrangements and how to handle disputes.
A key result of the focus-group discussions was that the reactions towards the Project in general are predominantly favourable. At most of the discussions an overall development of the village or settlement by a progress of business activities due to electrification was expected. People also expect some job opportunities linked to construction works of the transmission line. They also stated that the Project comes in time and that it should start as soon as possible.

On the other hand, concerns of damaged crops and destroyed properties were mentioned by the population quite often, too. A number of participants were afraid that the Project will take their land or that it will pay unfair compensation.

During RAP preparation 100 % of resettlement affected households were surveyed with census and inventory of losses from July to August 2011. Additionally, district/ province authorities were informed about the Project and consulted regarding expropriation experiences and livelihood development priorities. Also, key stakeholders from local administration were interviewed. District Development Plans / Communal Development Plans were analyzed concerning general data on health situation, education, agriculture, livestock and water supply as well as district priorities and targets. Potential environmental impacts were discussed with local administration officials as well as with community representatives.

Results of the social survey concerning PAPs affected by resettlement

- In all three countries efforts are put into the improvement of the health and education sectors, but many challenges remain, above all in rural areas.

- Especially in Burundi the need for accessible health centres / hospitals was mentioned. In Tanzania, access to health facilities in the concerned districts is available, but the number of doctors/nurses and equipment of health centres is reportedly not satisfying for the people.

- More than 90 % of their children above the age of 8 go to primary school. The situation of education in Burundi is worse than in Rwanda and Tanzania, particularly in rural areas. During the survey many interviewed households mentioned the need for a primary school in their village.

- In Rwanda the percentage of women among non-educated PAPs is 50 % but almost all young girls go to school. Also, the percentage of women with secondary education and beyond is higher than that of men. In Tanzania the percentage of women among the non-educated people is remarkably high (more than 70 %).

- There are 70 women headed households (31 in Burundi, 26 in Rwanda and 13 in Tanzania) and 18 households with disabled members that will be affected by the Project.

- In Rwanda and Burundi, the promotion of bovines (improved breeds i.e. Friesian) as livelihood restoration measure would be highly appreciated by PAPs. The situation in Tanzania is reportedly more favourable to small ruminants (i.e. goats).
• The wish and need for electricity supply have been mentioned in all focus groups, administration meetings and individual interviews.

• Drinking water supply was mentioned in several areas to be a persisting severe problem, especially in Ngoma district (Rwanda), Biharamulo district (Tanzania) and all three provinces of Burundi.

• Potential Loss of Agriculture surfaces was a widespread concern in Rwanda and Burundi

• Cutting of trees and re-planting provisions was a concern in Biharamulo district in Tanzania

• Wetland impacts and impacts on avifauna were a concern in Rwamangana an Ngoma districts in Rwanda (Lake Mugesera)

• Generally housing conditions in the affected districts/provinces are average to poor. People are usually not satisfied with their housing conditions, apart richer households and people living in Rwandan Imidugudu, where conditions are slightly better.

• The average family size is 5.2 persons in Burundi, 5.2 persons in Rwanda and 4.5 persons in Tanzania.

• The lowest income of PAPs is 130,000 FBU/y; 10,000 FRW/y and 79,000 TZS/y. The highest income of PAPs is 30,000,000 FBU/y; 2,180,000 FRW/y; 21,100,000 TZS/y.

• Detailed information on the results of the social survey 2011 is given in the RAP.

11. Conclusion

It may be concluded from the findings of this Environmental and Social Impact Assessment (ESIA) in summary, that, if

• all adequate mitigation and compensation measures are applied,

• the RAP is fully implemented and

• the implementation is professionally monitored according to international standards,

The proposed transmission lines and substations can be designed, constructed and operated without having significant adverse effects on people and the environment. The proposed 220 kV overhead transmission lines will contribute to a more reliable power supply in Burundi, Rwanda and Tanzania and will help in future to provide electricity to more households in rural areas where the corresponding distribution network is established.
12. References and Contacts

1. NELSAP (2013), ESIA study on the Power Transmission lines linked to the Rusumo Falls Hydor-Electric Generation Plant.

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