Tanzania Electric Supply Company Limited

Environmental and Social Impact Assessments (ESIA) for the Proposed 400 kV Power Transmission Line Iringa - Dodoma - Singida - Shinyanga

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P.O Box 63154, Dar es Salaam, Tanzania
Tel: +255 22 2134603
Email: nemc@nemctz.org

Prepared by:

MVV decon
Norsk-Data-Strasse 1
61352 Bad Homburg v.d.H., Germany
Tel: +49-6172-9460-108
Fax: +49-6172-9460-20
eMail: u.otten@mvv-decon.com

Institute of Resource Assessment
P.O. Box 35097
Dar es Salaam, Tanzania
Tel: +255-22-2410144
Fax: +255-22-2410393
eMail: ira@ira.udsm.ac.tz

Declaration

The following individuals prepared this ESIA Report:

- Dr. Herbert HANKE: Environmental Assessment (ESIA Team Leader)
- Ulrich OTTEN, Socio-economist and Resettlement (RPF Team Leader)
- Dr. Hussein SOSOVELE: Social Scientist
- Dr. Claude Gasper MUNGO'NG'O: Resettlement Action Plan (RPF)
- Mr. George SANGU: Biodiversity (ESIA)
- Ms. Beatrice MCHOME: Public Consultations and Participation (RPF)
- Prof. Palamagamba KABUDI: Environmental Law and Regulations
- Ms. Zubeda KICHAWELE - Social Surveys
- Mr. C. MSONGANZILA- Social Surveys
- Mr. Alexander CHAMBI - Social Surveys
- Mr. Florian SILANGWA - Social Surveys
- Mr. Emmanuel HANAI - Social Surveys
- Ms. Zaina KIJAZI - Social Surveys

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List of Abbreviations/Acronyms

ARI	Acute Respiratory Infection
AT	Angle Tower
BP	Type of World Bank document
CBD	Convention on Biological Diversity
CDA	Capital Development Agency
CO_2	Carbondioxid
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Conservation of Migratory Species
DC	District Commissioner
DED	District Executive Director
DMO	District Medical Officer
DNRO	District National Resources Officer
DOE	Director of Environment
DPLO	District Planning Officer
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMA	Environmental Management Act
EMF	Electro-magnetic Field
EPA	Environmental Protection Agency
ESCOM	Electrical Supply Commission (South African electricity utility)
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EUR	Euro
FR	Forest Reserve
GDP	Gross Domestic Product
GP	Type of World Bank document
GPS	Global Positioning System
ha	Hectare
HV	High Voltage
IARC	International Agency for Research on Cancer
ICNIRP	International Commission for Non Ionising Radiation
IFC	International Finance Cooperation
IRA	Institute of Resource Assessment
IRR	Internal Rate of Return
IUCN	International Union for Conservation of Nature
km, km^2	Kilometres, square kilometres
kV	Kilo Volt
kW, kWh	Kilowatt, Kilowatt-hour
LHS	Left Hand Side
MAFSC	Ministry of Agriculture, Food Security and Cooperatives
m.a.s.l.	Meter above sea level
MDG	Millennium Development Goal
MEM	Ministry for Energy and Mining

µT	Micro-Tesla
MKUKUTA	Mkakati wa Kukuza na Kuondoa Umaskini Tanzania
MLHS	Ministry of Land and Human Settlement
MNRT	Ministry of Natural Resource and Tourism
MW, MWh	Megawatt, Megawatt-hour
NEMC	National Environment Management Council
NEP	National Environment Policy
NFP	National Forest Policy
NGO	Non-Governmental Organization
NHSDP	National Human Settlements Development Policy
NPV	Net Present Value
NSGRP	National Strategy for Growth and Reduction of Poverty
OD	Operational Directives
O+M	Operation and Maintenance
OP	Operational Policies
OSHA	Occupational Safety and Health Authority
PEA	Preliminary Environmental Assessment
PV	Present Value
PFM	Participatory Forest Management
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
RHS	Right Hand Side
RoW	Right of Way
SWS	Shield Wire System
T	Tower
TAC	Technical Advisory Committee
TANESCO	Tanzania Electric Supply Company
TANROADS	Tanzania National Road Development Agency
TCO	Trästemännes Central Organisation (Swedish Certification Organisation)
TEURO	Thousand Euro
TM50, TM 200	Topographical Map 1:50,000 / 1:200,000
TRC	Technical Review Committee
TTCL	Tanzania Telecommunication Company Limited
URT	United Republic of Tanzania
VPO	Vice President's Office
WHO	World Health Organisation

0. Executive Summary

0.1 Project Background and Rationale

TANESCO plans to establish a 400 kV transmission line from Iringa via Dodoma and Singida to Shinyanga with a total length of 670 (initially 683) km. This new power line will link existing and future generating sources in the south and southwest of Tanzania to the load centres in the Mwanza and Arusha regions in the north. In anticipation of future interconnections with neighbouring countries of Kenya in the north and Zambia in the south, this reinforcement of the grid is a key component of regional economic cooperation and development.

World Bank regulations as well as the Tanzanian Environmental Management Act (2004) and the Regulations for EIA and auditing (2005), mandatorily require a full EIA for projects which are considered to have major environmental and social consequences. This ESIA will meet this obligation.

0.2 Description of Project Environment

The line route and associated substations are located in the central highlands of Tanzania between 32° to 36° east and 4° to 8° south.

The line is divided into three line sections, with the following section lengths that will be changed due to the findings of the ESIA (as far as the proposed routing alternatives will be approved by TANESCO):

- Iringa - Dodoma 225 km (initially 238 km)
- Dodoma - Singida 217 km (initially 214 km)
- Singida - Shinyanga 228 km (initially 231 km)

The total length will be 670 km (initially 683 km).

The transmission line will traverse areas with a differentiated topography with a highest elevation of 1,650 m a.s.l. in the Kidunda hills at Iringa and a lowest elevation of 750 m a.s.l. at the Mtera Reservoir, and therefore also slightly different climatic characteristics. The mean annual ranges between 400 - 600 mm from north of Iringa to Dodoma, whereas in the semi-arid climate of Shinyanga there is slightly higher rainfall,l with an average annual rainfall of 800 mm. The vegetation type varies depending on the climate pattern, rainfall quantity and soil characteristics of the area. However, crops induced by human cultivation activities and livestock grazing have replaced much of the natural vegetation.

The new line will pass cultivated farmland as well as grass-, bush- and woodland with scattered cultivation over a length of 440 km or 66% (initially 445 km or 65%), including settlements with a length of about 20 km or 3% of the total line length (initially 34 km or 5%). Main crops are maize, sorghum, rice, sunflower and cotton. Forest reserves will be crossed over a length of about 48 km (7%). The rest, some 180 km or 27% (initially 190 km or 28%) of the line will pass also uncultivated land, such as bush-, grass- and open woodland.

In some areas, the soil is vulnerable to erosion due to soil structure, orography, vegetation cover and the water regime. Along the line, at least along the stretch from Iringa to Dodoma, some sites with severe erosion problems have been observed.

The 400 kV transmission line passes areas with a variety of socio-economic conditions prevailing, as indicated by type and size of residential houses, type and amount of household income from crop yields and livestock keeping, and other assets. The socio-economic survey reveals that the average annual income per household in villages along the line from Mpwapwa District up to Manyoni District is about 31% smaller than in the villages of the other Districts. The report presents a socio-economic characterization of the affected communities and villages based on the information gathered from Statistical Offices.

0.3 Stakeholders and their Involvement in the EIA Process

Extensive stakeholder consultations were undertaken to ensure that major stakeholders and most of the issues were covered. Consultations included several stakeholders in relevant ministries and sectors in Dar es Salaam, Regions, Districts, various institutions including NGOs/CBOs operating at district levels and all villages where the 400 kV line is to pass. Awareness campaigns and participatory assessments such as discussions with local leaders, public village meetings, meetings and interviews with focus groups and various officials from public and private offices were held. Project affected villagers have also been visited to hear their views and concerns.

0.4 Results of Public Consultation

Discussions with officials from various districts and those at village level showed concern about the way the land acquisition procedure for development activities is undertaken in the country. In most cases local communities are not well informed of their rights and of the procedure as a whole. Another concern raised by stakeholders regarding compensation was on the duration of which one should be compensated once properties including land have been acquired by a developer. Another concern with regard to compensation was on prices/value given to affected properties. It was noted that prices given to crops, both seasonal and perennial were very low compared to the actual price or investment cost of that particular crop. In order to address some of these concerns some stakeholders recommended the following:

- Review of price of crops for compensation should be conducted every year and should involve relevant District Agriculture Officials. It is important to involve district officials because investment costs of crops differ from area to area due to variation in physical environment.
- Compensation of land value should include investment cost; for example, rice/paddy cultivation requires higher investment than the cultivation of maize.
- Compensation should also consider the fertility of land and the much higher prices that have to be paid to fertile land. For instance, the price of a land adjacent to a water source v/s a barren land should be much higher.

Several stakeholders raised their concerns regarding the prospect of increased spread of HIV/AIDS in their villages or even in the district as a result of the proposed project. World Vision, an NGO that operates in most of the areas covered by the project was also concerned about this and requested that measures for a prevention of spreading of HIV/AIDS should be taken, e.g. by the intensification of awareness campaigns among the local population and camp workers. In most areas the infection rate is already alarming and all possible measures should be taken to avoid a further spreading of the disease.

Most of the consulted District Council and Municipal officials as well as those at village level have highlighted the importance of the proposed development project to the Nation, Districts as well as the

local communities at large. Districts support the project with the expectation that the increased production of electricity in the national grid will lead to an increased electricity supply in their district areas. Currently two districts, Bahi and Kishapu, which will be traversed by the transmission line, are not connected to the national grid. However, local communities are still concerned as to when they will benefit from this project. Similarly, private companies working in the mining sector highlighted the benefits from the project that according to their point of view will ease the problem of electricity supply to the industries (currently the national electricity demand is not covered by the supply), increase power stability and reduce electricity tariffs. Investors also argued that the proposed development project would improve industrial development in Tanzania as well as increase the national income.

Other stakeholders mentioned benefits from the project, which include the possibility of increased employment opportunities for many people, especially for young ones; though they were concerned that employment may be given to people from outside the region, whilst local people will be left with simple casual jobs.

Other concerns are from villagers that settlements are likely to be impacted by the proposed project. At villages such as Mtera in Mpwapwa district about 125 houses may have to be removed to give way to the proposed project. However, rerouting decision could solve this problem completely. Other mostly impacted villages include Puma in Singida Rural and Bahi town where 50 respectively 85 houses would be impacted following the old line routing proposal. Also for the towns of Puma and Bahi, these impacts could be reasonably reduced or completely avoided by new line routing alternatives.

Though villagers are concerned about loosing their properties, especially houses and farmland, they also revealed their willingness to relocate, as they consider this project as very important for the Nation. Discussions with relevant District Land officers indicated that it is still possible to relocate project affected people within the districts, as there are other villages with sufficient and not occupied or cultivated land.

0.5 Major Significant Impacts

The main elements of the project causing environmental and social impacts will be the construction of

- the transmission line including the wayleave with conductors, towers and access ways
- 4 substations at Iringa, Dodoma, Singida and Shinyanga with capacitors, transformers, switching facilities and work shops
- about 6 - 7 temporary camps with storage areas, workshops and accommodation facilities.

The impact of utmost importance to the natural environment will be the clearance of the wayleave (about 51 km²) and the consequences hereof for most impacts with high significance. The area initially affected by changes of land cover and land use with diminished ecological functions due to the removal or at least degradation of the vegetation cover will amount to 17 km². As far as the proposed mitigation measures will be implemented, this impact will be reasonable more than fully compensated.

In some areas, the soil is vulnerable to erosion due to soil structure, orography, vegetation cover and the water regime. The most affected sections will be the line stretch from Iringa to Dodoma and the Wembere floodplain. This will not only be a threat to the soil in terms of soil loss and degradation, but also a serious danger to the stability of many towers along the existing line. Construction work may cause a serious acceleration of ongoing erosion processes or initiate new erosion threats.

The energy transported via the new line will be fed in mainly by hydropower plants. This may avoid or minimize future power production by thermal power plants in the areas served by the new line, making a considerable contribution to stabilising CO_2-emissions (some 2.5 Million tons of CO_2 per year).

The new line traverses the forest reserves Nyang'oro, Choda, and Sekenke -Tulya. About 40 km of the line will cross high valued and 8 km degraded forest reserves, all in all an area of 350 ha. Also these impacts may be more than fully compensated. Seasonally inundated areas will be crossed at a length of about 26 km, most of these in the floodplains of the Wembere River and its tributaries. Such areas are preferred breeding and feeding habitats of migrating waterfowls. Along the line, at least two (seasonal) wetlands of high value for birdlife will be directly concerned, Singidan Lakes (about 4 km line length) and the Wembere floodplain (about 20 km or more). National Parks or Game Reserves will not be affected.

Collisions will be a major cause of unnatural mortality for several species of threatened birds. The highest collision risk will be for large terrestrial birds where the earth wires are mounted ahead of the conductors. Some 80% of bird collisions happen at the earth wires. The areas concerned will be the wetlands mentioned before.

The most important negative social and economic impact will be the necessary removal of houses affected by the wayleave. Altogether, about 840 houses (initially 1,300 houses) will have to be relocated. This might be about 300 households and 1,500 people which have to be resettled, i. e. about 4.3 people out of 1,000, living in villages affected by the line will be concerned

Due to the fact that within the wayleave no buildings will be permitted, some areas potentially suitable for settlements will be lost. Counting the area within settlements or near by settled areas, about 20 km line length (initially 34 km) will be affected, i.e. 150 ha (initially 250 ha) of potential settlement area will be lost. This impact will be reduced

Agricultural activities in the wayleave area are generally tolerated (but not formally allowed), as long as the height of plants does not exceed 3 m. The area lost for cultivation will be limited to the space needed for substations, tower foundations, access ways and the ways for inspection along the line. Taking into account that access roads and ways will be useful (and also used) for agricultural purposes, these losses will be reduced to 122 ha during construction and later to 35 ha for operation. The benefit the farmers will have from using these ways / roads for their purposes may reduce or even more than fully compensate their losses in the long term.

Complaints of stakeholders have to be accepted also as indicators for social impacts. Most people do not see a benefit for themselves. Basically, the discussion focussed on the sentence "We only see the towers and the transmission line dissecting our villages, we provide security services to this important infrastructure, but we don't have the opportunity to utilize this service". Despite general expectations concerning job opportunities and rising income level, these effects will be very low taking into account the total number of people looking for jobs and income opportunities in the concerned villages. A proposal for a low-cost rural electrification technique along the new line is part of the Environmental and Social Mitigation Plan.

Health effects are focussed on the HIV/AIDS problems which are by nature challenging with regard to mitigation measures, as single men earning money and local girls struggling for their livelihood will be a risky combination.

Table 0-1 presents an overview of all impacts, which are expected to have at least a minor significance.

Table 0-1: Assessed Impact Levels With / Without Mitigation Plan

	Impact on	without mitigation		with mitigation		add. RE *
		short term	long term	short term	long term	long term
Natural environment	Vegetation cover	-5	-5	-2	+1	+1
	Soil erosion	-1	-3	-1	-1	-1
	Climate change	0	+3	0	+3	+3
	Landscape aesthetics	-1	-1	-1	-1	-1
	Valuable habitats without protection status	-3	-3	-2	+1	+1
	Diversity of habitats, wildlife barriers	-1	0	-1	0	0
	Collision of birds with the Line	0	-4	0	-2	-2
	Hydrocarbons	-2	-2	-1	-1	-1
	Waste and waste water	-1	-1	0	0	0
	sum 1	-14	-16	-7	0	0
Socioeconomic issues	Housing and resettlement	-5	-5	-2	-1	+2
	Public infrastructures and services	-2	-2	-1	+1	+5
	Settlement areas	-3	-3	-2	-2	+2
	Cultivated areas	-3	0	0	0	0
	Cultural heritage	-1	-1	0	0	0
	Employment and income	2	1	2	1	+5
	Complaints of stakeholders	-3	-3	-1	-1	+5
	sum 2	-15	-13	-4	-2	+19
Safety & health	Noise, dust and vibrations	-1	0	-1	0	0
	Electrocution	0	-1	0	-1	-1
	Electromagnetic fields	0	-1	0	-1	-1
	Accidents	-1	0	-1	0	0
	HIV/AIDS and other STD's	-3	-3	-2	-2	-2
	sum 3	-5	-5	-4	-4	-4
	total sum	-34	-34	-15	-6	+15

Legend

* Rural electrification of villages along the new line

Significance of impacts

0	neglectible	3	moderate
1	very low	4	high
2	low	5	very high
+	positive impact	-	negative impact

0.6 Project Alternatives

A **no-project alternative** entails that all above mentioned positive impacts will not take place (Chapter 0.1). Therefore, the socio-economic and environmental consequences of a no project alternative for the proposed project remain unrealistic.

An alternative strategy for energy supply at the same level would be the installation of diesel powered thermal power plants only. Costs as well as environmental impacts of this alternative will by far exceed those of the transmission line project.

Line routing alternatives are proposed in order to reduce impacts on houses and public infrastructure as well as conflicts with governmental authorities. Altogether, alternatives for 7 line stretches have been developed with a total length of 98 km, sparing about 460 houses (out of 1,300) and 10 public infrastructures (out of 23), and resulting in compensation savings of about 1,400 TEUR (and additionally lots of social grievances not rateable in monetary units). In summary, cost savings in the range of 6,000 to 8,000 EUR might be realistic, above all due to the fact, that these alternatives will reduce the total line length by about 13 km.

0.7 Mitigation Measures and Mitigation Plan

According to Chapter 0.5, mitigation measures have been defined in order to reduce the impacts of the project, and a mitigation plan has been drawn up.

The most important measure concerning the natural environment targets the wayleave area, where a selective clearing is recommended. That means that areas shall be cleared for construction work and inspection to a not more than absolutely necessary extent. After finalisation of construction work areas not needed anymore should be revegetated / reforested as far as the line safety is not impeded. These measures may reduce the area of necessary vegetation cutting by more than 90% and mitigate also the impacts on protected areas as well as the diversity of habitats, wildlife barriers and landscape aesthetics.

Addressing soil erosion, some technical measures are recommended which may prevent an acceleration of ongoing erosion processes as well as an initiation of new erosion threats in susceptible areas.

The risk for birds to collide with line conductors and shield wire will be reduced significantly by appropriate technical measures. The most efficient measure will require a different type of towers for line stretches crossing the wetlands mentioned in Chapter 0.5.

The impacts on housing, social infrastructures and cultivated areas will be mitigated significantly by the line routing alternatives (see Chapter 0.6) and above all by an Resettlement Action Plan (RAP), which will include all compensation issues and meet many complains of stakeholders.

The serious complaint that villages along the line corridor will not benefit from electrification, might be countered by an electrification of these villages, e.g. a timely deployment of shield wire systems (SWS) at least cost. This is best suited for rural electrification in sparsely populated territories traversed by HV transmission lines, and would be best implemented simultaneously with the construction of the new transmission lines.

The balance of impacts in Table 0-1 demonstrates that the proposed mitigation measures will fully compensate all impacts on the natural environment, whereas the impacts on safety and health condi-

tions will remain negative. The balance for livelihood and living conditions of the villages and people along the transmission line will remain slightly negative, in case electrification of the villages along line will not take place. This will turn into far more than a full compensation with regard to electrification, as this will boost the local economy.

Responsibilities and costs for the recommended mitigation measures are listed in an Environmental and Social Mitigation Plan. The total costs of this plan and the Environmental and Social Monitoring Plan (see Chapter 0.8) will be much lower than savings.

0.8 Environmental and Social Monitoring Plan

The main objectives of environmental monitoring are:
- to assess the changes in environmental conditions,
- to monitor the effective implementation of mitigation measures,
- to indicate potential problems in order to allow prompt implementation of effective corrective measures.

Monitoring will be particularly important where
- environmental impacts can't be estimated with suitable certainty
- the efficiency of mitigation measures are uncertain
- effects on socioeconomic items as well as health and safety issues are concerned.

Monitoring will already start in the planning phase, as in several aspects the actual situation is not yet known in the necessary spatial and factual resolution. This is above all true for some biological parameters for example the vegetation cover in the wayleave and the population of endangered birds in the wetlands, for the incidence rates of HIV/AIDS and other STDs, and for all compensation issues. Monitoring during construction time will concentrate on the supervision of activities of the contractor and is mostly based on observations in camps as well as at construction sites.

Responsibilities and costs for the recommended monitoring activities are listed in an Environmental and Social Monitoring Plan. The total costs for the Environmental and Social Monitoring Plan will be far below the expected savings.

0.9 Decommissioning

The expected lifetime of a high voltage transmission line may be estimated to be at least 50 years. An early decommissioning is therefore not very likely, but rather a long-ranging repair or exchange of line components.

Decommissioning of technical installations comprises dismantling, decontamination of materials and site, shipment and final disposal of materials as well as site rehabilitation. Disposal of materials can take place either by selling, re-use or depositing. For all metal components from the transmission line this will mainly mean scrapping. Due to high transportation costs and the lack of a scrapping infrastructure in developing countries on the one hand, and the high quality of these materials and value for local people on the other hand, these materials are at present usually left on site for cannibalisation. Any decontamination will not be necessary.

A substation is a very different problem. Due to a lot of hazardous substances such as hydrocarbons and electrical equipment containing heavy metals, a very careful dismantling, decontamination of materials and of the soil down to the deeper layers, shipment and recycling or proper disposal will be obligatory.

0.10 Conclusions and Recommendations

The proposed transmission line is a project of major importance for the infrastructure development and the socio-economic development of Tanzania in general and the north-western region in particular. However, by its nature, such a project will have a lot of impacts on environmental and socio-economic issues with a broad range of significance.

However, the balance of impacts demonstrates that the proposed mitigation measures will fully compensate all impacts on the natural environment, but the balance of impacts on safety and health conditions would remain negative due to the fact, that the main issue HIV/AIDS would be challenging in respect of appropriate measures. Therefore, one essential proposal is to clear the wayleave only to the technically indispensable extent, and to recultivate / reforest / revegetate also the wayleave of the old 220 kV line to the same extent. The balance for livelihood and living conditions of the villages and people along the transmission line will remain slightly negative, in case electrification of the villages along line will not take place. This will turn into far more than a full compensation with regard to electrification, as this will boost the local economy.

Positive impacts like employment opportunities and income rising for local people along the line will normally be by far overestimated. Verifiable effects will be minimal, as long as the construction of this line will not be combined with an electrification of the villages along the line. A least cost solution in time for this issue is part of the recommendations.

It is strongly recommended to start with the following monitoring activities as soon as possible:

- Establishment of a detailed large-scale mapping of the actual vegetation cover along the wayleave as well as of erosion prone areas, following the still pending demarcation of the new line;
- Observation of bird population and bird migration at the line stretches crossing the seasonal wetlands near Singida and at Wembere floodplain. This will be possible during rainy season only, the results will be an input for tendering;
- Documentation of available information on wildlife in areas where a high value for wildlife is indicated.
- Documentation of representative HIV/AIDS rates in the villages along the proposed line

These activities shall be carried out by experienced specialists only.

1. Introduction

1.1 Project Background

Tanzania is endowed with diverse energy sources that includes biomass, natural gas, hydropower, coal, geothermal, solar and wind energy. Much of these sources are relatively untapped. Wood-fuel accounts for up to 92% of total energy supply, about 2% from hydro-electricity and 7% from oil-derived products. Tanzania Electric Supply Company Limited (TANESCO) is responsible for electricity generation, transmission and distribution in Tanzania. The Company is 100% government owned and accounts for more than 90% of the country's electricity supply. Two thirds or 381 MW of Tanzania's installed capacity is from hydropower sources. It is reported that Tanzania has an estimated hydropower potential of about 3,800 MW and a per capita electricity consumption of 46 kWh per annum, the growing rate is estimated at 11 - 13% per year. Hence, the government is encouraging investments to expand generating capacity, distribution systems and developing alternative sources of energy. The coverage of the national electricity grid is about 10% of the total population (MEM, 2006).

The energy crisis in 2006 has highlighted the importance of reliable energy for economic growth and poverty alleviation. It once again revealed the underlying vulnerability of hydro-dominated generation systems to droughts and the resulting importance of adequate diversified generation planning and timely investments in the transmission and distribution sub sectors to reduce technical losses. As the sector is moving from a short-term crisis management to medium- and long-term planning, the following issues and strategic goals have been identified. These include:

- ensuring appropriate long-term generation capacity
- ensuring quality of supply;
- ensuring long-term financial sustainability of TANESCO;
- continuing sector reform process;
- improving Management of TANESCO;
- expanding access to other areas and
- increasing the use of renewable energy.

TANESCO is planning to establish a 400 kV transmission line from Iringa via Dodoma and Singida to Shinyanga with a total length of about 670 km. This new power line will link existing and future generating sources in the south and southwest of Tanzania to the load centres in the Mwanza and Arusha regions in the North. In anticipation of future interconnections with neighbouring countries, i. e. Kenya in the north and Zambia in the south, this reinforcement of the grid is a key component of regional economic cooperation and development.

1.2 Project Rationale

The vast majority of people in Tanzania do not have access to electricity, and the rural population is nearly completely excluded from this source of energy. It is estimated that only 10% of the population, mainly in urban areas, is connected to the national grid. It is intended that the rest of the country, including about 8,200 villages, should be supplied with electricity to curb deforestation. In addition there are plans to supply power to Kenya and Malawi from Tanzania.

TANESCO through government and the World Bank financing mechanism is intending to reinforce the existing 220kV transmission line from Iringa to Shinyanga through a new 400 kV transmission line with a length of about 700 km.

The main objective of this project is to improve power supply in the north and north-western Tanzania.. In addition the project intends to reduce the duration and frequency of power interruptions to central and northern regions i.e. Dodoma, Singida, Shinyanga, Mwanza and Mara, improve voltage conditions at consumer's premises, reduce power system losses - technical losses to meet the current and growing power demand in those regions. The project would also increase supply and therefore, increase number of customers and revenues to TANESCO. In addition, the project will increase the possibility of power exchange with neighbouring countries, and capturing possible opportunities for cross-border power trading within East Africa.

1.3 The Environmental and Social Impact Assessment (ESIA)

The Environmental Management Act of 2004, Cap. 191, recognizes the right of every citizen to a clean, safe and healthy environment, and the right of access to environmental resources for recreational, educational, health, spiritual, cultural and economic purposes.

In pursuance of the Environmental Management Act Cap 191 of 2004, TANESCO has commissioned DECON Company from Germany and the Institute of Resource Assessment (IRA) to undertake the Environmental and Social Impact Assessment for the above mentioned project. The main objective of this ESIA is to determine how the proposed project could impact on the environment and the livelihoods of people. Specifically, this ESIA intends to achieve the following objectives:

- Establishment of a baseline on the actual state of the social and biophysical environment in the proposed Right of Way
- Identification of impacts of the project onto the social and biophysical environment including identification of alternatives (including the no project alternative);
- Identification of project stakeholders and affected population and initiation of a public consultation process;
- Identification of measures to prevent, minimize, mitigate or compensate adverse environmental and social impacts;
- Elaboration of an environmental management plan (EMP) that describes in detail necessary mitigation measures, costing, scheduling and responsibility for such measures as well as an environmental monitoring plan.

The proposed development will be a World Bank funded initiative therefore, this ESIA has also taken into account the safeguard policies (including public consultations) of IFC and World Bank defined in their Operational Policies documents. These safeguard policies have been taken into consideration and addressed in as far as applicable; these include

- Environmental Assessment (OP 4.01, BP 4.01, GP 4.01)
- Natural Habitats (OP 4.04, BP 4.04, GP 4.04)
- Forest (OP 4.36, GP 4.36)

Further, this ESIA is responding to the Environmental Management Act (EMA) No. 20; Part VI Section 81(1) of Environmental Management Act No. 20 of 2004 requires project proponents or developers to undertake an Environmental Impact Assessment (EIA) at their own cost prior to commencement or financing of a project or undertaking. Types of projects requiring mandatory EIA are listed in the Third Schedule of the Act. Section 7 (i and iv) of the Act outlines projects that require mandatory EIA, which includes the proposed development. The Act prohibits any development to be initiated without an Environmental Impact Assessment (EIA) Certificate.

Section 86(1) of the Act stipulates that " the NEMC shall upon examination of a project brief, require the proponent of a project or undertaking to carry out an Environmental Impact Assessment study and prepare an Environmental Impact Statement" . According to the Act (Sub-section 1-4) the EIS should be submitted to NEMC, which carries out a review through its Technical Advisory Committee (TAC). NEMC is also required to make site visit during the review process for inspection and verification at the proponent's cost. The ESIA findings are expected to inform the final design and form the basis for environmental permission and approval of the project.

2. Project Description

2.1 Project Location

The line proposed in this project will be built from Iringa to Shinyanga via Dodoma and Singida (Table 2-1). Most line sectors will run parallel to the existing 220 kV line, with only minor variations in areas where alternative alignments have been proposed. The planned line has a length of approximately 670 km will interconnect four substations (S/S) at the towns of Iringa, Dodoma, Singida and Shinyanga. The line route is located in the central highlands of Tanzania between 33° and 36°30' east and 4° to 8° south of equator (see Figure 2-1). The lin e is divided in three sections between the 4 towns mentioned above.

The project will traverse the following districts, wards and villages as indicated in the table below:

Table 2-1: Regions, Districts and Villages along the Line

Regions	Districts	Villages
Iringa	Iringa Municipal	Igumbilo
	Iringa Rural	Kigonzile, Nduli, Igingilanyi, Ndolela, Mkungugu, Kisinga, Isimani Tarafani, Kihorogota, Nyang'oro, Izazi, Mtera, Migori, Makatapora
Dodoma	Mpwapwa	Mtera-Staff, Kisima, Chipogoro, Kisima, Seluka
	Dodoma Urban	Nkulabi, Mpunguzi, Mantumbulu, Mkonze, Michese, Nala, Chigongwe
	Chamwino	Fufu, Manzase, Mlowa Barabarani
	Bahi	Ibihwa, Mpamantwa, Bahi, Uhelela
Singida	Manyoni	Lusilile, Maweni, Chikuyu, Chibumagwa, Solya, Muhalala, Manyoni Mjini, Mitoo juu, Mkwese
	Singida Rural	Choda, Issuna A, Isuna B, Nkuhi, Ulyampiti, Muungano, Ikungi, Ighuka, Kipunguiko, Nkunikana, Puma, Isalanda, Utaho, Kisaki, Manga, Mnung'una, Msisi, Ntondo, Nkwae.
	Singida Urban	Kipungua, Misuna, Mungumaji, Unyambwa Mkimbii, Mtipa
	Iramba	Iguguno, Tumuli, Maluga, Kyengege, Mugundu, Kitukutu, Ulemo, Misigiri, Kibigiri, Nselembwe, Kizonzo, Mseko
Tabora	Igunga	Mgongoro, Makomero, Mbutu, Bukama Imalanguzu, Mwamakona, Igurubi
Shinyanga	Kishapu	Kalitu, Kiloleni, Ngunga, Mwajiginya, Mwaweja, Negezi,
	Shinyanga Urban	Ibadakuli, Mwamagunguli
5	**13**	**93**

2.1.1 Iringa - Dodoma Section

From the Iringa Substation the proposed line will run on the left hand side of the existing 220 kV line, with exception of a short cut between towers 5 and 9. Parts of the areas comprise mountain ridge with partly steep slopes that have difficult access, the terrain from Mtera to Dodoma is typical of rolling hills. At the Mtera power station the new line will pass 70 m adjacent to the switchyard, spanning over the 220 kV feeder lines. The power line passes through the Nyang'oro forest reserve before emerging at Mtera dam. In this ESIA alternative routes are proposed between Iringa and Dodoma, especially at Igumbilo and Mtera. These alternatives are discussed in the section on alternatives below.

2.1.2 Dodoma - Singida Section

From the Dodoma Substation the line runs along the right hand side of the existing 220 kV line on a mostly flat to slightly hilly terrain. Soils seem to be of similar characteristics over the entire line section, i.e. of dense clay sand. From Dodoma to Bahi, the route of the new line will affect the existing weighbridge. At T 230 near Kilimatinde the lines traverse a fault-scarp of over 100 m vertical shift, forming a very steep slope with large outcrop rock. In order to bypass massive granite blocks, the parallel distance to the new line had to be increased to 500 m over a length of around 3 km. The line passes through Sekenke and Choda Forest Reserves before reaching Singida Substation.

2.1.3 Singida - Shinyanga Section

The existing 220 kV line from T1 to T24 is completely built in and the new line running parallel to the existing line may need the removal of more than 100 houses, partially multi-storage modern buildings for business and administration purposes. Therefore an alternative line route has been developed. The proposed line route will run some km in parallel with the existing 220 kV Arusha line at its left hand side. Then it will cross this line near T10 which is on the left. It then passes a hill and runs through a seasonal wetland NE of Lake Singida and joins the line at T42 to Shinyanga. From T132 to T190 the corridor between the road and the existing 220 kV line is occupied by various buildings and scattered settlements.

Between T191 and T210 the new line would pass through steep slopes of up to 50° transversal. In order to minimize these effects, it was therefore decided to lead the new line from T132 to T210 about 1 km in parallel to the existing 220 kV line at the northern side of the road, leaving the existing settlements undisturbed and getting favourable terrain conditions in the latter part. From towers T260 to T265 B the line will run through the seasonal Wembere swamp in the Mseko and Mgongoro villages. The line traverses also a system of seasonal rivers (tributaries of the Wembere River) with localized erosion hazards, and then leads towards Shinyanga through a terrain with occasional outcropping rocks embedded in sandy soils.

Figure 2-1: Proposed Line Route from Iringa to Shinyanga

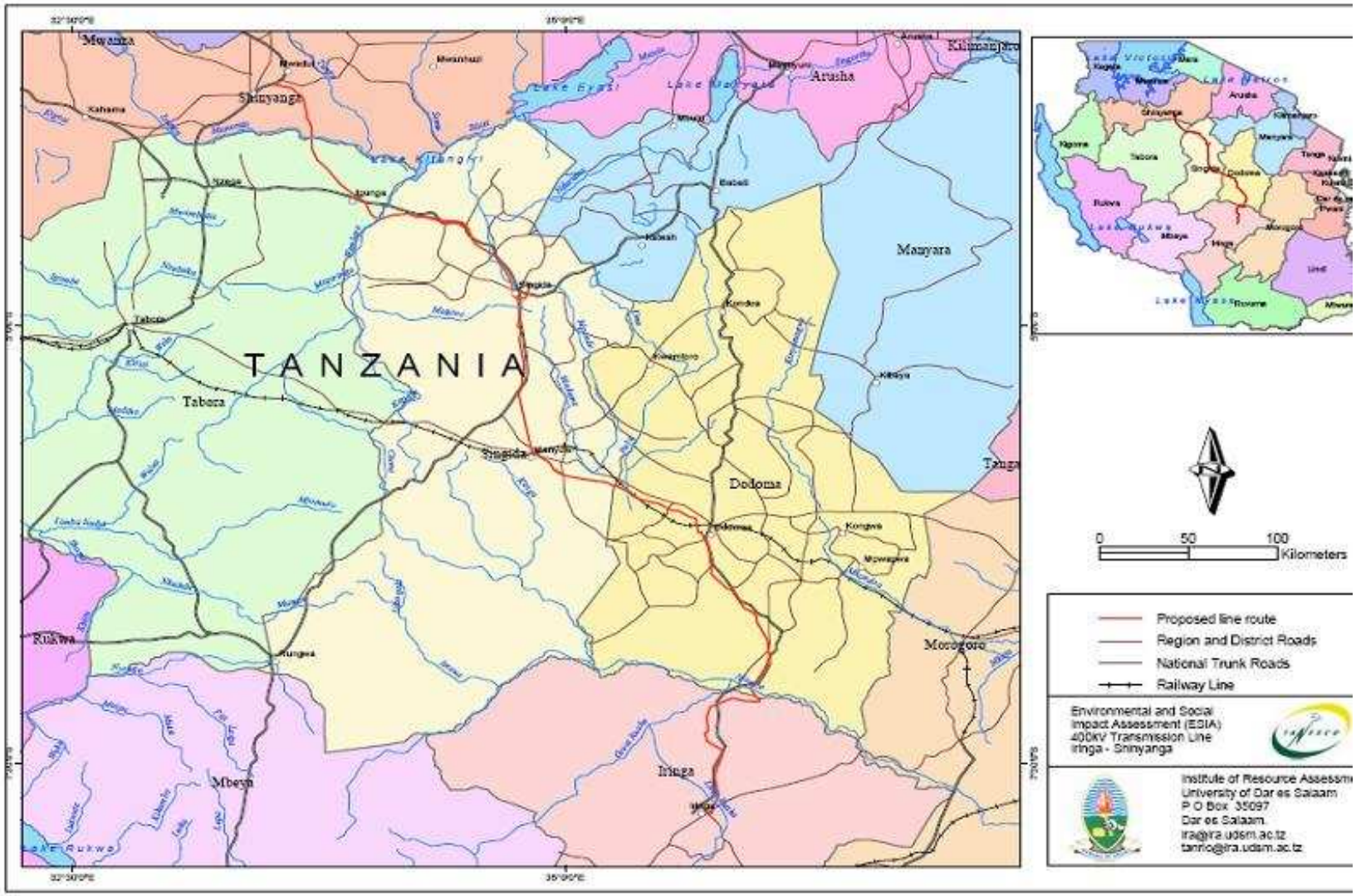


Figure 2-2: Route Map for Iringa - Dodoma Section

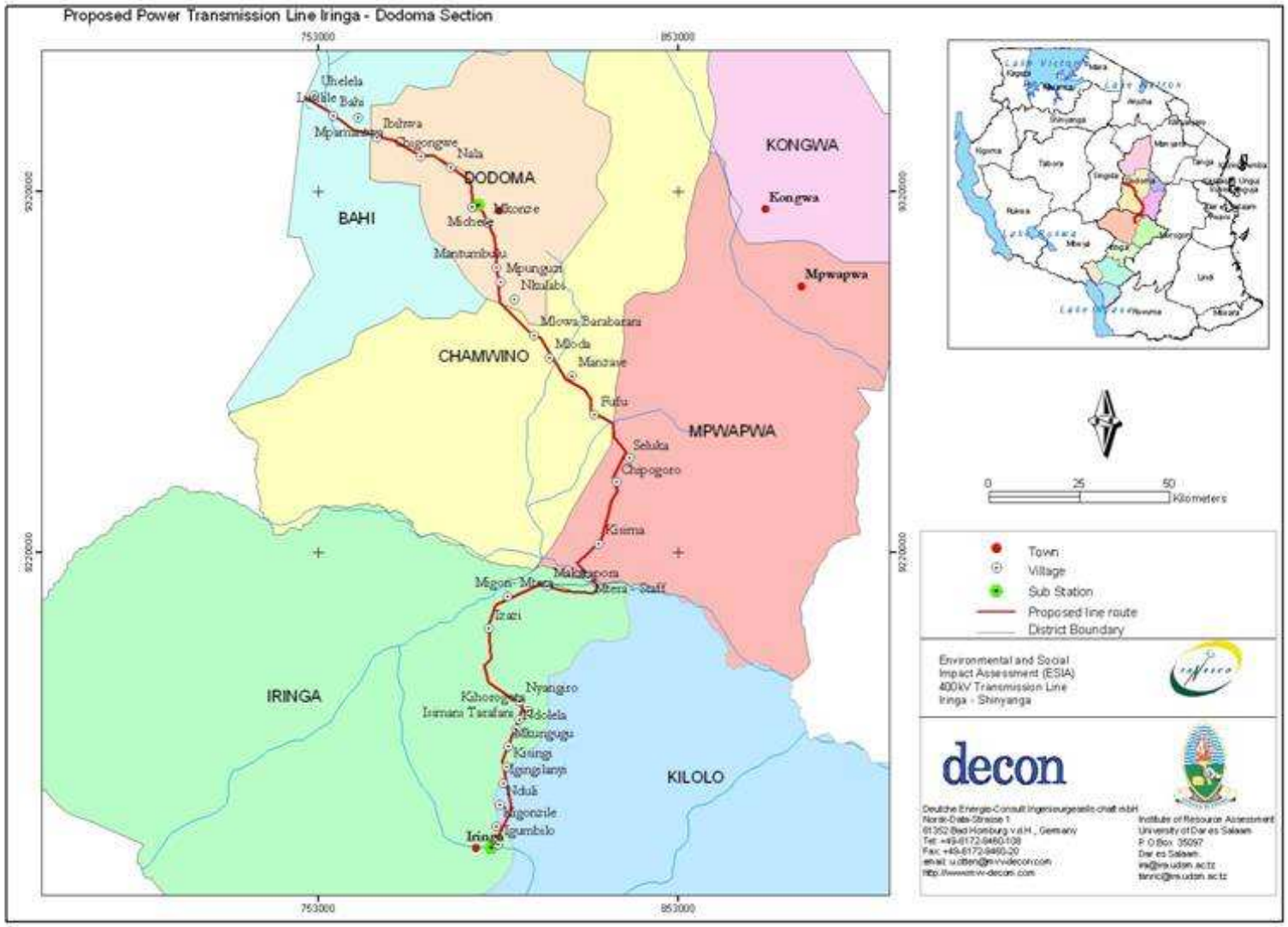


Figure 2-3: Route Map for Dodoma - Singida Section

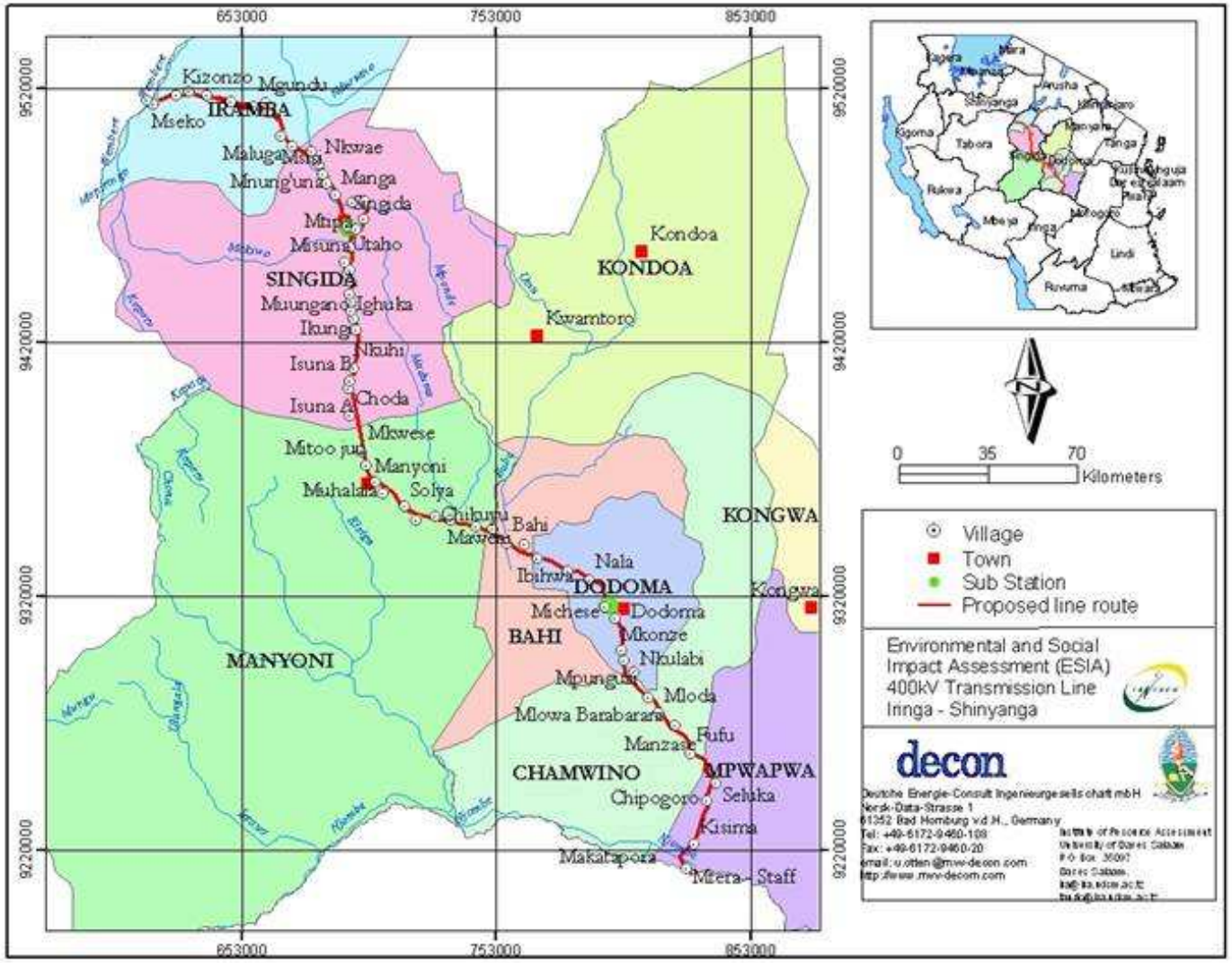
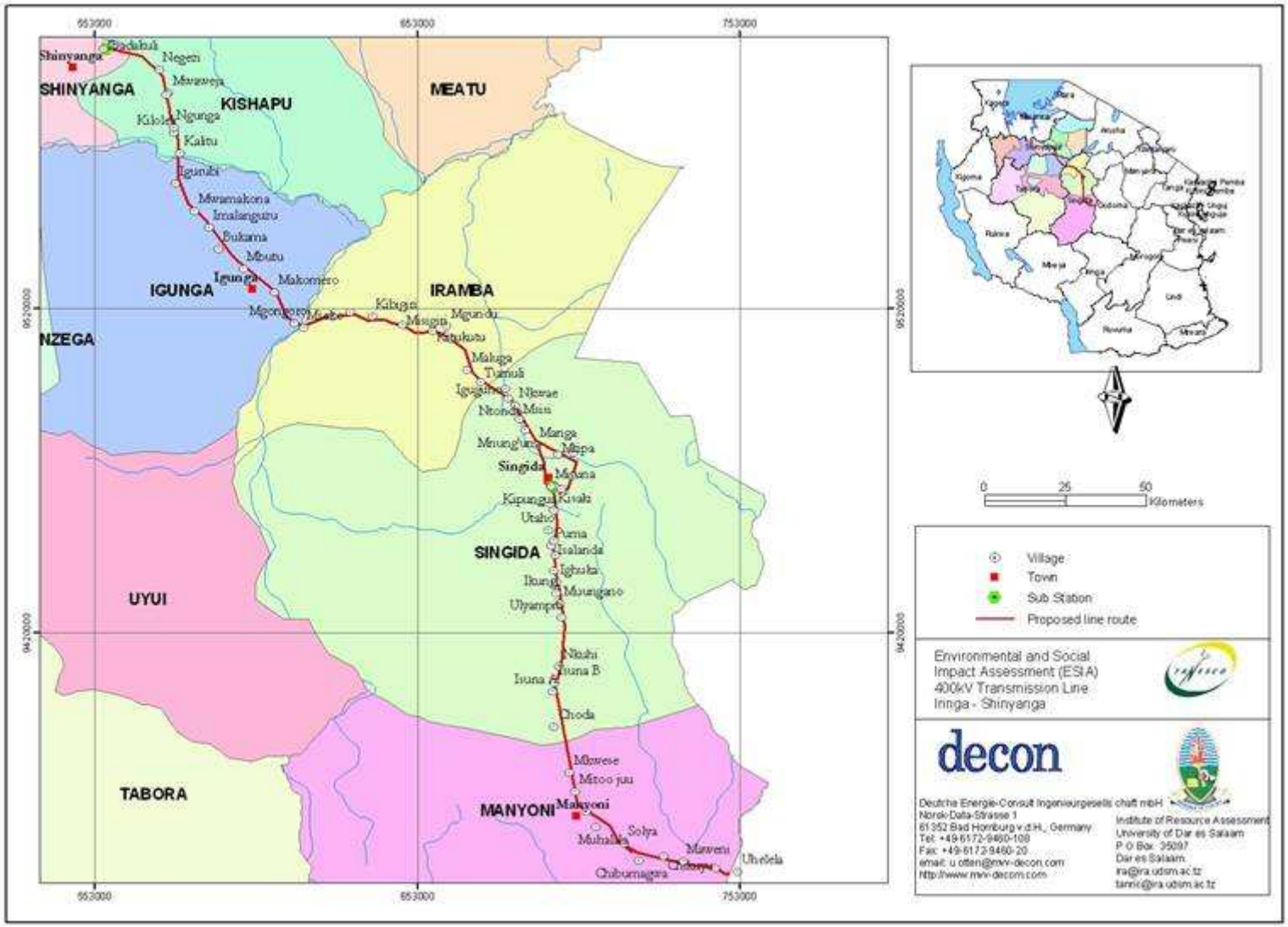


Figure 2-4: Route Map for Singida - Shinyanga Section



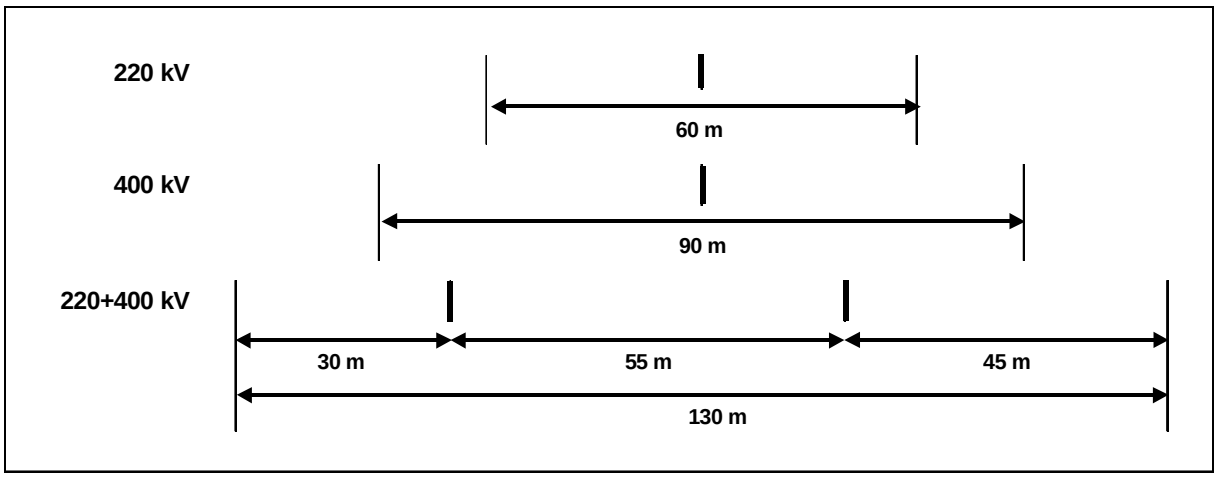
2.2 Project Components

Transmission projects normally consist of several components each with specific environmental and social aspects, as well as its specific potential impacts. The typical project consists of the following elements:

2.2.1 Wayleave Corridors

The wayleave corridor of a transmission line includes land set aside for the transmission line and associated facilities, land needed to facilitate maintenance, and to avoid risks of fires and other accidents. It provides a safety clearance between the high-voltage lines and surrounding structures. The proposed transmission line to be erected will utilize part of the existing 60 m wayleave of the 220kV transmission line from Iringa to Shinyanga, When running parallel to an existing line, use of common right of way will considerably reduce the overall RoW corridor width of the two lines. In defining the parallel distance due, consideration must be given to tower geometry, conductor swing-out, span length, induction interference and tower falling range. Since many of these parameters are not yet known for the planned line, an initial axis distance of 55 m to the existing line has been taken as a basis for assessment (5413A08-000/FICHT-3237680-v1 10, 2008).

Figure 2-5: Size of the Wayleave



2.2.2 Transmission Towers

Transmission towers are the most visible component of the power transmission system. Their function is to keep the high-voltage conductors (power lines) separated from their surroundings and from each other. Figure 2-6 shows the tower type of the existing 220 kV line on the right hand and the tower type will to be used for the new line (height 60 m, bare width 15 m) on the left hand.

Figure 2-6: Tower Types (South of Shinyanga)

Source: NORPLAN 2006, Environmental and Social Impact Assessment, Shinyanga - Kahama 220 kV Transmission line

2.2.3 Conductors

Conductors are the cables that transport the electrical power from a power station to the consumers. Generally, three conductors for each electrical circuit are strung on a tower. Conductors are fabricated primarily of twisted metal strands, but newer conductors may incorporate ceramic fibres in a matrix of aluminium for added strength with lighter weight.

Table 2-2: Characteristics of the New Line (without rerouting)

	total length	distance main road to new line > 500 m		new line not parallel to 220kV line		Towers total	Angle T. hereof
Line Segment	km	km	%	km	%		
Iringa - Dodoma	238,0	183	77%	1,2	1%	600	41
Dodoma - Singida	213,7	129	60%	4,2	2%	528	32
Singida - Shinyanga	231,5	137	59%	60,5	26%	532	36
total	683,2	449	66%	65,9	10%	1.660	109

2.2.4 Access Roads

Access roads to transmission line structures will be required for both, line construction and maintenance. They may either be paved or gravelled. Vegetation clearing and/or re-contouring of land may be required for access road construction. Additional temporary roads will also be needed during the construction phase of a transmission line project. Most of the existing access roads are in a bad condition, and need to be repaired. As a consequence of line construction planning, a clearing of vegetation may be needed for safety and/or access reasons, which might have a severe potential impact on vegetation and soil stability.

2.2.5 Substations

Substations vary in size and technical configuration and may cover several acres. They are cleared of vegetation and the foundations normally consist of gravel or stone aggregates. Substations are fenced to minimize the risk of electrocution for people and animals and are accessible by a permanent road. Transformers and capacitors are filled with oil. Larger transformers are always placed on a concrete platform to avoid a contamination of soil and ground water by oil leaks. For the erection of the new 400 kV line the area of the existing substations will be enlarged to more than the double size (altogether by about 29 ha); most of this area is owned by TANESCO.

2.2.6 Materials and Other Utilities

Equipment to be used by the project includes lattice towers, conductors and insulators that will be imported. Some other stuff, such as cement and of course sand and gravel may be locally obtained. The use of environmentally accepted equipment (i.e. transformer oils should be acceptable with regard to environment and health) will be recommended, and all relevant regulations on safety, health and environment have to be complied with.

During the construction phase some work camps will be needed as storage area for construction material, fuels and lubricants. They comprise workshops, offices and accommodation for staff etc. for a period of several months. Each camp may accommodate up to 200 workers, therefore they will need water supply, wastewater discharge and treatment systems, waste disposal facilities, as well as health care facilities. Generally, a work camp will be used only for several months during the construction period. The next work camp will be established some weeks prior to finishing the main construction work at the first line stretch and this process will continue throughout the whole construction phase. Constructing the work camp in succession will minimize the cumulative effect related with constriction of the work along the wayleave and provide opportunity to the contractor to rehabilitate the campsite when the next camp is ready for use.

Normally, such camps will be located in or near townships or larger villages in order to benefit from their infrastructure, such as accommodation, food supply areas, health care services etc. Depending on the technical requirements a camp may serve a segment of about 100 km situated in the middle of such a distance halfway backward and forward along the line. This means that in this project altogether 6 to 7 camps will be established. Due to information from TANESCO, such camps will be established within the TANESCO sites that are available near the existing substations mentioned above as well as at Mtera Hydropower Plant, adjacent to permanent staff quarters.

2.3 Project Activities

The project activities will consist of a range of operations that are aimed at ensuring that the 400 kV power transmission line from Iringa to Shinyanga via Dodoma and Singida will be completed in time and will be operational as required. The main activities are described below with additional information provided in subsequent sections and chapters.

2.3.1 Mobilization Phase

This initial phase of project implementation will commence when all necessary permits have been obtained and processes have been completed. For example, mobilization shall commence after the wayleave has been identified, project affected persons, and institutions have been compensated and/or relocated according to the national and international laws and guidelines. Mobilization entails establishing work camps and offices at site, assembling equipment; construction work force as well as materials for securing the wayleave. Securing the wayleave may not take place simultaneously throughout the whole wayleave but may be undertaken in successions when the contractor moves from one point to the other.

Issues of concern and impacts that may arise during this phase include noise, vibration, and dust emissions arising from the movement of heavy machines and equipment to the site and for construction of the work camp, as well as waste produced by temporary work force who is establishing the work camps.

2.3.2 Construction Phase

The construction phase includes the erection of the towers, securing the site and the construction of facilities for the substations and transformers.

Machines and manual labour will be involved in the construction phase. Some areas will require preparation of the access roads to bring equipment, workforce and materials to the designated sites. Given the terrain in some of those areas, this undertaking could be time consuming and challenging. On average, about 2 years are needed to construct a stretch of about 200 km. This implies that constructing 1 km of line will need about 3 working days. Impacts may last for a short duration of up to 2 months at most, however some impacts will continue beyond the construction phase. For example, opening up new areas for the wayleave will create a permanent mark that will remain even after construction. The visual impact created by the towers and their potential impact on bird flights will last for a long time after the construction work has been completed. These are some of the residual impacts that the project will create and which will be permanent as there will be no mitigation possibilities.

Some labour forces will be recruited from local communities - especially for simple and manual operations that could easily be accomplished using local skills. However, the main contractor will be responsible for the recruitment of the work force since he will be aware of the work schedule, quality of the work that is needed, the budget for the workforce and safety issues. It is estimated that about 20% of the 250 employees (or 50 workers) will come from communities located in the areas where the construction is taking place. Based on this estimation, only few people from places along the wayleave will be employed for a 2-years period.

Issues of concern associated with construction work include traffic accidents. However, the frequency of traffic of construction vehicles and other cars on the access road may be around 50 movements per

day, with concentrations during peak times in the morning and in the evening, and during a period of about 3 weeks to 2 months. Based on these estimates, only few accidents - about 2.5 per year -are normally reported, but about 5 accidents per year which can be associated with the construction work.. However, these estimates are based on conventional practice and may be subject to variations, especially as the wayleave runs through areas, where traffic is not common. Irrespective of the numbers of accidents to be expected, the contractor must ensure strict adherence to traffic regulations and should also provide sufficient safety measures, including warning to drivers and other road users to be careful of heavy trucks moving in their areas.

In addition, vibrations are likely to be an issue, especially from blasting and movement of heavy vehicles and machinery. Given the natural geological conditions along the proposed alignment, blastings are likely to occur at a rate of one blasting per 5 km stretch.

Other issues/impacts associated with construction include noise and dust, increased cost of living due to increased demand for goods and services (arising from increased population). Some of the impacts associated with construction will last for 3 weeks or 2 months, depending on the site and the specific conditions. However, some impacts will last well beyond the estimated time. For example, the cost of some consumer goods may not come down even after the construction on a particular site has been completed because shopkeepers usually do not reduce prices easily. In addition, some impacts, such as those associated with health effect (HIV/AIDS and other STD), social relationships, pregnancies of school girls (may not be noticed during the short duration of the construction period or even longer after the construction work) will prevail beyond the construction work. In addition, visual impacts caused by the sheer size of the towers and loss of vegetation caused by clearing the wayleave will remain as permanent changes well beyond the construction phase.

2.3.3 Operation Phase

During operation, the power line will need regular inspection and maintenance (e. g. site clearing and vegetation pruning) as well as occasional maintenance activities due to technical problems, vandalism and accidents caused by migratory birds, wild fires and natural disasters (especially in flood and erosion prone areas).

2.4 Decommissioning

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

Decommissioning of technical installations comprises dismantling, decontamination of materials and site, shipment and final disposal of materials as well as site rehabilitation. Disposal of materials can take place either by selling, re-use or depositing.

Metallic components of the transmission line will be good for scrapping. Due to high transportation costs and the lack of a scrapping infrastructure in developing countries on the one hand, and the high quality of these materials and value for local people on the other hand, these materials are at present usually left on site for cannibalisation. Any decontamination will not be necessary.

A substation is a very different problem. Due to a lot of hazardous substances, such as hydrocarbons and electrical equipment containing heavy metals, a very careful dismantling, decontamination of ma-

terials and of the soil to the deeper layers, shipment and recycling or proper disposal will be obligatory.

2.5 Overall Approach and Methodology

2.5.1 Environmental Issues

The main methods to work on an EIA will be

- review of documentation (above all of technical and ESIA reports) and internet investigations
- Interpretation of maps and satellite images
- Field investigations

Topographical maps at a scale of 1:50,000 (TM50) covering most of the project area were sourced to identify the alignment of transmission lines, topographical conditions as well as indications for some types of buildings (such as schools, churches etc.) according to the TM50-legend. The basic information of these maps is 25 years old or even older. The demographical dynamics indicate a considerable expansion of the settled area. For example, the annual average growth rate of the population between 1988 and 2002 was 2.3% p.a. for Singida (Population and Housing Census, Central Census Office, Dar es Salaam, Jan. 2003), which corresponds to a duplication of the local population within 30 years.

Maps showing land cover or land use (at a scale of 1:250.000) produced from Landsat images dated 1994-1996, and verified by field investigations, are available at IRA (Dar-es-Salaam), discriminating 34 types of land cover or land use. This database will be sufficiently up to date for an ESIA.

Some mapped information on protected and sensitive areas (national parks, game protected areas and forest reserves) will be available from the Ministry of Natural Resources. However, they have been compiled in 1965 at a scale of 1:2.000.000, and are therefore not very reliable, e. g. none of the forest reserves affected by the line will be documented in this map.

Mapped information on protected and sensitive areas (National Parks, Forest Reserves, Game Protected Areas, Ramsar sites ...) is available from the Ministry of Natural Resources.

Satellite images with a suitable spatial resolution are extremely helpful for identifying affected buildings and other structures, land cover /land use patterns, orographical conditions (in much higher resolution and accuracy than TM50). In the time period of the field surveys (see below), Google Earth presented satellite images with a suitable spatial resolution only for 56% (July 2009: 63%) of the project area (see Table 2-3). Unfortunately the coordinates are not fully reliable as shifts up to 400 m occur, differing from image to image, so an exact allocation of objects (coordinates) will need reference points from topographical maps.

GPS has been used for allocation of observation in the field as well as for finding objects with known coordinates. But it should be noted that GPS may have a fault tolerance of up to 100m due to atmospheric interferences, subsoil conditions, disturbing electromagnetic fields and of course the accuracy of the instrument used. This error margin will be in the range of the wayleave. That means, e.g., that the allocation of affected houses might be completely wrong, if there is no other structures with known coordinates (e.g. from TM50) nearby to enable a check of GPS-coordinates.

It has to be emphasized that a detailed design of the transmission line route and detailed land surveying, including the demarcation of transmission line corridors, is missing up to date. Taking into account the error margins described above and the sometimes very difficult topography, the exact allocation of

the wayleave and herewith of affected objects may be incorrect. In respect of houses and infrastructures identified as affected, an error margin of at least 10% has to be accepted. Exact figures may be acquired by the detailed land survey mentioned above.

Table 2-3 : Availability of Topographical Information (without rerouting, status 08/09)

	Topographical Maps 1:50.000 / GoogleEarth not available (km)			
line segment	TM50	GE	GE %	TM50+GE
Iringa - Dodoma	0	142	60%	0
Dodoma - Singida	0	102	48%	0
Singida - Shinyanga	53	129	56%	53
total	53	373	55%	53

GE GoogleEarth
TM50 Topographical Map 1:50.000

Two field investigations have been performed in July - August and in October 2008, the latter in order

- to verify some differences between observations and other information sources,
- to collect additional information for line routing alternatives and
- to explore routing alternatives which had not been indicated or sufficiently explored during the first field survey.

2.5.2 Social Impact Assessment

Public consultations and extensive stakeholder involvement constituted the main approach for this ESIA. The main activities in ESIA were as follows:

- In Phase I: the ESIA team first reviewed the literature and available information and developed data collection tools. During this phase and after thorough analysis of the literature, the team split into two groups. One group visited selected areas for proposed Right of Way (RoW) in order to identify some critical but spot areas that may need more attention during the detailed ESIA. After the reconnaissance survey, the team modified the tools and finalized the study plan.
- In Phase II: the team visited the project area to carry out household surveys, to conduct public consultation meetings with stakeholders, to interview key informants and stakeholders, and to assess social, physical and environmental conditions. The consultations were also extended to Dar es Salaam involving several stakeholders at the central government level. During field exercise consultations with stakeholders along the wayleave potential households and social infrastructure that will be negatively affected by the proposed development were also identified. These individuals and public infrastructure constitute the bulk of the information for the Resettlement Action Plan.
- Phase III: The team assembled and analysed the information gathered from the field work and prepared a draft report. The analysis involved an examination of the alternatives in view of the social, environmental and cost implications. Some members of the team returned to the site to verify some of the critical issues regarding alternatives, an exercise which helped to generate more options for TANESCO to consider.

The field survey and Consultation meetings were carried out in villages along the proposed power transmission line during July - August 2008. A "field survey team" consisting of 12 members was deployed to the site and given a two-day orientation prior to starting the data collection exercise in the project area. The survey team involved surveyors, asocial scientist, an environmentalist, a public consultation and participation specialist and a biodiversity expert to ensure that good and reliable data were collected. In addition, a land surveyor from TANESCO was involved to give orientation in land surveying. Also one sociologist from TANESCO participated in the field as part of on the job training. The following data collection tools were used for carrying out field surveys for the ESIA preparation:

i. Household questionnaire: A household questionnaire was prepared and used for collecting basic information from all possible affected people and possible affected structures/assets. In addition the questionnaire collected household demographic information, type of residential houses, economic activities, land related issues and views from the household heads in the proposed development.

ii. Village checklist: A checklist was prepared and used for collecting information about villages, social services that are obtained in the village, main economic activities, village land use, and views of the villagers regarding the proposed power line transmission project.

iii. Consultative meetings: Formal consultation sessions were held with village leaders and villagers in all villages where the proposed power transmission line will be passing. The issues that guided the discussions were as follows:

- Resettlement and environmental concerns resulting from proposed project
- Power transmission line alignment needs and options/alternatives
- Perceived benefits and impacts of the power transmission line project
- Current power line transmission related problems and future concerns
- Community's overall response to the proposed power transmission project
- Other expectations, demands and concerns.

Besides village consultative meetings, consultations were also held with officials at TANESCO headquarters in Dar es Salaam, officials from the Ministry of Natural Resources and Tourism, Ministry of Land and Human Settlements, Ministry of Agriculture, Food Security and Cooperative, Occupational Safety and Health Authority (OSHA), Tanzania Road Agency (TANROADS). Additional consultations were held with relevant district officials.

3. Policy, Legal and Institutional Framework

The proposed construction of the 400 kV power transmission line from Iringa-Dodoma-Singida-Shinyanga may induce changes in other sectors and the livelihoods of the people along the right of way in the villages and the districts that the power line will pass through. Several sector specific policies may be touched by the proposed development and its broader implications. Few of these policies and legislations are discussed below.

3.1 National Policies

3.1.1 National Environment Policy, 1997

The National Environment Policy (NEP) (URT, 1997) is the main policy framework governing environmental management in Tanzania. The NEP underscores national, natural and social issues arising from environmental issues, and promotes key principles of sustainable development. The NEP has also proposed the framework environmental legislation for coordinating, managing and regulating the various environmental activities in different sectors. In addition, the NEP defines strategic plans for environmental management at various levels and provides an approach for mainstreaming environmental issues for decision-making.

The Policy identifies six key environmental management and protection challenges Tanzania is facing:

- Land degradation;
- Lack of access to good quality water;
- Environmental pollution;
- Loss of wildlife habitat and biodiversity;
- Deterioration and aquatic ecosystems; and
- Deforestation.

Some of the identified environmental challenges are relevant and critical because the proposed development may contribute to them directly or cumulatively. The NEP promotes environmental assessment, use of economic instruments, regulatory tools and precautionary principles on managing the environmental problems. This ESIA is responding to the NEP requirements to ensure environmental concerns are mainstreamed in decision-making process at the earliest possible time and mitigation measures are provided.

3.1.2 National Forest Policy, 1998

The overall goal of the National Forest Policy (URT, 1998) is to enhance the contribution of the forest sector to sustainable development of Tanzania and the conservation and management of her natural resources. The main objectives of the Forest Policy includes " sustainable supply of forest products and services by maintaining sufficient forest area under effective management; increased employment and foreign exchange earnings, ecosystem sustainability through forest conservation and enhanced national capacity to manage forest sector" (URT, 1998:14).

A Forest reserve is an area of land covered by forest, reserved or used principally for purposes of sustainable production of timber and other forest produce known as production forest reserve; protection of water sheds, soil conservation and the protection of wild plants, known as protection forest reserve; or an area of land covered by forest reserved used principally to protect nature and scenic areas of

national or international significance and to maintain and enhance bio-diversity and genetic resources in an undisturbed, dynamic and evolutionary state known as a nature forest reserve.

From the definition forest reserves can be divided into production forest reserves, protection forest reserves and nature forest reserves. The identified forest reserves along the Right of Way are used principally for purposes of sustainable production of timber and other forest produce.

The Forest Policy recognizes that investment in forest areas may cause adverse environmental impacts. The policy recommends environmental assessment as mandatory requirement in order to ensure damage to the environment is avoided and possible mitigation measures are provided.

3.1.3 The Mineral Policy of Tanzania, 1997

The Mineral Policy of Tanzania (URT, 1997) provides policy guidance in the development of the mining sector in Tanzania by outlining the main objectives of the policy and the strategies of implementing the objectives. The Policy recognizes that Tanzania has a rich and diverse mineral resources base with high economic potential. However, the country has yet to realize a benefiting contribution from the vast mineral endowment" (URT 1997:1), the Policy enumerates the following challenges that it seeks to address:

- To raise significantly the contribution of the mineral sector in the national economy and increase Gross Domestic Product (GDP);
- To increase the country's foreign exchange earnings;
- To increase government revenues;
- To create gainful and secure employment in the mineral sector and provide alternative source of income to the rural population; and
- To ensure environmental protection and management (URT, 1997: 8).
- Several objectives are stated in the Policy.

The proposed transmission line may have no direct implication on mining activities although will foster the mining sector by securing future power supply. However, there are proposed uranium mining activities around Bahi and Manyoni district, which may be closer to the proposed alignment. Other mining activities that may be affected by this development or otherwise include the mining of construction materials.

3.1.4 National Land Policy, 1997

The main objective of the National Land Policy (URT, 1997) is to address the various and ever-changing land use needs. The Policy aims " to promote and ensure a secure land tenure system, to encourage the optimal use of land resources and to facilitate broad-based social and economic development without endangering the ecological balance of the environment (ibid: 5). Specific objectives are outlined in the Land Policy; however, the following are directly related to the proposed development.

- Ensure that existing rights in land especially customary rights of small holders (i.e. peasants and herdsmen who are the majority of the population in the country) are recognized, clarified, and secured in law;
- Set ceilings on land ownership which will later be translated into statutory ceilings to prevent or avoid the phenomenon of land concentration (i.e. land being held by few individuals);

- Ensure that land is put to its most productive use to promote rapid social and economic development of the country;
- Protect land resources from degradation for sustainable development

The proposed development may lead to the following:

- More land being taken up for the right of way by TANESCO to build the towers and the transmission line.
- More people along the right of way will loose land for farming, grazing, settlement and cultural functions (e.g. burials or sacrificial functions).

Consequently, there will be competition for prime land as more people are displaced from their existing lands to give way for the development. This will compound land tenure and land use matters in the villages along the right of way and increase cost of land in the same areas. This ESIA addressed the implication of the changes on the land use and tenure with respect to the proposed development. Issues such as resettlement and displacement of the local communities, impact on their livelihoods and future land uses have been addressed within the context of the proposed power transmission project.

3.1.5 Water Policy, 2002

The main objective of the National Water Policy of 2002 is to develop a comprehensive framework for sustainable development and management of the Nation's water resources and putting in place an effective legal and institutional framework for its implementation (URT, 2002). The policy aims at ensuring that beneficiaries participate fully in all stages of water resource developments.

The Policy recognizes the fundamental but intricate linkages between water and socio-economic development, including environmental requirements. The Policy expounds on the importance of water for domestic use, agriculture, livestock keeping, mining, energy, fisheries, environment, human health, wildlife and tourism, forestry, navigation and trans-boundary requirements.

In view of this, the Policy calls for an Integrated Water Resource Management in Tanzania so that „there is equitable and sustainable use and management of water resources for socio-economic development, and for maintenance of the environment" (URT, 2002). Several policy measures proposed to ensure sustainable utilization of the water resources. Some of these measures include economic and legal instruments. The proposed development will require a lot of water for lodges, industrial and domestic use.

Water supply is a critical problem in village along the right of way and some of the well, shallow wells, boreholes, dams and water tanks are located within or too close to proposed alignment. This ESIA addressed water supply and availability issues and proposed changes where water sources or distribution points are in danger of being negatively affected by the proposed development.

3.1.6 National Energy Policy, 2003

The National Energy Policy of Tanzania (URT, 2003) takes into account the structural changes in the economy and political system at national and international levels. The economic liberalization has had major implications on energy development and consumption. Increased private investment in mining, tourism, manufacturing, finance and communication has increased demand for reliable and cost effective energy. Human population and urbanization have also increased pressure on energy.

The main objective of the Energy Policy is to improve the welfare and living standards of Tanzanians. The Policy aims to provide input in the development process of the country by establishing a reliable and efficient energy production, procurement, transportation, distribution and end-use system in an environmentally sound manner and with due regard to gender issues.

The strategic focus of the Policy in meeting the main objective is to undertake the following activities:

- Develop domestic energy resources, which are least cost options.
- Promote economic energy pricing.
- Improve energy reliability and securing and enhance energy efficiency
- Encourage commercialisation and private sector participation
- Reduce forest depletion
- Develop human capacity.

Even with the Energy Policy in place since 2003, Tanzania is still facing major problems regarding energy. Only about 10% of the 35 million people in Tanzania are connected to the national grid, and in rural areas, this is about 1% of the population. Over 90% of the energy consumed is from fuel wood and charcoal, thus putting more pressure on forest resources. Power cuts in urban areas are also so frequent even when there has been sufficient rain to fill the dams. Power transmission lines and inadequate capacities are associated with these problems. The proposed construction of the power transmission line is intended to add 400 kV on the National Grid to alleviate the problem of inadequate powers supply.

3.1.7 The Wildlife and Wetland Policy of Tanzania, 2007

The Wildlife Policy of Tanzania promotes the conservation of wildlife as natural resources of great biological, economical, environmental cleaning, water and soil conservation, and nutritional values (URT, 2007). The long-term goal of the policy is to maintain great biological diversity, which contributes to healthy environment an increased contribution to the national economy. The policy recognizes the implication of human and development activities on wildlife resources inside and outside protected areas, and calls for environmental assessments for proposed development in order to minimize negative impacts.

Wetlands in Tanzania cover 10% of the total land area, of which 5.5% are presently under international protection status as designated Ramsar sites. The Wetland policy promotes conservation and management of wetlands as important natural resources of great biological value playing also an important role in poverty alleviation, water and soil conservation and for nutrition of people.

3.1.8 National Human Settlements Development Policy, 2000

The overall objective of the National Human Settlements Development Policy (NHSDP) is to promote the development of sustainable human settlement and to facilitate the provision of adequate and affordable shelter to all people, including the poor. The policy outlines a number of objectives including environmental protection within human settlements and protection of natural ecosystems against pollution, degradation and destruction.

The NHSDP recognizes planning and management of human settlement areas as one of the broad human settlement issues. Within this regard, the NHSDP identifies environmental protection as one of the strategic issues in human settlement planning and development. NHSDP also addresses the fol-

lowing issues:

- lack of solid and liquid waste management, leading to environmental deterioration;
- Emission of noxious gases from vehicles and industrial activities as a major cause of air pollution in urban areas;
- Encroachment into fragile and hazardous lands (river valleys, steep slopes and marshlands) leading to land degradation, pollution of water sources, etc;
- increasing dependence on firewood and charcoal as a main source of energy in human settlements leading to depletion of forest, environmental deterioration and air pollution; and
- Un-authorized sand mining in river valleys leading to environmental degradation.

3.1.9 Tanzania Development Vision, 2000

Composite Development Goal for the Tanzania Development Vision 2025 (URT, 2000) foresees the alleviation of poverty through improved socio-economic opportunities, good governance, transparency and improved public sector performance. These objectives, not only deal with economic issues, but also include social challenges such as education, health, the environment and increasing involvement of the people in working for their own development. The thrust of these objectives is to attain a sustainable development of the people.

The Vision 2025 seeks to mobilize the people, the private sector and public resources towards achieving shared goals and achieve sustainable semi-industrialized middle market economy by year 2025. The construction of the of 400 kV power line from Iringa to Shinyanga is aimed at increasing power supply to enable development to take place. Power in needed for industrial development and improvement of livelihoods.

3.1.10 National Strategy for Growth and Reduction of Poverty

The National Strategy for Growth and Reduction of Poverty (NSGRP) or *Mkakati wa Kukuza Uchumi na Kuondoa Umasikini* Tanzania (MKUKUTA) is focusing on promoting economic growth and reducing poverty in Tanzania. The NSGRP is a five years programme from 20005/06 to 2009/10, which addresses the Tanzania Development Vision 2025 for high and shared growth, high quality livelihoods, peace, stability and unity, good governance, high quality education and international competitiveness. In addition, NSGRP is contributing to implementation of the Millennium Development Goals (MGDs).

The main objective of the NSGRP is to stimulate economic growth and reduce poverty, improve quality of life and social well-being and improve good governance and accountability. The strategy recognizes the close linkages between economic growth, good governance, and improved quality of life and social well-being, and poverty reduction. The strategy has three main clusters that include (i) Growth and Reduction of income Poverty (ii) Improvement of Quality of Life and Social well-being and (iii) Governance and Accountability. Among the various factors that have been identified to stimulate growth is the improvement of energy generation in order to stimulate economic growth.

3.1.11 Agriculture and Livestock Policy, 1997

The Agriculture and Livestock Policy of 1997 addresses changes that affect the agricultural sector in Tanzania and specifically address restrictions to agricultural practices stemming from the national land use Policy of 1995. The Agriculture and Livestock policy, 1997 also addresses the needs of women in

agriculture and the needs for agricultural practices to evolve to ensure protection of the environment. The Policy promotes good husbandry and increased agriculture production. Some of the areas in the proposed right of way are utilized for crop production and changes in land use may reduce crop production and possibly impact on food security. This ESIA addresses the issue of land use changes and its implication on agriculture, especially where TANAESCO will acquire more land that is also used in agricultural production for annual crops.

In principle, the land TANESCO puts under the wayleave for power transmission becomes wholly owned and managed by TANESCO exclusively for energy uses. No farming, settlement or any other use is permitted on such land. However, in practice cultivation of seasonal crops below the power line is common and TANESCO has not taken a firm stand against such practice. Therefore, the net effect of power lines in agricultural production can be assumed to be minimal if farming will be left to continue under the lines.

3.2 World Bank Safeguard Policies

Several international financial institutions are taking proactive measures to ensure that the credit they give to countries or private sectors is not negatively impacting the environment. The World Bank Group is guided by a comprehensive set of policies and procedures, dealing with the Bank's main development objectives and goals.

The proposed development will trigger the following World Bank Operational Policies:

- Environmental Assessment (OP 4.01, BP 4.01, GP 4.01)
- Natural Habitats (OP 4.04, BP 4.04, GP 4.04)
- Physical Cultural Heritage (OP/BP 4.11)
- Forest (OP 4.36, GP 4.36)

World Bank OP/BP 4.01 *Environmental Assessment*: The policy helps to ensure the environmental and social soundness and sustainability of investment projects. It also supports integration of environmental and social aspects of projects into the decision-making process. The policy promotes environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions. The proposed development belongs to the category of projects that require mandatory EIA as it may have implications on natural habitats and forest areas.

World Bank OP/BP 4.04 *Natural Habitat*s: All natural habitats have important biological, social, economic, and existence value. Important natural habitats may occur in tropical humid, dry, and cloud forests; temperate and boreal forests; Mediterranean-type shrub lands; natural arid and semi-arid lands; mangrove swamps, and other wetlands; estuaries; sea grass beds; coral reefs; freshwater lakes and rivers; alpine and sub alpine environments, including herb fields and grasslands. The Bank does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs.

World Bank OP/BP 4.11 *Physical Cultural Heritage:* The policy aims to ensure that projects contribute to the preservation of cultural property and seeks to avoid their elimination. If projects cannot avoid affecting cultural property negatively the policy requires mitigation activities to be undertaken to limit adverse impacts to the maximum extent possible

World Bank OP/BP 4.36 *Forest*; The management, conservation, and sustainable development of forest ecosystems and their associated resources are essential for lasting poverty reduction and sustainable development, whether located in countries with abundant forests or in those with depleted or naturally limited forest resources. The objective of this policy is to assist borrowers to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests.

The World Bank has adopted principles of Environmental Assessment (EA) to examine the environmental and social risks and benefits associated with Bank lending operations. The present ESIA is part of the compliance process as detailed in operational Policy 4.01. The construction of the 400 kV power lines and associated substation facilities classified as Category A projects that call for ESIA. An Environmental and Social Management Plan is provided as part of this ESIA Report.

Beside the Bank's OP 4.01, the proposed project may trigger OP 4.12 on Resettlement Policy. The main focus of this operational guideline is to seek to avoid project affected people experiencing negative effects associated with the project such as loss of security, loss of land or assets on land, or being put into a detrimental life situation due to a Bank supported development project. Involuntary resettlement may cause severe long-term hardship, impoverishment, and environmental damage unless appropriate measures are carefully planned and carried out. For these reasons, the overall objectives of the Bank's policy on involuntary resettlement are the following:

- Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs;
- Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs;
- Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

As far as the proposed 400 kV transmission lines are concerned, some 800 - 900 houses and social infrastructures will still be affected after realignment and consideration of several rerouting alternatives. However, no major resettlement issues are envisaged as "sufficient" alternative land can be obtained within the respective villages to allow Project Affected Persons and institutions to rebuild the facilities or obtain land for farming and continue with their livelihood activities. The details related to this aspect will be provided in the Resettlement Action Plan.

3.3 Legal Framework

This section addresses the legal and regulatory framework, which is relevant to the proposed development of the 400 kV power transmission line from Iringa- Dodoma-Singida -Shinyanga. The legal and regulatory framework provides the various legal aspects that must be adhered to as the project in designed, implemented and later when it is decommissioned.

3.3.1 Environmental Management Act No. 20 - Cap 191, 2004

Environmental Management Act (EMA) Cap.191 (URT, 2004) provides a range of measures for sustainable management of the environment, prevention and control of pollution, waste management, and directs mechanisms for compliance.

Section 7 (2) states that " the Act provides a legal framework necessary for coordinating harmonious and conflicting activities with a view to integrating such activities into an overall sustainable environmental management system by providing key technical support to sector Ministries"

The Act is therefore a cross-sectoral law that takes precedence above all other laws except the Constitution with respect to environmental management. Consequently, Section 232 stipulates that:

> *"Where the provision of this Act is in conflict or is otherwise inconsistent with a provision of any other written law relating to environmental management the provision of this Act shall prevail to the extent of such inconsistency"*

Matters pertaining to environment management are governed by sectoral legislation however; the latter shall not be in conflict with EMA (2004).

The Act emphasizes and echo the Constitution of Tanzania by stressing on the need for Tanzanians to leave in a clean, safe and health environment and to access various areas for recreational, educational, health, spiritual, cultural and economic purposes (Article 4 (1) and (2).

Part VI of the Act directs developers to undertake Environmental Impact Assessment (EIA) at their own cost prior to commencement of a project. The types of projects requiring EIA are listed in the Third Schedule of the Act. The EMA prohibits any development to be initiated without an Environmental Impact Assessment (EIA) Certificate from the Minister responsible for Environment.

The responsibilities to ensure the requirement of the Act with regard to Environmental Impact Assessment are vested with the National Environment Management Council (NEMC). An Environmental Impact Assessment report is submitted to NEMC who will carry out its review and provide recommendations to the Minister responsible for Environment to issue a Certificate. If a report does not qualify for approval, it is not submitted to the Minister until when NEMC is satisfied with it. The NEMC is also required to make a site visit during the review process for inspection and verification at the proponent's cost.

3.3.2 Environmental Impact Assessment and Audit Regulations, 2005

The Environmental Impact Assessment and Audit Regulations No.349 of 2005 were made pursuant to Section 82 (1) and 230 (h) and (q) of the Environmental Management Act Cap 191 of 2004. In addition, the regulations provide the procedures and requirements for undertaking Environmental Impact

Assessments and Environmental Audits for various types of development projects with significant environmental impacts. The Regulations provides a list of projects that qualify for Environmental Assessment and Audit procedures in Tanzania. Regulation 46(1) classifies projects into two types: (i) Type A Projects requiring a mandatory Environmental Impact Assessment; and. (ii) Type B projects requiring a Preliminary Environmental Assessment (PEA)

The Fist Schedule lists typical examples of Type A and B projects. The proposed development of a 400 kV power transmission line falls under the category of projects that require mandatory Environmental Assessment. Item Seven (i) of the First Schedule refers to energy projects and specifically to production and distribution of electricity, gas, steam and geo thermal energy as projects that require mandatory EIA. The steps that must be taken to conduct an EIA are provided in the Fourth Schedule whilst Regulation 16 directs that the EIA study in addition to environmental impacts, also must address social, cultural and economic impacts. Regulation 17 stipulates the need for public participation during the EIA process and Part V, Regulations 18 (1), (2) and (3) directs the content and format of the Environmental Impact Statement. This EIA report responds to the legal requirement as provided in these Regulations.

3.3.3 Forest Act, 2002

The Forest Act (No. 14), 2002, provides for the management of forests in order to enhance the contribution of the forest sector to the development of Tanzania and the conservation and management of natural resources. In addition, the legislation fosters ecosystem stability through conservation of the forest biodiversity, water catchments and soil fertility.

Section 18, of the Act is relevant to the proposed development as it requires developers to prepare and submit to Director of Forestry, an Environmental Impact Assessment report. The law states that: " any proposed development in a forest reserve, private forest or sensitive forest area including watersheds, whether that development is proposed by, or is to be implemented by a person or organization in the public or private sector, the developer of the development shall prepare and submit to the Director an Environmental Impact Assessment of the proposed development. Section 70 of the Act prohibits any person from burning any vegetation on any land outside the cartilage of his own house or compound without permission.

In addition, Section 49 of the Act outlines various permits that are required when certain activities are undertaken. These activities include:

- For activities carried out in national and local authority forest reserves
- Felling or extraction of timber (for domestic use; export; mining purposes, or for prospecting and for exploitation of mineral resources)
- Gathering and picking parts or extracts of any protected plant for the purposes of research or the production manufacture of any medicine or product.
- Erection of buildings or other structures.
- Construction of roads, bridges, paths, waterways or runways;
- Sow, plant or cultivate trees, crops or other vegetative matter;
- Enter to hunt or fish.

Relevant provisions of this Act have been addressed during the Environmental and Social Impact Assessment for the proposed construction of power transmission line. TANESCO must obtain the relevant permits from the Director of Forest and Beekeeping before undertaking any activities in the forest reserve found along the wayleave.

3.3.4 Wildlife Conservation Act, 1974

The Wildlife Conservation Act No. 12 of 1974 (URT, 1974) provides for the protection, conservation, development, regulation, control of fauna and fauna products and for matters incidental thereto, and connected therewith. The Act restricts entry into a protected area without proper permission, restricts carrying of fire arms; bow and arrow; prohibits wilfully or negligently cause of bush fire, felling of trees, hunting, digging, laying, or constructing any pitfall, net, trap, snare or other device whatsoever, capable of killing, capturing or wounding any animal. The stretch along the right of way from Iringa - Dodoma - Singida - Shinyanga does affect wildlife-protected areas or any concentration of wildlife in a single area.

3.3.5 Land Act, 1999

The Land Act, 1999 (No.4 of 1999): provides basic legal requirements in relation to land other than village land, the management of land, settlement of disputes and related matters.

Tanzanian land falls under three categories, namely;

- **Reserved Land** is land set aside for wildlife, forests, marine parks, etc., and the ways these areas are managed is explained in the laws that protect each sector (e.g. Wildlife Conservation Act, National Parks Ordinance, Marine Parks and Reserves Act, etc.). Specific legal regimes govern these lands under the laws used to establish them.
- **Village Land** includes all land inside the boundaries of registered villages, where the Village Councils and Village Assemblies are given power to manage. The Village Land Act gives the details of how this is to be done. The Village Land Act is governing this land.
- **General Land** is land, which is neither reserved land nor village land and is therefore managed by the Commissioner. The Land Act is governing this land

The Land Act of 1999 provides for the basic law in relation to land other than the village or reserved lands, the management of land, settlement of disputes and related matters. Since some of the areas where the right of way may pass fall under public lands, this Act is relevant to the proposed development. The Act lays down fundamental principles for occupying and using the land. Among them, is the principle that any land user shall ensure that land is used productively and that any such use complies with the principles of sustainable development.

The Land Act confirms National Land Policy directive that that all land in Tanzania is public land vested in the President as trustee on behalf of all citizens. The Land Act seeks to achieve the following objectives:

- to ensure that existing rights in and recognized longstanding occupation or use of land are clarified and secured by the law;
- to facilitate an equitable distribution of and access to land by all citizens;
- to regulate the amount of land that any one person or corporate body may occupy or use;
- to ensure that land is used productively and that any such use complies with the principles of sustainable development;
- to take into account that land has value and that value is taken into consideration in any transaction affecting that land.
- to pay full, fair and prompt compensation to any person or institution whose right of occupancy or recognized long-standing occupation or customary use of land is revoked or otherwise interfered with to their detriment by the state under this Act or is acquired under the Land Acquisition Act; and

- provided that in assessing compensation for land acquired in the manner provided for in this Act, the compensation shall be based on the following:
  - Market value of the real property;
  - Disturbance allowance;
  - Transport allowance;
  - Loss of profits or accommodation;
  - Any other cost, loss or capital expenditure incurred with respect to the development of the subject land;
  - Interest at market rate; and
  - Provision of an efficient, effective, economical and transparent system of land administration.

In addition, and in relation to the proposed power transmission line, the Land Act (Section 151) states that the Minister " may create rights of way which shall be known as public rights of way " to serve for the that purpose for the proposed development. In addition, it defines that a "wayleave" may be any public right of way created for the benefit of the Government, a local authority, a public authority, or any corporate body to enable all such organizations, authorities and bodies to carry out their functions within the designated area.

Furthermore, the Act states that:

- "a public right of way shall attach to and run with the servient land in respect of which it has been created and shall be binding on all occupiers from time to time of the servient land, any manner they are occupying the land, whether under a right of occupancy or a derivative right thereof, or under customary law or as a successor in title to any such occupier or as a trespasser" ;
- "a wayleave shall authorize persons in the employment of or who are acting as agents of or contractors for any of the organizations, authorities and bodies enter on the servient land for the purpose of executing works, building and maintaining installations and structures and insetting all such works, installations and structures in the servient land and to pass along that wayleave in connection with purposes of those organization, authorities or bodies."

Regarding the application for a wayleave as the proposed power transmission line, the Land Act establishes that:

- except where the Commissioner is proposing of his own motion to create a way level, an application from any ministry or department of Government, or local authority or public authority or corporate body shall be made to the Commissioner;
- an application shall be made on the prescribed form and shall be accompanied by any information which may be prescribed or which the Commissioner may in writing require the applicant to supply and the Commissioner shall not begin the process of creating a wayleave until all information which may be prescribed or required is submitted to him;
- the applicant shall serve a notice on:
  - All persons occupying land under a right of occupancy over which the proposed wayleave is to be created, including persons occupying land in accordance with customary pastoral rights;
  - All local government authorities in whose area of jurisdiction the proposed wayleave to be created is located;
  - All persons in actual occupation of land in an urban and peri-urban area over which the proposed wayleave is to be created;
  - Any other interested person.
- The Commissioner shall give publicity to the application along the route of the proposed wayleave clearly and in a comprehensible manner, and inform all persons using the land over which the proposed wayleave is like to be created.

Section 156 that applies to non-governmental corporate bodies, institutions or groups of persons, requires compensation to be paid to any person for the use of land of which he/she is in lawful or actual occupation. These include:

- any damage suffered in respect of trees, crops, and buildings as result of the creation of a wayleave;
- Damage due to surveying or determining the route of that wayleave and
- Acquisition of land for the purpose of a wayleave

The body or organization that applies for the Wayleave must pay compensation to affected persons according to national and international standards. The proposed development will entail compensation, which may call for Tanzania and World Bank guidelines to be applied.

3.3.6 Village Land Act No. 5, 1999

The Village Land Act No. 5 of 1999 (URT, 1999) governs village land and all matters related to land tenure under the Village Councils. Most of the land that will be involved in the power transmission line may be on village land, except for new areas where the wayleave may be in forest reserves or social infrastructures belonging to specific institutions. Section 8 (1), (2) and (3) of the Village Land Act empowers the Village Council to manage all village lands in accordance with the principles of a trustee with the villagers being the beneficiaries. In exercising these functions, the Village Council is required to have regard to the following principles:

- sustainable development and the relationship between land use, other natural resources and the environment in and contiguous to the village and village land;
- the need to consult with and take account of or comply with the decisions or orders of any public officer or public authority with jurisdiction over any matter in the area where the village is; and
- the need to consult with and take account of the views of other local authorities with jurisdiction over the village.

Although the Village Land Act recognizes the role of the Village Councils in management of village land, most of the land in the villages is under individuals through the customary land rights. The right of the individuals to the land must be recognized and respected and development should not take more than the land it needs for that particular development.

3.3.7 Land Regulation, 2001

Among several aspects, the Land Regulations provides guidance on the issue of compensation, which is relevant in the proposed development. According to Section 10 (1) of the Land (Compensation Claims) Regulation 2001, compensation shall take the form of:

- Monetary compensation;
- Plot of land of comparable quality, extent and productive potential to the land lost;
- A building or buildings of comparable quality, extent and use comparable to the building or buildings lost;
- Plants and seedlings;
- Regular supplies of grain and other basic foodstuffs for a specified time.

The Regulation (Assessment of Value for Compensation) states "...the basis for assessment of the value of any land shall be the market value of such land" . The market value is arrived at by the use of the comparative method substantiated by actual recent sales of similar properties, or by use of income approach or replacement cost method, in case the property is of special nature and not saleable.

The assessment of the value of land and any improvements will be done by a Qualified Valuer and verified by the Chief Valuer of the Government or his/her representative.

In addition, the Regulation defines affected persons that are eligible for compensation/resettlement if some of their properties are affected by a proposed development:

- Holder of right of occupancy;
- Holder of customary right of occupancy whose land has been declared a hazard land;
- Holder of customary and who is moved or relocated because his/her land becomes granted to other person;
- Holder of land obtained as a consequence of disposition by a holder of granted or customary right of occupancy but which s refused a right of occupancy;
- Urban or peri-urban land acquired by the President.

If the person does not agree with the amount or method of payment or is dissatisfied with the time taken to pay compensation, he/she may apply to the High Court for redress. If proved justifiable, the High Court shall determine the amount and method of payment, determine any additional costs for inconveniences incurred, and order the plaintiff to be paid accordingly.

3.3.8 Land Disputes Courts Act No. 2, 2002

Every dispute or complaint concerning land shall be instituted in the Court having jurisdiction to determine land dispute in the given area (Section 3).

The Courts of jurisdiction include-

(i) The Village Land Council
(ii) The Ward Tribunal
(iii) District Land and Housing Tribunal
(iv) The High Court (Land Division)
(v) The Court of Appeal of Tanzania.

The Act gives the Village Land Councils powers to resolve land disputes involving village lands (Section 7). If the Council fails to resolve the dispute, the matter may be referred to the Ward Tribunal as established by the Land Act (1999) and the Village Land Act. If any dispute will arise because of this project, the provision of this Act shall be observed.

Land use conflicts are normally occurring in many villages along the proposed alignment. For example, conflicts between farmers and livestock keepers, villagers and managers of public social facilities (schools or heath facilities over boundaries) and also there is an impending and latent conflict between TANESCO and the local communities in areas where villages have encroached under the power lines and built houses, established farms or water wells. Land under the power lines is under the custodian of the power utility and any land use other than what is designated is illegal. Local people are complaining about the taking of land by public utilities such as TANESCO therefore, taking of land from villagers must be handled carefully to avoid exacerbating land use conflicts elsewhere or within the

same villages.

3.3.9 Local Government Act No. 9, 1982

The Local Government Act of 1982 is an important legal framework for Village Councils and local government set up, which were reintroduced in the early 1980s. The Act establishes and regulates District Councils, township authorities and village authorities. An important provision is the sub division of districts into divisions and wards and the establishment of Ward Development Committees along with procedures for implementation of schemes and programmes at ward level. Councillors lead the wards and form the main component of the District management team. Ward authorities and Ward Development Committee are empowered to participate in matters related to compensation, taking land from villagers and their decision is often considered with the seriousness it deserves.

Part V of the Act describes the functions of local government authorities. However; relevant provisions in the context of resettlement are Section 111 and 114. Section 111 (b) states that the local government authorities shall" promote the social welfare and economic well-being of all persons within its area of jurisdiction". In addition, subsection (c) obliges the local authorities to promote social and economic development in their areas of jurisdiction. The Act grants local government authorities a role in resettlement processes to ensure that, the affected people's social welfare is taken into account when resettlement and compensation matters are involved. Most of the areas where the power line will pass fall under local government jurisdictions.

3.3.10 Occupational Health and Safety Act, 2003

This Act makes provisions for the safety, health and welfare of persons at work in factories and all other places of work. In addition, it provides for the protection of persons other than those at work against hazards to health and safety arising out of or in connection with activities of persons at work. Relevant sections of the Act are Part IV Section 43 (1) - Safe means of access and safe working place; Prevention of fire; and Part V on health and welfare provisions, which includes provision of supply of clean and safe to workers, sanitary convenience, washing facilities and first aid facility.

Section 15 gives powers to the Registrar of factories and workplace to enter any factory or workplace to perform his duties as provided by the Act. Section 16 requires that factories and workplace should register with Registrar of factories and workplaces before commencing operations.

Part VI is dealing with special safety provisions for working places involving handling hazardous chemicals, hazardous processes or hazardous equipment. This Act is relevant for the proposed development of the power transmission line and the construction of the substations. Safety issues are likely to be important in the project during construction and operation since the project involves handling high voltage electricity cables, construction of towers, use of machines and instruments that may affect workers or other people. The need to ensure that all workers and workstations adhere to the laws is imperative. Personal protective gear during all times the worker is at the site must be enforced to the maximum, and people who are not relevant to the site are prohibited.

3.3.11 Legal Provisions on Waste Management Issues

Tanzania is in the final stages in preparing guidelines for waste management however, the Part IX of the Environmental Management Act Cap 191 directs on the management of solid waste. Section 114 provides duties of the local government authorities to manage and minimize solid waste and Sections 133- 139 refers to management of hazardous waste.

Similarly and in tandem with the Environmental Management Act No. 20 (Cap 191), more legislation governing waste management in Tanzania are found in the Local Government (District) Authorities Act No.7 of 1982. The Act provides for the protection and management of the environment. Section 111 of the Act promotes social welfare and economic well being of all residents within their areas of jurisdiction.

Section 118 deals with protection and management of the environment. The District councils are required to take necessary measures to control soil erosion and desertification; to regulate the use of poisonous and noxious plants, drugs or poisons, regulate and control the number of livestock; maintain forests, manage wildlife, ensure public health, and provide effective solid and liquid waste management.

In connection with the construction of the Iringa - Dodoma - Singida and Shinyanga 400 kV power line, TANESCO will be required to obtain permission from the District councils for the disposal of waste, and take care of the solid waste that can be hazardous - e.g. sharp metal pieces, nails and wires. These should be taken back to TANESCO for proper disposal or recycling.

3.3.12 Legal Provisions on Pollution

Several environmental standards are relevant to the proposed development. The legal provisions for these standards is provided in Part X of the Environmental Management Act No. 20 Cap 191, which provides directives on environmental standards and compels the National Environmental Standards Committee of the Tanzania Bureau of Standards to develop, review and submit to the Minister (responsible for Environment) for approval standards and criteria covering:

- water quality,
- discharge of effluent into water,
- air quality,
- control of noise and vibration pollution,
- sub sonic vibrations,
- soil quality,
- control of noxious smells,
- light pollution, electromagnetic waves and microwaves, and
- any other environmental quality standards.

Standards such as for discharge of effluent into water control of noise and vibrations and soil quality are relevant to the proposed development. The Government has issued some of these standards. For example, the Regulations for Soil Quality Standards are made under Section 144, 145 and 230 (s) of the Environmental Management Act Cap 191 and set out minimum standards for soil quality and identifies contaminants of heavy and other metals including liquids such as oils.

The Regulations for Soil Quality compels all developers to ensure they do not emit any substances that may contaminate the soils beyond levels that are provided in the laws. Possible areas of soil pol-

lution from the project activities include vehicle and equipment maintenance yards (from oil spills), metals from construction sites and at the substations where oil spills and metals could contaminate the soil.

The Regulations for Water Quality Standards are made under Section 143, 144 and 230 (2) (s) of the Environmental Management Act Cap.191 to provide for minimum standards of water quality and sets mechanism for the protection of water sources and ground water. The Regulations further prohibits to discharge hazardous substances, chemicals and materials or oil into water bodies and outlines procedures that have to be followed in sampling an assessing the quality if water for different purposes ad allowable emission form different sources. The proposed development and TANESCO in particular must adhere to emission standards especially during construction and operation by avoiding contaminating sources of water found on the right of away. Several wells and pipes have been identified and in some areas, alternatives locations for the power lines have been proposed as mitigation options.

In addition to provisions in the Environmental Management Act Cap 191 and subsequent Regulations, the Local Government Act of 1982 also empowers the local governments to enact by-laws to protect public health and regulate pollution problems. Other relevant legislation with regard to soil includes the National Land Use Planning Act of 1984, the Town and Country Planning Ordinance of 1961, the Mining Act of 1998 and the Water Utilization (Control and Regulation) Act No.10 of 1981. TANESCO will be compelled to comply with all legal provisions governing environmental issues with respect to this work.

3.3.13 Land Use and Spatial Planning

Important pieces of legislation, which address land use planning, and management are contained in the following laws:

- The Town and Country Planning Ordinance of 1961, which regulates the use of land in urban areas, beaches and lakeshores. It was established to facilitate land use planning schemes. According to the Ordinance, development is not allowed without obtaining a planning consent. it also provides a specific land-use class for ecologically sensitive areas;
- The National Land Use Planning Commission Act of 1984, which covers preparation of regional physical land use plans and formulation of land use policies for implementation by the Government. It specifies standards, norms and criteria for the protection of beneficial uses and maintenance of the quality of land. The Act does not cover urban centres, beaches and lake shores;
- Te Local Government Act of 1982 enables local authorities to enact by-laws regarding soil protection, agriculture, natural resource exploitation, etc.

These provisions are relevant to the proposed development especially in urban areas of Iringa, Dodoma, Singida and Shinyanga where power lines and substations will be built. For instance in Bahi, the district council has prepared an initial Town Master Plan for District Headquarters and some key infrastructures have already started to be built. TANESCO must take into account District Plans in order to avoid damages and conflicts with the proposed town planning. However, in some urban areas, physical structures such as schools, play grounds, hospitals/health facilities and offices might be affected by the proposed development. TANESCO and this ESIA have taken into account these issues and provided mitigation options (i.e., alternatives) to address such problems.

3.3.14 Land Acquisition Act, 1967

The Land Acquisition Act (Act No. 47 of 1967), repealed and replaced the Land Acquisition Ordinance, to provide for compulsory acquisition of land for public purposes and in connection with housing schemes. The Act is however relevant also in cases that are not related to housing schemes. For example, Part II of the Act refers to issues related to compensation and procedures that have to be followed when land is acquired. These procedures are also outlined in the Regulation for the Land Act and include issues of fair and prompt compensation to affected persons. The proposed development will acquire land from the villagers for the purpose of development.

The provisions of this Act and subsequent land laws must be adhere especially with regard to fair and prompt compensation. Complaints from the Village and District leaders on delays in compensations have been raised. Local leaders are concerned that delays to pay compensations and complaints from affected persons usually affect the relationship between local leaders and the affected persons. In addition delays in paying compensation result in new developments emerging in the proposed wayleave thus, causing further conflicts between developers and local people. TANESCO must therefore ensure compliance with the laws in order to reduce conflicts between local people and the local authorities.

3.4 International Agreements and Conventions

Tanzania has signed and ratified several international agreements and conventions relating to the environment. Agreements relevant to the proposed development are briefly mentioned below.

- The Convention on Biological Diversity (CBD) has been ratified. A major objective of the Convention is to ensure the conservation of biological diversity and the sustainable use of its components.
- Tanzania has signed, but not ratified, the Convention on the Conservation of Migratory Species of Wild Animals (CMS). The objective of the Convention is to conserve those species of wild animals that migrate across national boundaries.
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has been ratified by Tanzania. It seeks to ensure that the international trade in species of wild fauna and flora does not threaten survival in the wild of the species concerned.
- Tanzania has ratified the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention).

Some areas of the wayleave will possess characteristics and features relevant to these conventions or agreements. For example, the line will run through or near to wetlands suggested for the protection status as Ramsar site. Also some forest reserves will present a biodiversity of high conservation value.

The project has to comply with the international conventions and agreements that Tanzania has signed or ratified and ensure the conservation of the environment as per the agreements of conventions. While most of the issues will be limited to the right of way, clearing of vegetation and construction of towers and power lines may have implications on the movement of animals and birds and may change the habitat for those species.

3.5 Institutional Framework

The Environmental Management Act Cap 191 provides an institutional set-up for environmental management with details of responsibilities at national and village (including mtaa level, which is the lowest administrative level). The institutional set up involves the following main decision making points:

- National Environment Advisory Committee;
- Minister Responsible for Environment;
- Director of Environment (DOE);
- National Environmental Management council (NEMC);
- Sector Ministries;
- Regional Secretariats; and
- Local Government Authorities [City, Municipality, District, and Town Councils; Township; Hamlet (Kitongoji); Ward; Street (Mtaa); and Village].

The Vice President's Office (VPO) is the main regulatory organ and responsible for coordinating environmental management in Tanzania. Within the VPO, Division of Environment and National Environmental Management Council However are responsible for policy development and enforcement respectively. Similarly, other sector ministries and agencies are equally involved in implementing environmental policy objectives. The Environmental Management Act Cap 191 outlines in environmental management processes in Tanzania.

The proposed development will touch several institutions and organizations. This ESIA consulted most of them and have integrated their views and concerns in the report. Beside the office of the Vice President (DOE and NEMC), other sectors that are involved include Ministry of Energy and Minerals, Ministry of Natural Resources and Tourism, Ministry of Land and Human Settlement, and Ministry of Water. Others are the Prime Minister's Office for Regional Administration and Local Government - particularly the regions and districts along the right of way from Iringa to Shinyanga. In addition, the Ministry of Infrastructure Development, the Ministry of Education and Vocational Training and the Ministry of Health are the institutions that will be affected by the proposed development and have been involved. The various legal aspects relevant to this ESIA are provided above to indicate the institutional boundaries within which the project will be confined.

4. Baseline Information

4.1 Human Environment

4.1.1 Socio-economic Characteristics

This section describes the socioeconomic baselines of all the districts affected by the project's Right of Way (RoW). The project covers five regions, namely Iringa, Dodoma, Singida, Tabora and Shinyanga and several districts and villages.

Generally, all villagers that will be affected by the project have most of the basic social services as described in each District socioeconomic profiles. The services include schools (primary and secondary), water, health and communications (roads and telephone) .However most of these services are either of poor quality or not sufficient. In newly established Districts such as those Kishapu, Bahi and Chamwino, most of the major social services such as a district hospital are unavailable. This is also the case in newly established villages such as Mitoo-Juu in Manyoni District and Isalanda in Singida Rural where basic social services such as health and primary schools are still unavailable. Annex 3.5 provides information on available social service infrastructures in all villages likely to be affected by the project. It has however been noted that the proposed project might affect some of the existing social and cultural infrastructures. This ESIA proposes some alternatives that will minimize impacts of the projects to social infrastructure and services.

Most of the local communities along the proposed ROW are small-scale farmers, making agriculture and livestock keeping their main economic activities. Other affected population especially those in urban areas are engaged in activities such as employment, business and fishing. Most farmers practice subsistence farming with very low annual output. There is very little use of agricultural fertilizers and mechanized agricultural. Seasonal crops including sunflower and cotton are grown for cash while food crops include maize, groundnuts and millet. Few villagers in Chamwino and Mpwapwa districts of Dodoma Region cultivate grapes as a cash crop. The proposed project is likely to impact land used by local communities for agricultural activities; in some villages such as Kisima in Mpwapwa District part of the most fertile piece of land is likely to be affected by the project. Details of the socio-economic baseline conditions in each district are provided below.

4.1.2 Iringa Region

4.1.2.1 Iringa Municipality

Iringa Municipality is one of the districts in Iringa Region found in the southern highlands of the country. The total area of the district is 162 km^2.

Population
According to projections based on the 2002 population and household census, which provided an annual growth rate of 1.6%, the district has today a total population of about 113,350 people, of which 58,879 are female and 54,471 are male. The number of children under 5 years old is about 22,675.

Economy
The main economic activity of the district is agriculture, mainly based on subsistence economy and small scale sales for villages, which are on the periphery of the district. People living in the urban area are mainly practicing business, small-scale industries activities, commerce and petty trading.

Education Services
The district has 43 primary schools out of which 36 are governmental schools and seven are private owned. There are also 11 secondary schools. In addition, district has three universities, one Teachers College, one vocational training centre, one Community Development College and 3 University Colleges.

Health sector
There are two 3 hospitals in the district. One belongs to the government, the other two belonging to religious institutions. There are also two government owned health centres and one private health centre. The district has 20 dispensaries. Major health problems are malnutrition and infant mortality rate. Other common diseases are HIV/AIDS, malaria and tuberculosis. There is an increase of HIV/AIDS by 13.7% per year, and the region as such is one of the highest infested regions in Tanzania. The main cause for this high rate include poverty, lack of education, and migrant labour force that moves a lot between the region and other regions in search of job opportunities as plantation workers, domestic workers and traders.

Water Supply
The main sources of water for the district are Ruaha River and Kitwiru spring water. About 90% of people have access to safe and clean drinking water.

4.1.2.2 Iringa Rural District

Iringa Rural District has an area of 20,576 km^2 of which only 9,857.5 km^2 is habitable whereas a national park, some forest reserves, rocky mountains and water bodies occupy the rest of the land area.

Population
Iringa Rural District has a total population of about 263,000. The dependence ratio is about 50%, whereby more than 122,000 children and the elderly are dependent on 124,000 economically active people.

Economy
The mainstay for the majority of the people in the district is agriculture, which employs about 82% of the active population. Livestock keeping is another main economic activity, largely undertaken at low sedentary levels. Pastoralists are concentrated in the areas close to the national park as well as around the Mtera dam in search of pasture and water. Other economic activities include fishing, forestry, tourism, service sector (transportation) and trading. Crops grown for commercial purpose include pyrethrum, coffee, tobacco, and sunflower while crops cultivated food but also occasionally sold include maize, beans, millet, sorghum, peas, tomatoes, paddy, groundnuts and wheat.

Infrastructures
The district has good road network well-developed telecommunications, electricity supply, postal and banking services, water supply as well as various financial institutions.

Energy Supply
Electricity consumed in Iringa District is supplied from the National grid system. In addition, the district is home to one of the major hydropower plants in Tanzania, the Mtera Dam that runs on water from the Ruaha River, a key landmark of the district.

Health Services
Iringa District Council has 1 hospital, 5 Health centre, 58 Dispensary and 35 pharmacies. The main health problems include malnutrition, infant mortality diarrhoea, malaria and HIV/AIDS. With sudden increase in the number of universities and students in Iringa, pressure on existing health services is likely to increase and the possibility of getting more cases of sick people due to communicable diseases is high.

Education Services
With regard to education, the District Council has 144 primary schools and 9 secondary schools.

Water Supply
About 197,809 people or about 60% of the population in the rural areas have access to clean water within a range of 400 meters. Most of the water is from river, springs and boreholes.

4.1.3 Dodoma Region

4.1.3.1 Bahi District

Bahi District is one of the six districts in Dodoma Region. The district is located at the central plateau of Tanzania, towards the western side of the country. The district has a total area of 6,100 km^2 with 56 villages and 20 wards, which are divided into four divisions, namely Mwitikira, Chipanga, Bahi and Mundemu.

Economy
Bahi is among the least developed districts of Tanzania and is the poorest in terms of estimated income per capita. It is estimated that the annual per capita income is 120,000 Tshs. The district economy is almost entirely depending on agriculture and livestock keeping which are not doing well in the district due to poor climatic conditions. Agriculture is characterized by low productivity resulting from low rainfall, high evaporation and low moisture holding surface soils.

Population
According to the 2002 national census, the population of Bahi District was 179,704 people, thereof 85,430 male and 94,294 female. The population growth rate was 1.6% per annum. The average household size is estimated about 4.5 people compared to the national level average of 5.2 people per household. Bahi has about 3,659 households.

Energy
Apart from the hydroelectric scheme of the Mtera Dam, there is also energy from diesel, petrol and kerosene, which are used by small industries and domestic use. However, more than 95% of the population depends on firewood and charcoal as their source of energy mainly for cooking. Excessive use of charcoal and firewood has led to the destruction of the eco-system in terms of forest depletion and its subsequent negative impacts.

Education Services
The district has 67 primary schools including one special school for handicapped. Bahi district had fewer secondary schools in the past 10 years, a situation that aggravated the problem of low numbers of pupils going to secondary schools. However, the district began to implement measures to deal with this issue and now there are 8 secondary schools built at the district.

Health Services
The district has 30 health facilities, 3 government owned rural health centres and 27 dispensaries of which 26 are government owned and one dispensary is under the ownership of a voluntary agency. The district does not have a hospital forcing local communities to depend on hospitals that are located in other districts.

The most common diseases in the district include malaria, URTI and eye infections. Other diseases such as diarrhoea, kwashiorkor are associated with hygiene and malnutrition. The health sector in the district faces problems of shortage of human resources, medical supplies and finance.

Water Supply
Water supply is one of the major components for improving the hygiene and sanitation of a community. However, poor climatic conditions and the absence of permanent rivers and springs have necessitated the drilling of boreholes, shallow wells and use of windmills to pump water to distribution points. In addition, water-harvesting techniques are also common in Bahi as a measure to deal with water scarcity.

The district has 133 water supply schemes capable to providing clean and safe water to 66% of the district population. Some of the water supply points are within the proposed wayleave and this ESIA has proposed mitigation measures in the form of alternative alignment to prevent effect to the water supply infrastructure.

4.1.3.2 Chamwino District

Chamwino District in Dodoma region is located on the central plateau of Tanzania. The district has a total area of 8,856 km2 with 72 villages and 28 wards, which are divided into 5 divisions namely Itiso, Makang'wa, Mvumi, Chilonwa and Mpwayungu.

Population
According to 2002 national census, the population of Chamwino District was 260,841 people, made up of 123,972 male and 136,869 female, with an average population density of 31 people per km^2. There are about 103,659 households in the district with an average size of 4.1 people per household. According to Regional and District projections, the district population for 2007 was estimated at 284,637, of which 136, 684 were male 147,953 were female.

Education
The district has 109 primary schools including one special school for handicapped at Buigiri Mission. In addition, the district has 47,239 students in its 109 schools out of which 24,266 are boys and 22,975 are girls. In 1996, there was only one secondary school in Chamwino but this situation has changed and there are now 11 secondary schools in district.

Health Services
The health situation in the district portrays the same patterns experienced by other less developed areas in the Dodoma region. The district is characterized by high occurrence of common preventable diseases such as malaria, eye disease, diarrhoea, skin disease and intestinal worms. Apart from prevalence of common diseases among the district population, infant and child mortality rates and maternal mortally rates are higher than the national average. The district has one private hospital, 3 rural health centres and 49 dispensaries.

Water Supply
Poor climate condition and the absence of reliable water sources like permanent rivers and spring has forced the district population to depend on boreholes, shallow wells, rainwater harvesting structures and wind mills which have minimized the perpetual chronic water shortage for both animals and domestic use. The district has 129 water supply schemes capable of providing clean and safe water to 74% of the district population.

Energy
The National hydroelectric power grid serves some parts of the district; other sources include diesel, petrol and kerosene, which are sources of energy for both domestic and commercial usage. However, like in other areas if the region, the majority of the population depends on firewood and charcoal for their energy needs. This dependence has implications on forest and vegetation cover and is a critical factor to note as TANESCO expands the power supply to the district.

Economic activities
The district has one of the lowest incomes per capital in the region, which is estimated at 120,000 Tshs. The economy of the district is entirely dependent on agriculture and livestock keeping, which are not doing well after all. The main cash crops produced in the district include groundnuts, sunflower, castor and simsim. Other economic sectors such as mining, forestry, bee keeping and fishing play an important role in the economy of the district.

4.1.3.3 Dodoma Municipality

Dodoma Municipality is one of six administrative districts that make up Dodoma Region. The municipality was established in July 1980. However, the government declared Dodoma Township the new national capital as early as 1973. Today Dodoma Municipality is still the official capital of Tanzania and the substantive seat of the Union Parliament.

Population
The current projected population is 441,450 people based on the Population and Housing Census of 2002. The total number of households is 76,112 with an average household size of 5.8 people per household. The average population growth rate is 3.3% per annum. There are 238,383 people living in the rural areas and 203,067 living in urban areas of the municipal council but the whole of the district is a planning area under the Capital Development Authority (CDA).

Economy
About 75% of the municipal income is derived from agriculture (crop and animal husbandry) and the remaining 25% from other sectors. The contribution of industries to the Municipal economy to date is low due to little industrial investment. The peri-urban population is engaged mainly in crop and animal husbandry. The municipal income per capital has slightly risen from 170,000 Tshs in 2005 to more than 240,000 Tshs in 2008.

Education Services
Dodoma Municipal Council has 103 primary schools with 66,547 pupils of which 33,101 are male and 33,446 are female and 52 secondary schools of which 36 are public schools and 16 are private schools. The municipality also has 8 special education centres for disabled students. There are also two universities established in Dodoma Municipal Council, one is a public university and another one belonging to religious institution. Dodoma University (public) and St. Johns' University (private) are located within the Municipal Area have a combined number of students of over 15, 000 in total. Other institutions include the Dodoma Branch of College of Business Administration, a Vocational Training

Centre and a Rural Development Institute.

Health Services
Dodoma Municipal Council has 3 hospitals, 2 of which are owned by the Government and 1 hospital owned by a religious institution. There are five health centres, the Council owns three and two are privately owned, 48 dispensaries, of which 23 are government owned, 15 belong to religious institutions and 10 are privately owned. Dodoma Regional Hospital (General Hospital) serves as Dodoma Municipal Council Hospital because the district does not have an own hospital. Common diseases in the district include malaria, acute respiratory infection (ARI), Sexually Transmitted Infections and (HIV/AIDS).

Communication Infrastructure
Dodoma Municipality has a total of 526.4 kilometres of road in which 40.8 km (7.75%) are tarmac, 62 km (11.8%) are gravel and 423.6 km (80.5%) are earth road.

Water Supply
There are 40 villages in the municipality with 34 deep-water wells, 80 shallow water wells, 2 dams, 1 natural spring and 4 windmills. The total number of people living in the rural areas is 238,383, of which 166,868 (70%) people have access to clean and safe water. The community is operating these water schemes through their water user committees. The rest of the municipal population receives water from the municipal supply system. Water is a critical resource in the district, largely due to poor infrastructure support system.

4.1.3.4 Mpwapwa District

Mpwapwa District is located about 120 km from Dodoma regional headquarters towards south east of the regional headquarters. The district covers a total area of 7,379 km^2.

Population
By the year 2002, the district had a total population of 253,602 people. With an annual growth rate of 2.1%, the District population is now estimated to be 289,914 people.

Education Services
The district has a total number of 130 nursery schools, 115 primary schools and 23 secondary schools. Existing primary and secondary schools are facing major shortage of school infrastructures; currently the government in collaboration with the local communities is in the process of improving the status and quality of these schools.

Health Services
The health care system consists of one hospital, 2 health centres and 43 dispensaries. The public owns about 78% of the health service facilities while charitable organizations, NGOs and private institutions own the rest. The most common diseases in the district are malaria, ARI, diarrhoea and pneumonia.

Water Supply
The district has about 32 boreholes, 71 shallow wells (using hand pumps) and 32 water springs. As part of the effort of the district to reduce some of the water borne diseases, the district has been increasing the population served with clean water in the rural areas from 62% in 2005/06 to 74% in 2006/07.

Economic Activities
Agriculture and livestock keeping are the main economic activities of the people of Mpwapwa. About 90% of the total population is engaged in these economic activities. Other activities include small and medium scale business, small-scale industries and office work employing about 2% of the population.

4.1.4 Singida Region

4.1.4.1 Iramba District

Iramba District is part of Singida Region. Kiomboi, which is the district headquarter, is located 100 km from Singida Town.

Population
Iramba is the mostly densely populated district in Singida Region. Currently the District population is 392,645 people, whereas 190,818 people are male and 201,827 people are female. The total number of household in the district is 75,943 with an average household size of 5.1 persons.

Economy
Agriculture is the largest economic activity in the District employing about 85% of the population. Main food crops include maize, millet, sorghum, paddy, cassava, sweet potatoes and beans, while main cash crops are sunflower, onions, groundnuts, cotton, simsim, pigeon peas and yellow grams. The annual per capita income in Iramba accounts is about 240,000 Tshs. Other households complement agriculture with livestock keeping and petty business. The district natural resources sector comprises of forestry, fisheries, beekeeping and wildlife, and is one of the key sectors that contribute to the district gross domestic product.

Education Services
The district has 148 primary schools and 16 secondary schools. The district is expecting 13 additional secondary schools by the year 2007.

Health Services
The district has two hospitals (one public hospital, and one hospital owned by a voluntary agency). There are also four government health centres, 35 government dispensaries and 13 voluntary agency dispensaries, three dispensaries under the national parastatals and one private owned dispensary. The most common diseases in the district include malaria, pneumonia, diarrhoea, eye infections and HIV/AIDS.

Water Supply
In the year 2007, Iramba District had 341 functioning water supply schemes in addition to 7 schemes, which were not properly working. The water supply schemes are dominated by shallow wells as the main source, followed by hand pump.

4.1.4.2 Singida Municipality

Singida Urban District covers an area 754 km^2, of which 730.5 km^2 is land area and 23.5 km^2 is covered by water. It is bordered to the north by Iramba District, to the northeast by Manyara region, to the south by Manyoni district and to the West by Singida Rural District. Administratively, the district has 2 division, 13 wards, 19 villages and 39 streets.

Population
Singida Urban District had a total population of 115,354 by 2002. Of these, about, 55,828 were male and 59,526 were female. It is projected that in year 2008 the population of Singida district will be 153,548 people of which 75,750 will be male and 77,798 female. The total number of households in 2002 was 24,512 with an average household size of 4.7 persons. The population growth rate is 2.5% per annum.

Economy

Agriculture is the largest economic activity in Singida Urban, which employs about 90% of the economically active population. The district has an average total area of 9,452 hectares under cultivation, of which 8,456 hectares is under food crops and 996 hectares under cash crops. The main food crops grown in the district are maize, sorghum, bulrush millet, sweet potatoes and beans. Maize has a high risk of failure in the district, as it requires higher rainfall. The main cash crops grown in the area is sunflower that is sold raw or pressed into cooking oil and sold locally or to other regions, including Dar es Salaam. Other economic activities include petty trading, commerce, employment (formal) and service provision.

Livestock keeping is an important economic activity in the district. It provides the population with high quality protein such as meat, milk, and eggs. It also provides draught power, hides, skin and manure. Common livestock in the district are cattle, goats, sheep, donkeys and pigs. In addition, poultry (locally kept) is a thriving business in Singida with chicken transported to Dar es Salaam and Dodoma, Morogoro and markets. The district has been affected by factors such as unreliable rainfall poor market, limited access to facilities capable of controlling or preventing animal diseases, insufficiency pasture and lack of reliable water sources especially during the dry season such that its livestock industry has not developed fully. There are no large-scale industrial activities in the district part from few and isolated oil pressing facilities.

Water Supply
The larger part of the population does not have access to clean and safe water, especially the people living in rural areas. In Singida Urban District, only 51% of the population has access to safe, clean and adequate water. Insufficient water sources and inadequate resources to distribute water to more people are factors that limit supply of this resource to the needy population. Most of the sources are shallow wells, which dry up during dry season.

Health Services
Malaria is the main disease affecting many people in the district. Other diseases include ARI, Pneumonia and diarrhoea. Epidemics also pose a greater danger to Singida urban community. Diseases, which have a tendency to spread fast and become fatal, are measles, cholera, plaque, meningitis and dysentery. The district has one regional hospital, two health centres, one public and the other one private, 9 public dispensaries and 6 private dispensaries. The services are low to moderate due to inadequate staff and resources to provide for better equipment. The power transmission line will increase pressure on such services due to the workers who will be involved in construction.

Energy Supply
Firewood and charcoal are the main sources of energy in household in Singida district. The proposed power line transmission line is intended to increase the capacity of electricity to the district through the substation however; most of the people in outlaying villages will continue to depend on firewood for a long time to come. The power line project will have low to moderate effect on firewood production and consumption during the construction phase, due to increased demand by the workers.

Education Services
The District has 33 public and 8 pre-primary schools with 3,430 pupils, and 34 primary schools with 26,979 pupils. It has also five public secondary schools and two private secondary schools with 10,139 students. Education in the District is facing problems of shortage of primary schools, poor enrolment rates, shortage of teachers and equipments. However, since most of the workers in the proposed power line will be for short duration only, pressure on schools will not be an issue. However, delinquency, school absenteeism and pregnancies could be issue of concern along the right of way within the district.

4.1.4.3 Singida District

Singida District Council covers an area of about 12,164 km^2. It is bordering with Tabora to the west, Iramba to the north, Hanang to the east, Kondoa to the south - east and Manyoni to the south.

Singida District has an annual per capita income of only 144,000 Tshs. The population growth rate is 2.4%. Poor farming technologies, unreliable rains, low soil fertility and poor farming methods contribute to the underdevelopment in the district. However, the district is endowed with unexplored natural resource bases including minerals, forests, wildlife and water (dams). Moreover, 55% of the total land area is arable while grazing land covers an area of about 3737 km^2.

Population
The District had a total population of 400,377 people in year 2002 of which 195,022 were male and 205,355 were female. Singida Rural District had 79,595 households of which 75,009 households were located in rural areas and 4,586 households in urban areas. According to the 2002 census, the average household size was 5.0 persons per household.

Economy
The main economic activities in the district are farming and livestock keeping. Other activities include fishing, beekeeping, small-scale mining, small businesses, cottage industry, and lumbering. Both food and cash crops are grown. Food crops include maize, sorghum, millets, paddy, beans, cassava and sweet potatoes. Cash crops include sunflower, groundnuts, finger millet, yellow peas, coriander, onions, simsim, cotton, and other newly introduced crops like pigeon peas, cashew nuts and mlonge (Aloe Vera).

Small-scale farmers constitute 40% of the economic activities, pastoralists 20%, agro-pastoralists 30% and mixed farmers 10% of the total population. Others include small-scale industries such as grain mills, oil mills carpentry workshops, black smith and tailoring. On the business side shops, kiosks, tearooms, guesthouses, saloons, and groceries provide services to the people on essential products. These activities will greatly benefit from increased and expanded supply of energy from the proposed power transmission project.

Health Services
The district has 38 dispensaries, 6 health centres and one hospital. Malaria and pneumonia are the most common diseases in the district. HIV/AIDS and tuberculosis are also becoming a threat to the district.

Education Services
There are 147 primary schools and 11 secondary schools in the district.

4.1.4.4 Manyoni District

Manyoni District is located in the central part of Tanzania. It has an area of 28,620 km^2 and covers 58% of the Singida Region area. The district is located at the edge boundary between Singida and Dodoma region along the truck road from Dodoma to Singida where it meets the road to Tabora via Itigi Division.

Population
The District had a population of 205,423 people in 2002, of which 105,238 were female and 100,185 were male. The highest population density is in Manyoni ward with 24,318 inhabitants and the least populated ward is Aghondi with 4,027 inhabitants. The district has 42,889 households with an average household size of 4.7 people.

Economy
The main economic activities in the District are farming where crops such as maize, beans, sorghum, millet, cassava, sweet potatoes, sunflower, cotton, tobacco are cultivated on small-scale level. Other economic activities include mining, petty trading, timber processing, tourism, hunting and beekeeping. Livestock is also an important economic activity in the district. The annual per capita income in the district is 215,760 Tshs.

Water Supply
The District Council is concerned with the delivery of clean and safe water in urban, peri-urban and rural areas. Water sources include 55 deep wells 27 medium deep wells, 36 shallow wells, 10 dams and 2 irrigation schemes. Motor pumps and windmills provide most of the energy sources for pumping water from the sources to the distribution systems and points. The proposed power transmission line will put more pressure in water, although this will be experienced only during the short period of construction phase. About 31% of the rural and 23% of the urban population have access to clean and safe water.

Communication
Several telecommunication companies operate in Manyoni district. These include Tanzania Telecommunication Company (TTCL) and some mobile phone companies such as Zain, Vodacom, Tigo and Zantel. The District is also connected with the Central Railway System from Dar es Salaam to Kigoma and Mwanza and a junction to Dodoma -Singida Railway line. These railway lines are very crucial for transport of raw materials and passengers between western, central and eastern Tanzania and could be used to transport construction materials for the proposed power transmission line in bulk form.

Energy Supply
Manyoni district council is connected to the National grid and some of the people are served with electricity in their homes. However, still the largest population in the district is depending on firewood and charcoal. The proposed power line project may increase pressure on biomass and exacerbate forest depletion although this will only be during constriction phase.

Education Services
The District has 16 secondary schools though most of the schools lack necessary buildings such as laboratories, libraries or boarding facilities. Each division and Ward has at least one secondary school.

Health
Health service facilities in Manyoni District Council include 3 hospitals, 4 health centres and 28 dispensaries. Major epidemic diseases are cholera, Meningitis and Measles.

Historical and Cultural Sites
Manyoni district is a potential touristical and historical site. Unique features, which are found in Manyoni, are the ecological characteristics of Itigi Thicket, which is not be found in any other part of the world. Another historical site is the old Caravan route, which was followed during the slave trade all the way to Bagamoyo from in the north-western part of Tanzania. The Kilimatinde village, situated on the hilltop served as an observation point when the caravan was moving down the embankment. The proposed line will affect none of these items.

4.1.5 Tabora Region

4.1.5.1 Igunga District

Igunga District is one of the six districts of Tabora Region, which covers an area of 4,499 km^2, and borders with Kishapu District to the north, Iramba District the east, Uyui District to the south and Nzega District to the west.

Population
According to the 2002 Population Census, the district had 324,094 inhabitants, of which 159,667 were male and 165,880 were female. The district has 51,176 households with an average household size of 6.3 persons.

Economy
Agriculture and livestock keeping are the main economic activities in Igunga District. The livestock include cattle, goats, sheep and pigs. Agriculture is poor because of unreliable rainfall and poor farming methods and technologies. Consequently, there are wide variations of crops production every year. In order to increase production, irrigation farming must be supported fully. The District has a potential of 40,790 hectares for irrigation system.

Education Services
By the end of 2006, Igunga district had 128 primary schools and 16 secondary schools.

4.1.6 Shinyanga Region

4.1.6.1 Kishapu District

Kishapu District is part of the 8 districts that form Shinyanga Region. The District borders with Meatu and Iramba Districts in the eastern side, Igunga in the southern part, and Maswa and Kwimba in the northern side. The total area of the district is 4,039 km^2.

Population
In 2002, the district population was 240,086 of which 120,806 were male and 119,284 were female. The average number of people per household is 6.1. With an annual population growth rate of 1.6%, the population is currently estimated to be 292,000 people.

Economy
The main economic activities in Kishapu District are agriculture (88.1%), forestry and fishery (6.3%), local mining (0.9%), small-scale businesses (0.9%) and other economic activities (3.8%). The average daily income per head was about 727 Tshs and annual per capita income was about 262,000 Tshs. The main crops grown include sorghum, yams, maize, sunflower, groundnuts, paddy, and cotton. To-

tal arable land is about 319,200 hectares but only 56.7% of this area is cultivated (181,138 hectares). Livestock keeping is the second main economic activity, which engages about 27% of the district population.

Education Services
There are 115 primary schools and 28 secondary schools in the district. The district has also an adult education program and there are 86 centres for adult education.

Health Services
The district has one hospital, 4 health centres and 42 dispensaries. Common diseases in the district are malaria, diarrhea, pneumonia, eye infection, *Helmini athiasis,* skin infection and HIV/AIDS.

Water Supply
Most of the population obtains drinking water from dams and rivers (59.8%) and shallow and deep wells (40.2%). About 70% of people use water for domestic purposes from protected wells, and 30% from taps or rainwater collection.

4.1.6.2 Shinyanga Municipality

Shinyanga Municipality borders Mwanza Region to the north, Shinyanga Rural District to the south, Kishapu District to the east and Kahama district to the west. The district covers an area of 548 km^2, and has 13 wards and 19 villages.

Population
In 2002, the district had 135,166 people, of which 66,835 were male and 68,331 were female. It is estimated that the total population will be 181,838 in 2008, of which 89,266 are male and 92,271 female. The district inter-censual growth rate is 3.3%. In 2002, the district had 67,583 households with an average household size of 2.0 persons per household.

Economy Activities
The district economy is depending mainly on agriculture, most of which is at subsistence level. Approximately 90% of the population is engaged in agricultural activities. Agricultural production in the district is mostly rain fed. Main cash crops are cotton and tobacco, while the main food crops are maize, sorghum, paddy, sweet potatoes, millet and cassava. Modern diary farming and poultry are also taking place in the district.

Apart from agriculture, livestock, keeping; mining, and industrial activities play an important role in the district economy. Indeed, the propose power line will add 400 kV of power to the existing capacity and boost the supply of energy to the expanding mining industry. Other industrial activities that may also benefit from the power supply include cotton ginning, cottonseed oil extraction, milling and small-scale industries.

Water Supply
Currently, Shinyanga urban district receives water from four sources, namely, Ning'hwa, dam, boreholes near Kizumbi, shallow wells and Nhumbu dam near Mwadui. It is estimated that only 56% of its population have access to clean and safe water. The demand of water, which was estimated, to 14,689 m3 per day is expected to reach 17,000 m3 per day by the year 2010. Most of the pressure is from mining activities that demand more water. The proposed project will only compound the already strained water supply system but buy additional demand especially during construction.

Energy Supply
Energy source utilized for both industrial and domestic activities are hydro- and thermal electricity, firewood, diesel, petrol and Kerosene. The dominant source of energy for domestic consumption is fuel wood. In urban, fuel wood normally takes the form of charcoal, while in rural areas, firewood is preferred. Even where electricity is available to households, only few people cam afford it. For example, in year 2005 some 5,881 customers in 13 villages were supplied with electricity from TANESCO. The total customers' consumption in 2005 was 3,716 MWh per month.

Health Services
High infant and maternal mortality characterize the health situation in Shinyanga urban. The f high rates of water borne diseases as well as severe malnutrition are also experienced in some parts of the district. Inadequate health facilities, poor equipment, inadequate hospital supplies and delivery services have compounded the health problems in Sinyanga Urban District. Some of the common diseases in the district include malaria, anaemia and pneumonia.

For instance, there were 23,327 cases of malaria in 2005, followed by 368 cases of anaemia and 148 cases of pneumonia. HIV/AIDS is also a problem in Shinyanga district. The number of cases is increasing much more and faster than in other districts. Increased human interaction, relatively more money in circulation from mining, livestock sector and farming as well as poverty are factors that prompt this increase in HIV/AIDS cases. The proposed development will increase labour force and money economy and thereby, creating additional conducive environment for the spread of communicable diseases.

Education Services
The District has 46 public and 6 pre-primary schools with 4,078 pupils and 33 public and 4 private primary schools with 30,396 pupils. In addition, there were 18 public and 4 secondary schools with 10,139 students in 2006. Education service is facing problems such as shortage of primary schools, poor enrolment rates, shortage of teachers and equipments.

4.2 Socioeconomic Characteristics of the Affected Population

This section presents a brief description and analysis of the basic socio economic characteristics of the affected population, based on the results of the household surveys conducted in all 93 affected villages along the ROW. It should be noted that most rural areas in the country have similar socio economic characteristics.

4.2.1 Demographic Characteristics

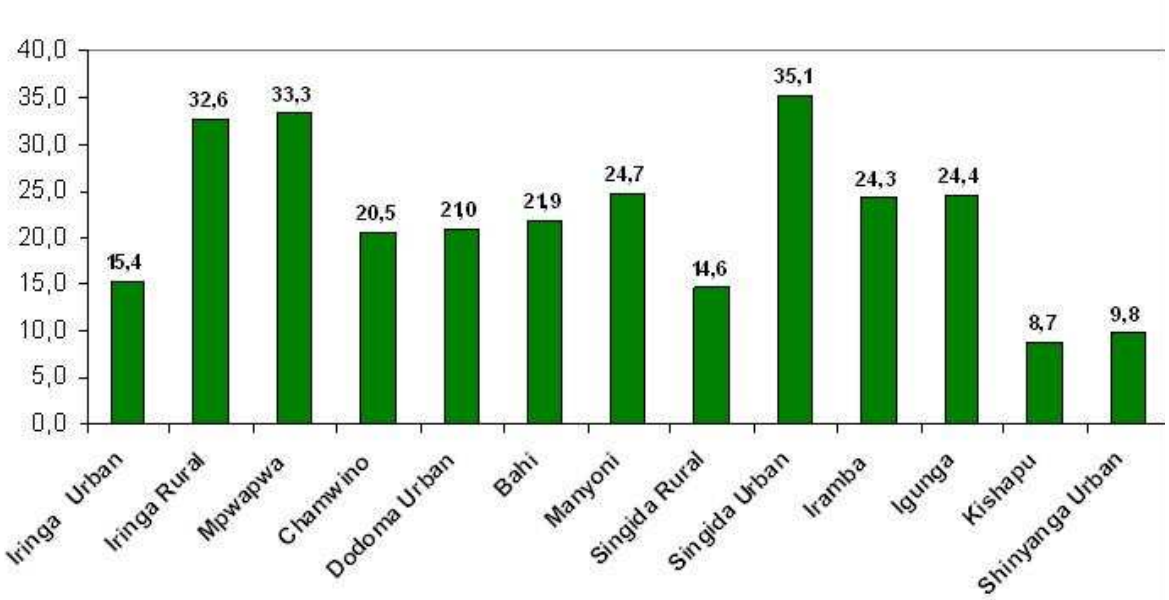
The average household size along the ROW ranges from 4.0 to 6.3 people per district household. Kishapu district has the highest household size. About 87% of the heads of household in the affected villages are male. Household with female heads are mostly widows or divorced, a factor also observed in villages that are located in urban areas.

In most of the villages, families tended to stay together and to share most of the resources including meals. For instance in Kishapu families sharing compound would include parents, their married children as well as their grandchildren. This family tends to share meals, farms and other basic needs.

4.2.2 Migration

With exception to local communities that live in urban areas such as those in Dodoma Urban (Mkonze and Michese villages) as well as Mtera village in Mpwapwa District, most of the affected populations were born in their respective village or District. Mtera village in Mpwapwa District had the highest rate of migrants (about 31%) due to fishing activities carried out at Mtera dam as well as employment at the Mtera Hydroelectric Generating station. The proposed power transmission line project may influence further migration to the villages along the wayleave in search of employment.

Figure 4-1: Percentage of Population per District Village Cluster Born Outside of Villages



Source: Field Survey, 2008

4.2.2.1 Educational Levels

Almost 29% of the surveyed heads of households in all the 13 districts have not attained any level of education. The rate of illiteracy was relatively high in Kishapu District (44%) and Mpwapwa District (39%). Most head of household have attained basic primary education (35%), and only 2.7% with secondary education. Less than 1% of the affected population has college or vocational education-mostly being in urban areas. With the current emphasis by the government to ensure that Tanzanian children attend schools, the rate of school enrolment has also increased in most parts of the country.

For instance within the project area, the rate of children within the school going age who are at school is about 87% and 24% are attending secondary education. In all the 13 districts to be affected by the project there are only three vocational training centres of which three are located in Iringa Municipal. However, there are also several universities in Iringa and Dodoma while such facilities are lacking in Shinyanga and Singida. The table 4.1 below shows the percent of education status in the proposed power transmission area.

Table 4-1: Education Status of the Heads of Households in the Project Area

Level of Education	Percent
None	28.8
Primary school	35.0
Secondary	2.7
College	0.4
Technical/vocational	0.3
Attending primary school	24.7
Primary school Dropout	2.6
Drop-out secondary	0.5
Attending secondary school	4.7
University	0.1
Adult Education	0.2
Nursery School	0.0

Source: Field Survey, 2008

4.2.2.2 Water Supply

Various sources of water are available in the villages and urban areas along the wayleave. These sources and supply systems include traditional wells, communal wells with pumps, rivers, dams, streams, water taps from municipal and Council systems and water harvesting techniques. Water tapes accounts for about 20% and of total supply systems. Severe drought affect most of the villagers in terms if availability of water, forcing people to travel over 10 km in search of this services. For example, Mwamakona village in Igunga District is very much affected during dry season.

Some of the villages have more than one source of water. For example, Mkwese village in Manyoni District and Mkonze in Dodoma Urban while others still rely on neighbouring village for the services. Kizonzo village in Iramba District for instance has to obtain waster from Nselembwe village. In addition, although water is available in some areas, its quality is very poor due to lack of treatment processes.

4.2.2.3 Health Services and Other Support Infrastructure

Other social services found in the project area include health facilities; 39 villages out of the 93 affected villages do have health centres, critical cases are referred to the responsible district hospital. Districts such as Chamwino, Bahi and Kishapu currently do not have district hospitals and therefore, the residents in these districts use hospitals in nearby districts. Common diseases in the areas include Malaria, URTI and other water borne diseases. HIV/AIDS is also a major challenge and an issue to be seriously considered in the proposed project. Other social infrastructure available in the project area include police posts/stations, courts, post offices telecommunication facilities, banks, internet services and markets and shops (mainly in urban areas) (Annex: 3.5).

4.2.2.4 Transport

Currently most of the affected villages are easily accessible from their relevant district headquarters. In addition, most of the villages are located along the main roads of Iringa-Dodoma-Singida-Shinyanga. Since the transmission line will follow the main road (except in some few areas where it diverts several

meters away), most of the villages will also be accessed and therefore the work camp will have better access to sources of supplies. Kishapu District is probably the only district that is not along the main road making its accessibility very difficult during rain season. Other districts such as Manyoni, Singida Urban, Singida Rural and Shinyanga urban, are also accessible by rail that links the central part of Tanzania and the rest of the country. Airports and Airstrips are also available in some districts and specifically within the project area. Example the Manyoni airstrip is at Mitoo village and the Iringa airport is at Nduli village. Officials from the Manyoni District also expressed concern that the proposed project is likely to affect the Manyoni airstrip visibility and therefore requested if TANESCO to finance new air strip elsewhere to avoid further problems. Access roads that have been developed by TANESCO for maintaining the existing transmission line have become important roads for transportation in villages of Mitoo, Isalanda and Choda.

4.2.2.5 Energy Use

Out of the 93 villages likely to be affected by the proposed project, only 16 are connected to the National Grid of TANESCO. Most of these areas are in the urban centres such as Singida, Manyoni, Dodoma and Iringa. Other villages use generators or solar panels to obtain electricity; however, most villagers use kerosene (about 88%) as a major source of lighting and firewood is used for cooking in both urban and rural areas. Some household mainly those in urban areas also use charcoal as a source of cooking energy.

4.2.2.6 Land Tenure and Use

About 96% of the interviewed heads of household own one or more pieces of land. Land is mainly used for settlement, agriculture and grazing. Land owned by heads of households was inherited, bought or obtained from the village government. There is a significant difference of size of land owned by head of household from one area to another with other areas having total land size of up to 100 acres. For instance, in Kishapu and Igunga District land is mainly used for cotton cultivation and grazing. Households in urban areas or villages that are located adjacent to urban areas such as Ibada Kuli in Shinyanga Municipal, Nala in Dodoma Urban and Puma in Singida rural have relatively low farm sizes.

In most of the consulted villages, land is still available and could be allocated to households that are likely to be impacted by the proposed project. However, a lot of the surveyed households reported that it might be difficult to obtain land close to where they are currently located within the village.

4.2.2.7 Housing Condition

Most of the houses along the wayleave are of poor quality. Most such houses have been constructed using mud and thatches. The type of houses found in the rural areas of Mpwapwa and Bahi district are of similar design i.e. very short and small, mostly built with mud and that and covered by mud on top. These houses are having al least one to two rooms. In Iringa region, most of the houses are improved i.e. a combination of traditional and modern construction materials such as corrugated iron sheets for roofing, burnt brick and also cement in some cases.

Villages that are close to missionary centres such as Chibumagwa and Chikuyu in Manyoni and Misigiri village in Iringa Rural have improved houses. Villages that are located along the main Dodoma - Singida road, or on small towns such as Iguguno, Nselembwe-Selui and Misigiri village have mixed

materials in their houses combining, modern building materials (cement and corrugated iron sheets) or improved (i.e. a combination of modern materials and traditional once). Social services and infrastructure along the wayleave that are likely to be affected are also built with very modern and strong structures.

Most of the houses in the rural areas comprise more than one structure, which includes the main house (normally with three rooms), a kitchen, store, toilet and other small houses used by household members. It should be noted that of the structures might not be directly under the wayleave but the proposed development may affect them by changing the composition of the compound and hence the social system as well. For instance, in Igunga District, toilets used by household were observed to be located 50 meters away from the main structure and possibly in the wayleave. A detailed resettlement assessment shall reveal the more pertinent features of the housing condition in order to determine appropriate compensation packages for the project affected persons.

Figure 4-2: Common Types of Houses (Kizonzo Village)

4.2.2.8 Economic Activities

The major economic activities in the affected districts are farming and livestock keeping. Other activities include fishing, beekeeping, small-scale mining and small businesses. Both food and cash crops are grown at different scales. There is very little variation in the type of crops grown in most parts of the project area. With exceptions of cotton that is mostly grown in Igunga and Kishapu as the main cash crops, other districts of Singida, Dodoma and Iringa region grow sunflower and maize as their main cash crop. Food crops include maize, sorghum, millets, paddy, beans, cassava and sweet potatoes. Other cash crops grown in the project area include groundnuts, finger millet, yellow peas, coriander, onions and simsim. Small-scale farmers constitute 40% of the economic activities, pastoralists 20%, agro-pastoralists 30% and mixed farmers 10%.

Very few of the heads of surveyed households (less than 10%) reported having a wage-paying job. As well, neither the spouses of the heads of the surveyed households nor other members of the surveyed households reported having wage paying jobs. Incomes per households also differ markedly between districts with Kishapu getting the highest from amongst the districts in the wayleave.

Table 4-2: Average Annual Households Income by District

Districts	Average Income (TZS) per household per year
Iringa Urban	594,153
Iringa Rural	370,176
Mpwapwa	591,602
Chamwino	740,918
Dodoma Urban	420,065
Bahi	479,721
Manyoni	350,823
Singida Rural	251,268
Singida Urban	573,864
Iramba	531,357
Igunga	727,777
Kishapu	1,360,913
Shinyanga Urban	508,951

Source: Socioeconomic Field Survey, 2008

Most of the villagers are small-scale producers. For example, about 70% of them reported producing less than 10 bags of maize during the previous season. Only 8% reported they produced about 2o bags of maize during the previous season.

4.2.3 Livestock Ownership

Besides farming, most of the households along the wayleave have livestock. The most common livestock in the project area are cattle, goats, sheep, and chickens. Almost 50% of the surveyed households reported not having any cattle, 20% reported owning less than five, and the remaining 30% reported having more than 5. However, about 40% of the surveyed households reported not having any chickens, whereas about 25% reported owning more than 10. More than 30% of the surveyed households reported having sold some livestock in the previous year.

4.2.3.1 Willingness to Relocate

As expected, a large majority (72%) of the surveyed households declared a preference for being relocated to a site close to their current homestead. The remaining surveyed households indicated that they were willing to relocate anywhere. This option however, does not imply resettlement arrangement have to be made. These 28% of the surveyed households are willing to resettle even outside heir villages provided they are paid fair compensations in time to allow them to establish new homes elsewhere.

4.3 Physical and Biological Environment

4.3.1 Topography

Starting in the south, the line runs from the Iringa Highlands to the north over the Kidunda Ranges at 1,650 m a.s.l. From the rocky, steep slopes, the highlands drop sharply, i.e. nearly 1,000 m within about 50 km over a dissected scarp towards the Mtera Reservoir through Fufu Escarpments to Dodoma. Continuing to the north-west along the Great North Road, the terrain is generally flat to gentle sloped. After Singida, the line traverses moderately rising hills with another sharp drop into the Wembere Plains. Towards Shinyanga, the terrain rises steadily from lightly hilly to undulating landscape.

Figure 4-3: Topographic Features (near Mkonze)

Table 4-3: Topographic Variation along the Proposed Line

Location	Altitude above Sea Level	Remarks
Kidunda (Iringa Rural District)	1,650 m	highest elevation of transmission line
Mtera	750 m	lowest elevation of transmission line
Iringa Substation	1,550 m	highest substation location
Dodoma Substation	1,120 m	lowest substation location
Singida Substation	1,510 m	
Shinyanga Substation	1,170 m	

Source: FICHTNER, 2008 line routing

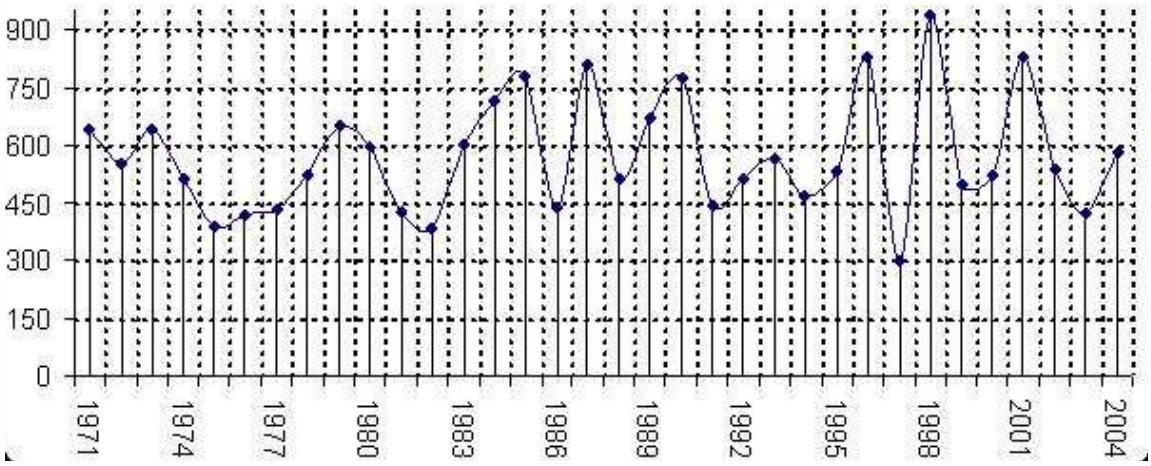
Figure 4-4: Line Crossing the Great Ruaha River Valley at Mtera

4.3.2 Climate

Having a tropical climate, Tanzania experiences two seasons (wet and dry), with temperatures varying from hot temperatures during the wet season to cooler temperatures during the dry season, particularly in regions in the central plateau of the country, and with more humidity in the coast areas. In the lake zone, the drier months are interrupted by short rain from late October to December followed by the heavy rain season from January to May with the peak in March. The rest of the country experiences only one wet season, from November to May. The climatic condition between Iringa and Shinyanga is influenced by changes in altitude. The variation in altitude along the project area defines the differences experienced in temperature, rainfall and humidity. The temperature in Dodoma, Manyoni, Singida and Iringa is relatively low 15ºC, occasionally dropping below 10ºC at night during the months of June and August. While rising as higher as 30ºC during the hot months from December to March.

Generally, the project runs through semi-arid climate with mean annual rainfall ranging between 400 - 600 mm from north of Iringa to Dodoma. The section between Iringa and Mtera Dam and areas between Manyoni up to Misigiri can be classified as moderate rainy zone with 1 to 3 months precipitations per year. The area north of Mtera via Dodoma to Bahi belongs to the dry climatic zone with average rainfall below 600 mm per year. Climatic data of Dodoma town metrological station show an average rainfall of 570mm, for Dodoma and about 85% of this falls in the months between December and April. Apart from the rainfall being relatively low, it is rather unpredictable in frequency and amount. In the long dry season, persistent desiccating winds and low humidity contribute to high evapotranspiration and to soil erosion in the area. It is this unreliable rainfall, which has imposed a pattern of risk aversion in traditional agriculture and is a serious constraint on present efforts to improve crop yields.

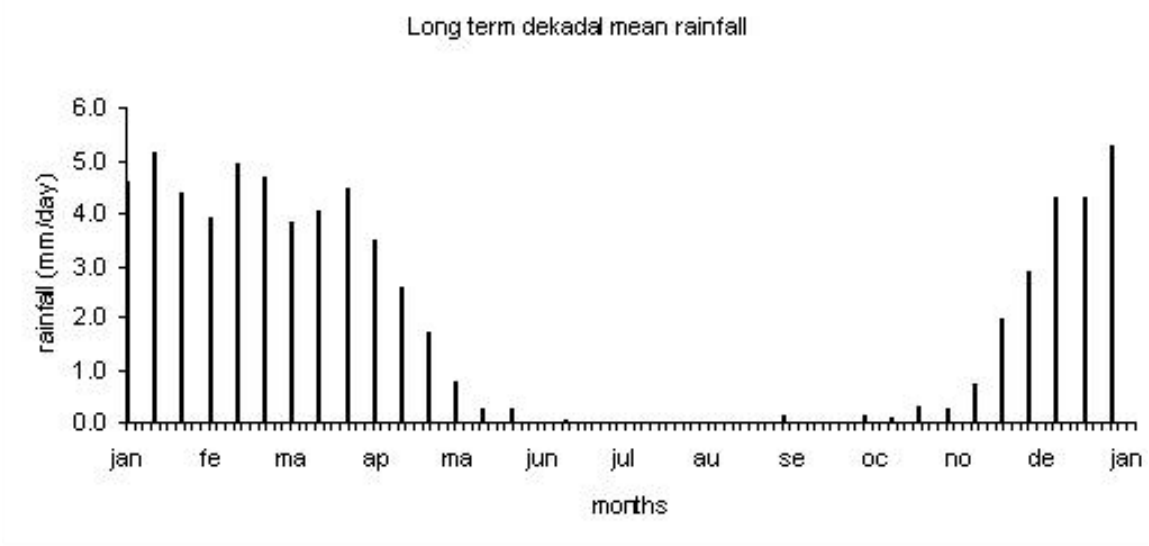
Figure 4-5: Total Annual Rainfall for Dodoma and Singida



Source: Tanzania Meteorological Authority, 2004

Temperature in the region varies in response to altitudinal difference; with the average maximum and minimum temperature of 31^{o}C and 18^{o}C respectively. Meteorological data from Dodoma town station shows daily temperature of 35^{o}C dropping to as low as 10oC at night during cold months of June - August. Singida being part of the central region plateau experiences a similar climate as Dodoma, except in a localized area (Kilimatinde, Manyoni and Misigiri) where the rainfall data register higher values.

Figure 4-6: Rainfall Distributions in Central Region Plateau

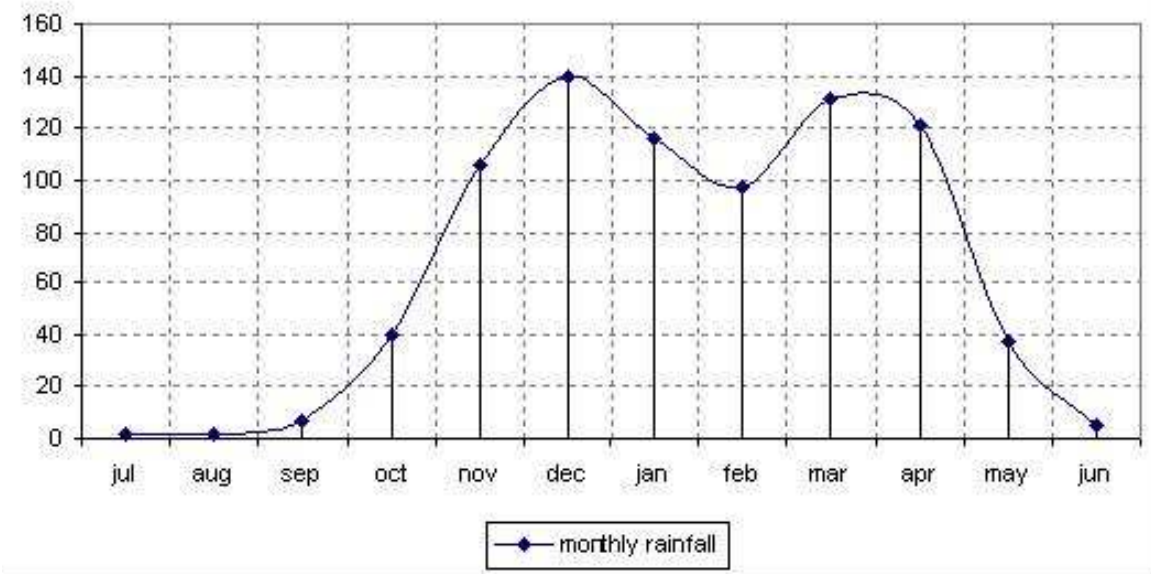


Source: Tanzania Meteorological Authority, 2004

The semi-arid climate of Shinyanga receives slightly higher rainfall; data from meteorological stations in Shinyanga shows an average annual rainfall of 814 mm with potential evapo-transpiration estimated at 2,000 mm per year for Shinyanga (1995-2005 - Norplan (2007); low humidity with temperatures ranging between 20℃ and 27ºC during the cooler mon ths of June through August. Precipitation month in Shinyanga region lasts from October to May, while the area receives virtually no rainfall in the months of June, July and August. The mean temperature is 22° C with high temperatures of 30ºC, es-

pecially between the months of December and March. This climatic condition is extending to Igunga district in Tabora Region.

Figure 4-7: Monthly Rainfall for Shinyanga and Igunga



Source: Tanzania Meteorological Authority, 2004

4.3.3 Hydrology

Only two rivers in the project area, the Great Ruaha and its largest tributary, the Little Ruaha, which feed the Mtera Reservoir, are perennial. The Transmission line crosses a number of sand rivers as well including Manonga river at Igurubi and Kalitu, Mzonga or Ruluma river at Misigiri, Iguguno river at Iguguno that form part of Internal drainage of lake Eyasi, Lake Kitangiri and Wembere swamp (Norplan, 2007). The phenomenon of seasonal rivers and seasonal swamp allow great mobility across the countryside during dry season from June to October. The mountain ranges around Iringa and Dodoma are like cloud-bursting obstacles in the weather atmosphere. The annual rainfall of around 1000 mm in the highlands to less than 500 mm in the plains is concentrated on the wet months only from November to May, peaking in March and April frequently associated with intensive thunder storms during rainy season. This pattern of rainfall in combination with sandy ground let rivers and marshy terrain dry up after rainy season. Other important water bodies close to the transmission line are Lakes (Singidani, Mungumaji), at Singida town, the partly swampy Wembere plain, and the Mtera Reservoir.

4.3.4 Geology and Soils

The geology of the Project area varies as one move from Iringa towards Dodoma, Singida up to Shinyanga. Near Iringa the geological formation is of granite and granodiorite, this is the dominant geological formation with few area with Archaean mainly marble, quartz, graphite, schist, chlorite and Amphobole. Other geological formations include Proterozoic near Nyang'oro and Kainozoid near Manyoni (FICHTNER, 2008).

Some parts of the line route are located in areas of outcropping metaigneous weathered-rock basement. Differential continental plate drifts during the late tectonic phase of the Precambrian period pushed the rock partially to the surface. The fractured earth-crust underwent a medium-grade metamorphic transformation forming a rock basement of various harnesses, predominantly, of granite accompanied by gneiss and sequences of intercalated metacalcerous crystalline rocks, quartzite and schist. Two major parallel faults of a highly sheared and down-thrown area between Fufu and Isimani are forming the plains of the Great Ruaha River.

4.3.4.1 The Soil Types

The soils in the project area vary from weakly developed soil i.e. lithosols on basic parent materials, chiefly lavas and gneisses, ferrisols of sub humid regions chiefly on crystalline rocks, hydromorphic soil and soil-associated vertisols and solonetz as you move from Iringa to Shinyanga. In some section of the line the soils is very vulnerable to erosion e.g.in the area around Iringa the soil is very erodible.

Literally, the soil characteristics along the project area fall within three major soil types red-yellow brown sand loam, brown sandy with varying texture and clay soil varying in colour from yellowish brown to typical black cotton soil (see Fig. 4-9)). These soil types contribute to different vegetation types that feature along the project area. Most of the cultivated land is sandy loam to clay loam with some clay soil (black cotton soils) on the lower land. These soil types were characteristic for acacia woodland, particularly in the area from Kihorogota to Nyang'oro in the Iringa -Dodoma section, the lower land down the Sekenke escarpment all the way to Shinyanga. On hills, mountain ranges and the escarpment the soils change to sandy and gravel, with rock outcrops in some sections of the transmission line e.g. between Mpunguzi to Dodoma substation, Singida town, Nala to Kilimatinde and Manyoni as well as some part of Shinyanga, two towers before the last angle tower to Shinyanga substation.

Figure 4-8: Tower Close to Erosion Prone Soil (Iringa Escarpment)

Figure 4-9: Black Cotton Soil: Typical in Igunga & Kishapu Districts

Figure 4-10: Line Crossing Commiphora Woodland (near Makatapora)

4.3.4.2 Soil Composition and Geomorphology

The low-grade metamorphosed outcropping sedimentary rock and granites are gradually weathering to partly gravely sand with fines. The weathering product of predominantly coarse crystalline sand forms the slopes of the hilly terrain, whereas the large plains are of alluvial deposits and residual soils of clayey fine sand with some silt. Although the soil is, in general of firm to dense compactness having good bearing properties, the low percentage of cohesive fine components makes the soil in exposed areas prone to erosion. Particular effort has been made during the field investigation in locating and recording these areas for tower spotting and erosion protection measures. In some isolated parts and marshy terrain localized lateritic and black cotton soil has developed and is extending up to several meters depth.

4.4 Vegetation Cover

The vegetation in the project area varies, depending on climate pattern, rainfall quantity and soil characteristics. Bush land and thickets, woodlands (i.e. Acacia and Miombo) and bushed grassland with groups of scattered trees like Baobabs (Adansonia digitata) and Commiphora characterizes the uncultivated project areas (about 26 % of the line length). Along the rest of the line route, the natural vegetation has been replaced more or less by human activities, mainly livestock grazing and crop production, mostly scattered cultivation with maize, sorghum, rice, sunflower, cotton etc., intertwined with human settlement. Riverine vegetation can be seen along the rivers and streams with permanent flow including Little and Great Ruaha at Mtera area. In close vicinity of the Little Ruaha river all-year well-watered banks allow maize and paddy fields as well as fruit plantations. The original vegetation is indicated by the remnants of Commiphora woodland from Iringa to Bahi district (except at Nyang'oro and Kidunda mountain ranges where, Miombo woodland exists), and Miombo woodland from Chikuyu to

Sekenke escarpment, and Acacia woodland vegetation down the Sekenke escarpment and interrupted by seasonally inundated grassland, up to Shinyanga.

Table 4-4: Vegetation Cover / Land Use along the Line
(including routing alternatives)

Vegetation cover / land use	km	%
Total Lenght	670	
Settlements	20	3%
Farmland, scattered cultivation	440	64%
Forest Reserves	48	7%
Saisonal wetlands	26	4%
Uncultivated areas	180	26%

Source: Land Cover and Land Use Map (1996) 1:250,000 (see Annex 5)
Annotations: Figures refer to the line after mitigation; sum of values exceeds 100 %, as some values are not disjunctive (e. g. seasonal inundated wetlands are mostly used as farmland)

Figure 4-11: Dense Commiphora Woodland (near Mtera)

4.4.1 Iringa-Dodoma Section

The vegetation along the Iringa - Dodoma section varies from regenerating Miombo woodland on Hills from the substation, dissecting the Iringa mountain ranges at Igumbilo to Nduli airport. This vegetation gives way to dense acacia woodland, to sparse acacia-commiphora with baobab trees toward Mtera. From Nduli to Nyang'oro the scattered acacia woodland interrupted with extensive agricultural farms can be seen along the ROW. In most cases, village houses interrupt these woodlands and farms. The dense Miombo woodland characterizes the Nyang'oro escarpment forming the Nyang'olo Forest Reserve, which is under Participatory Forest Management (PFM) to the lower slope where dense acacia -commiphora woodland dominates. This vegetation type stretches from the foot of the Nyang'oro escapement to Dodoma passing through Mtera and Fufu escarpment.

The transmission line crosses within the Nyang'oro Forest Reserve (FR), from the foothill up to Kibaoni sub village north of the Nyang'oro escarpment. The wayleave touches a considerable distance of more than 20 km consuming significant number of trees, including protected species, such as Tamarindus indica, Milletia stuhlmannii, and Swartzia madagascariensis. Part of this forest reserve, like many other forest reserves in Tanzania, has been mismanaged and encroached upon for a long time due to lack of funds, qualified staff and proper enforcement of rules and regulations related to conservation of such areas; thus the forest has been degraded by human activities mainly fuel wood collection and clearing for cultivation. The forest however, still supports a number of wildlife resources utilizing the forest as their habitat. During the survey animals, such as dikdik and guinea fowl were spotted. On lower slopes the reserve forms a wildlife corridor allowing elephants and other large mammals from Mikumi to cross the forest to Mtera reservoir for drinking, especially during dry season.

4.4.2 Dodoma - Singida - Sekenke Section

The vegetation from Dodoma substation to Chikuyu is scrubland changing into thickets with baobab trees forming the emergent trees. The density of baobab trees increases just past Nala village up to Bahi village. From Bahi to Chikuyu more Miombo characterized by (Terminalia -Combretum) woodland interrupted by bushed acacia in some sections dominate the area. From Chikuyu Terminalia woodland changing into Miombo woodland covers large part of the Salanda hills up to Kilimatinde hills; which stretches up Manyoni town. However, as you move toward Manyoni the vegetation is highly disturbed by people fetching firewood and charcoal (Figure 4-12).

Beyond Manyoni the dominant Miombo woodland changes around Mkwese to thickets. From Mkwese village to Isuna B, dense impenetrable thickets and seasonally water covered lowlands characterize the area between Mkwese to Isuna B. The characteristic species on thickets include Albizia sp, Grewia sp. This thicket is part of a wildlife corridor joining the Rungwa game reserve further south. On the raised hills, the disturbed Miombo woodland resumes and extends up past Singida town to Misigiri village where it becomes evident forming the Sekenke -Tulya Forest Reserve on Sekenke escarpment between Misigiri and Kibigiri.

Figure 4-12: Human Disturbances (Sekenke - Tulya Forest Reserve)

4.4.3 Sekenke - Shinyanga Section

Sekenke escarpment marks the end of Miombo woodland giving way to acacia woodland degrading into bushed acacia, as it descends into Wembere plain to Igunga. The bushed acacia intermixed with commiphora can be observed from the Igunga district, crossing the rift valley to Shinyanga, where density of baobabs increases gradually, as you move toward Shinyanga. Around Shinyanga the bushed acacia woodland has been degraded to more scrub land with some Baobab tree standing as emergent trees. In large sections of the transmission line much of the vegetation is interrupted by farmland where maize, sorghum and cotton are cultivated.

4.5 Wildlife resources

There are no National Parks or Game Reserves along the route of the transmission line. However, uncultivated areas as bush land and thickets, woodlands and bushed grassland and, above all, (seasonal) wetlands may host a good number of wildlife ranging from small mammals, reptiles and amphibians to large mammals as well as birds, even if they have not (yet) an official protection status and are already partially degraded (the latter is also true for parts of National Parks or Game Reserves).

The new line will traverse the Forest Reserves Nyang'oro, Choda and Sekenke -Tulya, which are designated for community management for sustainable utilization, but not for biodiversity conservation. Nevertheless, the Nyang'oro Forest Reserve is utilized as a corridor for large mammals migrating between Mikumi NP and Mtera Reservoir area especially during dry season; indications therefore are animal's dropping and trails found during the field survey as well as complaints of villagers to local community concerning elephants. Choda Forest Reserve is characterized by impenetrable thickets and seasonally water covered lowland. This thickets form part of the wildlife corridor joining the Kizigo and Rungwa Game Reserves further south. During the field survey in July 2008 complains of villagers concerning attacks of lions against people have been published, and we received warnings from officials.

For the Sekenke-Tulya Forest Reserve actually no specific information on wildlife is available, but by nature forests are also home to a variety of large and small mammals, reptile, amphibians and other wildlife resources. Due to the fact, that the process of forest degrading also in Tanzania is still going on, as harvesting of forest products, like fuel wood, charcoal, building poles, timber, honey, beeswax and even bushmeat are an important economic activity for some residents (even if a forest has a protection status), all additional encroachments to forests areas should be restricted as far as possible.

The new line will traverse also seasonal inundated areas, north-east of Lake Singida and the floodplains of Wembere River and its tributaries; such areas are preferred breeding and feeding habitats of migrating waterfowls. Based on censuses of waterfowls, both areas are recommended as potential Ramsar sites by the NGO BirdLife International (www.birdlife.org, see Annex 2.5). Lake Singida and the nearby situated Lake Kindai are typical alkaline Rift Valley lakes and preferred breeding areas for endangered species, above all the Lesser Flamingo (Phoenicopterous minor, IUCN Red List of Threatened Species). This is also true for Lake Kitangire, some 30 km NE of the site where the line will cross Wembere River; this lake will be affected indirectly, as a main route for migrating birds runs along this River, connecting the southern Wembere swamps with the north-western alkaline Rift Valley lakes. The Wembere floodplain is also a preferred resting place for these birds.

5. Stakeholder Identification and Methods of Participation

Section 89 of the Environmental Management Act (EMA, 2004) and ESIA Regulation 17 (URT, 2005) provide details and procedures for public participation in the ESIA process. The term "stakeholders" has become common in the EIA process and stakeholders' participation is important component of the EIA process. It is one of the key factors that enhance environmental governance. Stakeholders are individuals, groups of individuals or institutions that have interest in the proposed project. This includes those positively and negatively affected by the project. Stakeholder participation involves processes whereby all those with an interest in the outcome of a project actively participate in decisions on planning and management of the proposed development.

In ESIA process stakeholder is given a very broad definition to encompass all different individuals, groups of individuals, government agencies, and beneficiaries, cooperate bodies and all other formal or informal groups associated with a project. The range of potential stakeholders to ESIA was greatly a factor of the definition of the project boundaries but it is important to be 'inclusive' rather than 'exclusive' and ensure that all those who might be affected or affect the project are fully engaged in the ESIA process. Simple methods such as networks diagrams, literature review and interviews were used to identify the range of stakeholders for the proposed development. The list of stakeholders is provided in **Annex 1.1** of this report.

5.1 Methods of Stakeholder Participation

This ESIA was conducted in all villages that the new national grid is expected to go through. Various methods were used in ensuring that all relevant stakeholders are consulted and their views incorporated in this ESIA report. Participatory methods such as focus group discussion, household questionnaires and pubic meetings were used. The team also visited all critical sites and conducted discussions with stakeholders on site to identify their views and concerns. The team also visited the Mtera Hydropower Plant in Iringa to consult the technical people with regard to the project. Specifically the following methodologies were used in undertaking this exercise include the following:

5.2 Notification to Stakeholders

It is important to ensure that stakeholders are well informed prior to undertaking and consultation. Introduction letters were written by TANESCO to all relevant Regional Administrative Secretaries to first inform them about the project as well as secure permission to work in the respective districts. This letters were then channelled to District Executive Director (DED) for the same purpose and to seek appointments to consult the district officials and to undertake the ESIA in the respective villages. Letters from the DED office were then distributed to all relevant villages to secure appointments with village government officials as well as the local communities. The general public was also notified of the project through media that included radio, television and newspapers.

5.3 Household Questionnaire

Household questionnaires were also administered in the villages; the questionnaire intended to obtain baseline information of the affected population. The information was basically on socio-economic issues, land related issues as well as to obtain their views regarding the project, compensation and resettlement. The socioeconomic data will be used in future for monitoring purpose. The household sample was randomly selected but with a focus on households that might be affected by the project.

5.4 Village Public Meetings

To ensure that all villagers are informed of the project, the team conducted public meetings in all affected villages. The team also ensured that women attended and participated in the meetings. The meeting aimed at informing the villagers regarding the project and the impacts that are associated with the project. Villagers were informed of the positive and negative impacts of the project which include loss of land, possibilities of increase spread of HIV/AIDS especially during the construction phase as well as other environmental and social impacts associated with the project. Villagers were also sensitized on their right to be compensated and what is to be compensated if they will either loose land, crops and houses. Villagers were also given an opportunity to ask questions, raise their concerns and provide information to the team on issues such as availability of land in the village for resettlement purposes.

5.5 Official Meetings with Village Leaders

Similarly village meetings were conducted in all affected villages; these meetings aimed at collecting specific data at the village, discussing alternative line routing that can minimize impact as well as identifying sensitive sites/areas such as cultural sites that are within the village or its neighbourhood. A checklist was also administered during these meetings. This meeting also aimed at sensitizing the village leaders regarding how they can handle compensation matters and also to ensure that they will continue to sensitize and inform other villagers who were unable to attend the village public meetings. After each meeting a notice to the public was posted at the village office so that villagers can have an opportunity to contact TANESCO in case of any concern during any stage of the project.

5.6 Meetings with Districts Officials

Meetings were held in all thirteen districts that will be affected by the project. The aim of the meetings was to discuss the project with the district officials and to obtain relevant data and information from the respective districts. Issues of alternative land and compensation were also discussed with the district officials.

5.7 Consultations with Other Relevant Stakeholders

In Dar es Salaam the team also consulted various stakeholders at ministerial and Government Agencies to obtain views at policy level. These included the Ministry of Natural Resources and Tourism - Forestry and Beekeeping Division, the Division of Antiquities, TANROADS and TANESCO. Other stakeholders consulted in Dar es Salaam at this level included the Ministry of Agriculture and Food Security and the Ministry of Lands and Human Settlements. Various mining development companies that are based in the northern parts of the country were also consulted to air their views regarding the project.

5.8 Summary of Stakeholder Issues and Concerns

Stakeholders consulted for this specific development project had various views and concerns. Details of these views and concerns are provided in **Annex 1.2** of this report; however, briefly most of the views gathered from the stakeholders are positive about the project and expect that the project will have a positive impact to the economy of the Nation. However, various concerns have been raised by

the stakeholders, mainly on land and compensation issues.

Discussions from various district officials and those at the village level showed concern, on the way the land acquisition procedure for development activities is undertaken in the country. In most cases local communities are not well informed of their rights as well as the whole procedure. For instance there are other allowances such as disturbance allowance, loss of profits for house/business premises that will be affected are also supposed to be compensated. But because of lack of awareness some local people are denied such payments. During stakeholders' involvement in this assessment, sensitization was also undertaken to ensure that all affected people are aware of what they are supposed to be compensated. Another concern raised by stakeholders with regard to compensation was related to delay of compensation once properties including land and houses have been evaluated and acquired by a developer. "We have experience from the current Dodoma - Shinyanga road project, it took more than two years for us to be compensated," complained local communities of Chikuyu, Ntondo and Isuna villages; it takes a long time even up to three years for one to be compensated. By the time you are compensated the amount of money you obtain does not suffice your requirement due to inflation. Stakeholders were also informed that the land law is very clear regarding time as to when one has to be compensated, and if not compensated on time, the law requires the developer to pay the affected person.

Another issue that was also raised with regard to compensation was on value given to affected properties. It was noted that prices given to crops both seasonal and perennial was very low compared to the actual value of investment cost of a particular crop. Discussions with officials from the Ministry of Agriculture and Food Security revealed that values of crops are supposed to be reviewed after three years, though sometimes this is not the case. The value of bare land was also another issue raised by various stakeholders; most complained that it is very low compared to the actual market value in different areas. Under these circumstances most affected persons end up not being able to buy the same size and quality of land after being compensated. In order to address these concerns some stakeholders recommended the following:

- Review of crop prices for compensation should be conducted every year and should involve relevant District Agriculture Officials. It is important to involve district officials because investment costs of crops differ from one area to another due to variation in physical environment.
- Compensation of land value should include investment cost example preparation of rice/paddy farms one has to invest more compared to preparation of a maize farm.
- Compensation should also consider fertility of land and pay a much higher price to fertile land. For instance price of a land adjacent to a water source v/v a barren land.

This ESIA among other things has also recommend on how best the compensation issue should be undertaken as this will minimize most of the identified impacts associated with the project as well as reduce conflict between the developer and local communities.

Several stakeholders raised their concerns regarding the prospect of increased spread of HIV/AIDS in their villages as well as district as result of the proposed development. World Vision, an NGO that operates in most of the areas covered by the project, were also concerned about this and demanded that efforts to prevent the spread and to intensify awareness amongst the people and workers must be made. In most areas the rate of infection is already alarming, for instance Iringa Region is already very much affected by the rate of HIV/AIDS rating 1st in the country (Ministry of Health 2007). Therefore every measure must be taken to prevent further spread.

Most of the consulted District Council, Municipal officials as well as those at the village level highlighted the importance of the proposed development project to the Nation, Districts and local communities. For instance the officials at Kishapu District support the project with an expectation that the increase of electricity supply will enable the district to be connected to the National Grid. Currently the district is not connected to this important service.

Local communities were also concerned as to when they will directly benefit with such projects. They were quoted complaining that "we are tired of not only providing security to TANESCO infrastructures but also loosing our land for TANESCO project without enjoying the services provided by such infrastructures". Furthermore, several villagers said that "with the proposed increase production of electricity, it is now time for us to have electricity just like other Tanzanians in the urban areas". When asked on the willingness to use electricity most local communities indicated that they are willing, though complained about the cost of electricity connection being a hindrance for them.

The proposed project is expected to affect about 93 villages in 13 districts and 5 regions; however, out of the 93 villages likely to be affected, 16 villages are connected to the National Grid, of which most are in urban areas. Discussions with TANESCO officials revealed that in order to solve this problem, the company is currently implementing a Rural Electrification Project, which aims at an increasing number of villages to be connected to the National Grid.

Other stakeholders mentioned about benefits from the project such as increase of employment opportunity especially for young people though they were concerned that employment may be given to outsiders whilst the local people are left with simple manual jobs; other benefits include emergence of auxiliary activities, increase supply of electricity, revenue to the Nation and benefits that will result due to money from compensation which might improve their standards of living.

Other concerns from villages to be affected by the proposed project are basically associated with where they are going to be resettled in the village because it is not possible to obtain land, they might be forced to go to other villages which will be far from their economic activities and other basic social infrastructures. Though villagers are concerned about loosing their properties, especially houses, they also revealed their willingness to relocate as they recognize the importance of this project to the nation. After understanding what they are actually supposed to be compensated, they found that this is an opportunity for them to build a better house. Discussions with relevant District Land officers indicated that within the districts it is still possible to relocate affected population as there are other villages with enough land. This ESIA team conducted a survey to come up with alternative routes for the project that will minimize number of houses to be demolished by the project.

The developer also needs to take into account that there are other areas that have been planned for development that might be implemented before the actual survey and compensation for this project has taken place. For instance in Bahi; within the proposed site, the district intends to construct a bus stand, though the actual date for implementation has not been determined. Bahi District has also designated large part of the area for the new district headquarters and these issues must be taken into account during the planning of this transmission line in order to avoid land use conflicts.

Private companies working in the mining sector highlighted the benefit of the proposed development project that will solve the lack of electricity for the industries (currently the country's electricity supply does not suffice the demand) and also increase power stability. Investors also revealed that the proposed development project would improve industrial development in Tanzania as well as increase the national income.

Most District Executive Directors such as those of Iramba, Iringa Municipal, Iringa Rural and Kishapu District emphasized the importance of TANESCO facilitating a meeting for the various councillors within each affected district. These meeting would be used as a forum to create awareness to the political leaders who are supposed to continue to sensitise local people on project relevant issues. "Land related matters are very sensitive to local people; likewise they have much trust with their councillors than any District official. If they hear it from their councillors they will appreciate, accept and understand more". This was emphasized by the District Executive Director of Iramba District. Though in some villages councillors participated in the consultative meetings, this report will also recommend to the developer to prepare such forums.

6. Impact Assessment and Evaluation

6.1 Introduction and Rating Scale

The descriptions of impacts and as well as their valuation are grouped in three complexes

- natural resources,
- socio-economic issues and
- health & safety.

All **quantitative** information as well as line routing alternatives (described in Chapter 8.) will refer to the situation **without** mitigation measures (described in Chapter 7) if not otherwise stated explicitly. Ratings are given

- without mitigation measures
- with mitigation measures including line routing alternatives.

The impacts concern the whole project area, but also some aspects are site specific. The quantification and valuation of the impacts will be based on quantitative data as far as available, e. g.

- number of affected houses,
- size of impacted area by type of impact,
- people employed in construction and maintenance in relation to the total number of PAP.

Hence the rating scale will be something between an ordinal and a cardinal scale type. The rating will be from + 5 to - 5 in order to allow a sufficient differentiation of the magnitude of impacts and the assessed effects of mitigation measures.

Table 6-1: Rating Scale for Impacts

+	positive impact
-	negative impact
o	negligible
1	very low
2	low
3	moderate
4	high
5	very high

As the valuation will differentiate between short term and long term impacts, for each type of impact two rating figures are given:

- the 1st figure indicates short term impacts (construction period, normally <1 year)
- the 2nd figure indicates long term impacts (operation period, at least 50 years)

The rating takes also into account the present or common situation in the project area in order to assess the relevance of additional impacts (e. g. with regard to environmental pollution such as dust, noise, traffic accidents, health risks etc.).

6.2 Impact on the Natural Environment

6.2.1 Vegetation Cover

The impact of utmost importance on the natural environment will be the clearance of the wayleave. The wayleave of the existing 220 kV line is 60 m, for the planned 400 kV line it will be 90 m. Where both lines will run parallel, and this will be the case for about 90% (with line re-routing measures 82 %, see Chapter 8) of the overall line length, the total wayleave may be reduced to 130 m. For more details see Figure 2-1 (wayleave scheme). Within this corridor, the land use is restricted: buildings and most infrastructures will not be permitted, as well as all vegetation growing higher than 3 m. In general, people will be permitted to cultivate annual crops.

Additionally, some land outside of the wayleave will be required for access roads from the main road to the line (generally to the angle towers, but due to the topographical conditions occasionally also to other sites along the line), for work camps and substations.

In Tanzania it is usual to clear the entire wayleave of all wild growing trees, shrubs and bushes, and to also repeat this exercise periodically during the operation phase (although for technical reasons this would not be necessary), thus denying any chance for vegetation re-growth on the wayleave.

The total land area affected by the wayleave and the structures mentioned above are presented in Table 6-2. Following these figures, the area affected by changes of land cover and land use is assumed to be about 50 km² of land with diminished ecological functions due to the removal or at least degradation of the vegetation cover. With suitable mitigation measures, these areas may be reduced by 95%. An application of these measures also on areas along the route of the old 220 kV line would rehabilitate another 20 km².

Other impacts by this issue such as loss of land for settlements and agricultural purposes will be addressed in Chapter 6.3. Suitable mitigation measures are described in Chapter 7.

Impact rating: -5 / -5 without mitigation, - 2 / + 1 with mitigation

Table 6-2: Land Occupation for the New Line

	Construction phase			Operation phase		
	ha	ha	%	ha	ha	%
			without mitigation measures			
Way leave	4.914			4.914		
hereof tower construction		86	1,8%		6,3	0,13%
way for inspection/maintainance		137	2,8%		137	2,8%
Outside way leave	39			32		
hereof new access roads		2,8	7,2%		2,8	8,7%
substations		29	75%		29	91%
work camps		7	18%		0	0%
Total land occupation (to be cleared)	4.953			4.946		
Loss for agricultural cultivation		262	5,3%		174	3,5%
hereof without ways/roads		122	2,5%		35	0,7%
Loss for settlements		246	5,0%		246	5,0%
			with mitigation measures [1)]			
Total land occupation	5.110			5.103		
hereof to be cleared				268		
Loss for agricultural cultivation		268	5,2%		183	4,7%
Loss for settlements		147	2,9%		147	2,9%
			difference without/with mitigation measures			
Total land occupation	195		4%	189		**4%**
land to be cleared				-4.678		**-95%**
Loss for agricultural cultivation		6	2%		8	**5%**
Loss for settlements		-99	-40%		-99	**-40%**

[1)] including line routing alternatives

6.2.2 Soil Erosion

In some areas, the soil is vulnerable to erosion due to soil structure, orography, vegetation cover and water regime. Along the line, at least along the stretch from Iringa to Dodoma, some sites with severe erosion problems have been observed, both steep terrain and flat areas exposed to flooding during rainy season, and of course near sandy river banks. This will not only be a threat to the soil in terms of soil loss and degradation, but also a serious danger to the stability of many towers along the existing line. TANESCO is aware of this problem.

Whether these erosion effects have been caused or initiated during the course of the construction of the 220 kV line or not will be left open. In any case, one of the main reasons for human caused soil erosion is construction work including earth movement, removal of the vegetation cover and soil compaction by vehicles and machines. All these activities are associated with the construction of a power line.

Only sensitive planning of access ways and tower sites, careful construction work and adequate mitigation measures may prevent an acceleration of ongoing erosion processes or initiation of new erosion threats in susceptible areas.

Suitable mitigation measures are described in Chapter 7.

Impact rating: - 1 / -3 without mitigation, - 1 / - 1 with mitigation

Figure 6-1: Soil Erosion (near Mlowa Barabarani)

Figure 6-2: Sedimentation (near Mlowa Barabarani)
Tower footing about 1m below the surface

6.2.3 Climate Change, Landscape Aesthetics

Climate change

The removal of the vegetation will have some minor effects on local climate, such as rising of temperature and reduced air humidity. The energy transported will be mainly fed in from hydropower plants. This may avoid or minimize future power production by thermal power plants in the areas served by the new line, causing a considerable contribution towards stabilising CO_2-emissions. Under the following assumptions

- energy transport of about 184,000 GWh within 30 years,
- quota of 65% hydropower of the energy production, and
- price of 100 € per ton CO_2 (the present price for CO_2 emission licences in Europe)

about 2.6 million to/year of CO_2 emissions will be avoided. These emissions have a market value of 260 million €/year, compared with a generation of the same energy by diesel power plants.

This means an impact rating: 0 / + 3 (no mitigation measures)

Landscape aesthetics

Large scale, open or slightly undulated landscapes and areas with quite dense vegetation have a high tolerance for infrastructures, such as transmission lines; most of the proposed line will cross such landscapes dominated by open woodland, bush land and grassland as well as cultivated land with scattered settlements. More sensitive mountainous areas with open and spectacular views will be found at the escarpments of Nyang'oro, Fufu, Kilimatinde and Sekenke and north of Lake Singida. As the new line (with more slender but higher towers) in these areas will generally follow the existing line, the additional impact on landscape aesthetics in these areas will be quite limited. Only near Singida the new line will run far from the old one, so the impact on landscape might be higher, but anyway not serious.

Impact rating: -1 / -1 (no mitigation measures)

6.2.4 Valuable Areas without International Accepted Protection Status

The line does neither cross areas with an international accepted protection status (e. g. National Parks) nor natural habitats in terms of Worldbank's OP 4.04.

About 40 km of the line will cross high valued Forest Reserves covering an area of 280 ha, and another 8 km degraded Forest Reserves of an area of 72 ha, all in all an area of 352 ha. These reserves are designated for community management. Crossing Nyang'oro and Choda Forest Reserves, the new line runs parallel to the 220 kV line, thus widening the existing corridor from 60 m to 130 m width and a length of about 20 km in each FR. The Sekenke-Tulya FR will be crossed at a length of about 8 km. Access of people to the area for poaching and other illegal activities will not be facilitated. Due to the orographical situation (very steep slopes down to Wembere plain) the new line runs about 300 to 600 m north of the 220 kV line, with the former main road T 3 from Dar es Salaam to the north-western provinces in between. So also no new access roads will be necessary. The forest along the old road is seriously degraded and the lower vegetation has been partially burned. It has been emphasized that degradation does not necessarily implicate a serious loss of habitat value and other ecological functions.

Annex 2 presents lists of species (animals and plants) by vegetation types recorded in the project area, including also endangered and vulnerable species. A few observations have been made in the course of the field investigations within or nearby the wayleave. The proposed large scale mapping of the wayleave (essential for selective cutting, see Chap. 7.1, Table 9-1 and Table 10-1) will bring some additional information on the presence of such species. Even if the necessary clearance of vegetation for construction and maintenance purposes may have an impact on such species, this impact will be insignificant, as the proposed mitigation measures, above all revegetating also in the existing wayleave of the 220 kV line, will improve the ecological situation in the project area,. in accordance with OP 4.04, break 3 ("The bank promotes ... the rehabilitation of degraded natural habitats") and break 4 (".. mitigation measures include ... post development restoration"). Hence, a more in depth going investigation on these aspects will be not necessary.

However, some consideration was given to avoid a crossing of the Nyang'oro and Choda Forest Reserves. The line crosses Nyang'oro Hills, strung-out from WSW to ENE. This mountain range, with a very difficult orography, and the northern foothills are covered with open to closed woodland: the Nyang'oro Forest Reserves. An alternative routing with significantly minor occupation of woodland might be possible some 15 km WSW of T 151 of the existing 220 kV line with a length of about 30 km between T 68 and T 151 and an additional occupation of 60 ha of not or only scarcely populated land and opening a new but some km shorter corridor across the woodland. It may be doubted that such an alternative would have a less severe environmental impact.

A bypassing of the Choda Forest Reserves with a less severe ecological impact than the proposed routing solution is not possible, as for many km on both sides of the existing line there will be not much more as impenetrable thicket and swamp.

Seasonally inundated areas will be crossed with a length of about 3 km near Lake Singid, and in the Wembere floodplain with a length of 20 to 40 km. The natural vegetation cover in both areas is predominantly open grassland, actually mostly cultivated with herbaceous crop (see Figure 6-3**,** Figure 8-11 and Figure 8-12). The line construction work in seasonal wetland areas will be done during time periods when the areas concerned are drought out. So, no change of the habitats will occur, no clearance of high growing vegetation will be necessary, and no harm to waterfowls may be expected during construction time. Both areas are recommended as Ramsar sites by the NGO BirdLife International (see also Chapter 6.2.6 and Annex 2-5).

Suitable mitigation measures are described in Chapter 7.

Impact rating: -3 / -3 without mitigation, - 2 / + 1 with mitigation

Table 6-3: Allocation of Valuable Habitats (Forest Reserves and Wetlands) along the Line

	Forest Reserves					
	Nyang'oro		Choda		Sekenke-Solya	
	from	to	from	to	from	to
UTM Coordinates N	9.182.000	9.196.000	9.381.000	700.000	9.515.000	9.516.000
E	803.000	801.000	9.400.000	696.000	648.000	639.000
Line stretch (LCLU Maps)	Iringa	Manzase	Muhalala	Ntondo	Ntondo	Ibadakuli
Towers	T130	T170	T317	T362	T184	T206
next villages	Nyang'oro	Izasi	Mkwese	Isuna A	Misigiri	Kibigiri

	Wetlands (Seasonal Inundated)				
	Lake Singida		Wembere Floodplain		
	from	to	from	to *)	
UTM Coordinates N	9.468.000	9.475.000	951.400	9.529.000	9.544.000
E	698.000	698.000	618.000	604.000	590.000
Line stretch (LCLU Maps)	Muhalala	Ntondo	Ntondo	Ibadakuli	
Towers	routing alternative		T260	T308	T360
next villages	Misuna	Mtipa	Mseko	Mbutu	Imalanguzu

*) final demarcation in the next project phase (see ESMP)

Figure 6-3: Wembere Floodplain (near Mgongoro)

6.2.5 Diversity of Habitats and Species, Wildlife Barriers

Opening and enlarging corridors in closed woodland, thickets and closed bushland may have some influence on the diversity of habitats and species in the area concerned, mainly for birds and small mammals, as the open space will attract non-bushy/forest dependant species. Other species will have a minimum size requirement for their habitats, so a partition of their habitat area might lead to their

disappearance. On the other hand, this open space may provide a barrier as some migrating animals (seasonal migration, daily migration between feeding and sheltering habitats, etc.) are reluctant to cross open space areas. Some of these impacts will be directly opposed.

The new line will cross valuable habitats as mentioned above with a total length of about 90 km, hereof 78 km running parallel to the existing line. The rest of about 12 km will cross closed woodland as a single line:

- within Sekenke-Tulya Forest Reserve, which is seriously degraded in this part (see the preceding chapter), with a length of about 8 km, and
- along the routing alternatives Mtera and Bahi with a total length of about 4 km (see Chapters 8.2.2 and 8.2.4 as well as Table 8-2).

Hence, really new corridors will be opened with a length of 4 km only.

Long-term experiences in National Wildlife Parks demonstrate that even remarkably frequented roads will not cause barrier effects for wildlife. So much the less it will be quite unlikely that a transmission line with an open space of less than 10 meters width a ground distance of at least 8 meters will cause such an effect. So these impacts may be of minor or even no significance at all.

Where the line will cross seasonally inundated wetland, the land use and vegetation cover will not be changed. As these areas are already used for livestock grazing or crop cultivation, the terrestrial habitat for waterfowls will not be changed.

Disturbances due to equipment noise and vibration at the construction site will last only some days or a few weeks. Following long term experience in wildlife reserves, there is no reason to assume that these disturbances will have any remarkable impact on wildlife behaviour.

Impact rating: -1 / 0 without mitigation, - 1 / 0 with routing alternatives (no mitigation measures)

6.2.6 Collision of Birds with the Transmission Line

Collisions will be a major cause of unnatural mortality for several species of threatened birds. The species most affected by collisions with wires are bustards, storks, cranes and various species of water birds, as they will be mostly heavy-bodied birds with limited manoeuvrability, which makes it very difficult for them to take the necessary evasive action to avoid colliding with transmission lines. Recent studies in South Africa (Anderson 2001) as well as in Iceland (Haas et. al. 2008) found that collision risk will rise with the voltage and the number of conductor levels. The utmost highest collision risk will be for large terrestrial birds where the earth wires are mounted ahead of the conductors. Some 80% of bird collisions happen at the earth wire. Birds migrating nightly will be the most endangered, as they cannot see the earth wire and may collide with it when trying to avoid collision with conductors, noticeable e.g. by the electromagnetic field.

The line stretches with the utmost highest collision risk will be in or near the seasonal inundated wetlands north-east of Singida and the Wembere floodplain, as there the line will cross known flight corridors of protected waterfowls. Suitable mitigation measures are described in Chapter 7.

Impact rating: 0 /-4 without mitigation, 0 / -2 with mitigation (operation phase only)

6.2.7 Hydrocarbons

Hydrocarbons pose a severe risk to surface and ground water sources when released into the environment: 1 litre of oil may contaminate 1 million litres of drinking water. Fuels and lubricant used for operation and maintenance of vehicles and machinery have to be transported, stored and used. These activities will pose a certain risk of accidental discharge of hydrocarbons to the environment. Sites prone to such events will be the work camps with storage and maintenance facilities and activities, and the sites where tower construction takes places and therefore vehicles and engines have to be refuelled. This potential impact will be temporary and will cease with the end of the construction phase.

At substations substantial amounts of hydrocarbons will be stored and used for transformers and capacitors. The risk of oil spill at the substations is a constant negative impact with low probability but high potential damage. Suitable mitigation measures are described in Chapter 7.

Impact rating: -2 / - 2 without mitigation, -1 / -1 with mitigation (construction phase only)

6.2.8 Waste and Wastewater

Work camps, substations and construction sites will be sources of scrap metal, oil contaminated waste, and household waste. It is usually "good practice" of serious contractors to collect, recycle or depose these wastes at designated facilities.

About 80% of the labour forces will have their accommodation within the work camps. Sewerage systems are not common in the villages affected by the line, but pit latrines. The temporal presence of 250 people in a larger village or smaller town will cause no relevant additional environmental pollution, if the work camps will use the same method. This is likewise a "good practise" for serious contractors.

Hence, there will be no relevant impact on environment from these potential pollution sources.

Wastewater from repair shops and washing places may be contaminated with hydrocarbons (oil, lubricants and solvents) and will occur also in the operation phase (Substations). Suitable mitigation measures are described in Chapter 7.

Impact rating: -2 / - 1) without mitigation, 0 / 0 with mitigation (construction phase only)

6.3 Socio-Economic Impacts

6.3.1 Housing

The most important negative social and economical impact will be the necessary removal of houses affected by the wayleave. Following the results of the field survey performed and the subsidiary counting of houses from satellite images about 840 houses (initially 1,300 houses, see Annex 4.1) will be affected by the wayleave and will therefore have to be removed. This refers to the following line sections:

- 180 houses between Iringa and Dodoma, i.e. 0.8 houses / km,
- 216 houses between Dodoma and Singida, i.e. 1.0 houses / km and
- 442 houses between Singida and Shinyanga, i.e. 1.9 houses / km.

It has to be emphasized that in the course of field investigations no inquiries of the type of use of the

identified houses has been performed. This will be the task of the valuation process, which may start after the geodetic demarcation of the final line route (see Chapter 2.5.1). It can be assessed by experience that in urbanized areas about 50 to 65% of the houses are residential houses, whereas in rural areas this ratio ranges from 25 to 40%. Hence, the total number of affected households may amount to 30 to 40% of the houses named above, i.e. 250 to 340 households out of 840 houses.

Some line routing alternatives developed and explored in the course of field investigations as well as afterwards on the basis of the collected information and secondary sources (above all satellite images), will spare a considerable portion (36%) of the initially affected houses (see Chapter 8). As most of houses which will be spared are located in more urbanized areas (see Annex 4.2) with a lower ratio of houses by household, at least 50% of the affected households can be spared.

Most of the settlements affected have developed in a linear structure along the existing line. Such an infrastructure often plays the role of a development axis. In such areas there will be no problem shifting the houses, i.e. to construct a new house on the same plot nearby, and people will be able to continue their farming and livestock keeping activities as usual. But some villages will be quite restricted in this regard due to topographical reasons (e. g. in Puma) or due to the fact that the settlement has developed two-dimensionally (e.g. Mtera, Mkonze, Bahi and Misuna).

Suitable mitigation measures are described in Chapter 7.

Impact rating: - 5 / -5 without mitigation, -2 / -1 with mitigation

6.3.2 Public Infrastructures and Services

Some public infrastructures, such as schools, churches, mosques, water supply structures etc., either existing or planned, have been identified and allocated within the wayleave. Such items found in the course of field investigations are listed in Table 6-2. The proposed line routing alternatives will avoid the demolition of 50% of these infrastructures (see Chapter 8). According to World Bank objectives, the original condition has to be improved in the course of a reconstruction of demolished infrastructures.

Social services such as dispensaries, water supply schemes, and accommodation facilities do not exist in most of the settlements along the line. In smaller villages with a work camp there would be some pressure on existing services in case these are in poor condition and inadequate. This might create some social stress in terms of conflicts regarding the use of resources.

However, the site selection for work camps will be done by the contractor in close cooperation with TANESCO as well as the relevant authorities on local and District level. Normally, the work camps will be located close to towns or larger villages (see Chapter 2.3.1). According to information from TANESCO; the sites near the existing substations and adjacent to permanent staff quarters may be used as construction camps as well as camps for the accommodation of the workers. As this will be possible for 5 sites (Iringa, Mtera, Dodoma, Singida and Shinyanga), only one or two new sites might have to be found and probably located close to Manyoni town which has some 25,000 inhabitants and Igunga (some 16,000 inhabitants). Hence, the above-mentioned social stress might be very limited

Suitable mitigation measures are described in Chapter 7.

Impact rating: -2 / -2 without mitigation, - 1 / + 1 with mitigation

Figure 6-4: Affected Secondary School (Tumuli)

Figure 6-5: Affected Church (Mgongoro)

Table 6-4: Affected Infrastructures

Village	District	Affected Infrastructures	Alternative
Nala	Dodoma Municipal	water tank with pipes and tap, primary court, weighbridge	yes
Bahi	Bahi	church, mission, secondary school	yes
Lusilile	Manyoni District	toilets of primary school	no
Nkunikana	Singida Rural	small secondary school under construction, small mosque	no
Puma	Singida Rural	watertower	yes
Misuna	Singida Rural	dispensary	yes
Mnung'una	Singida Rural	small dam + cattle soaking structure	no
Ntondo	Singida rural	small mosque	no
Tumuli	Iramba District	larger secondary school	no
Kyengege	Iramba District	boreholes, well, water pipes	yes
Kitukutu	Iramba District	boreholes, primary school, secondary school	yes
Kitusha	Iramba District		yes
Mgongoro	Igunga District	small church, small mosque	no
Planning Conflicts (to be negociated)			
Ulyampiti	Singida Rural	village office / dispensary planned	no
Kipumbwiko	Singida Rural	secondary school planned	no
Misigiri	Iramba District	town development area	yes
Kizonzo	Iramba District	village market planned	no

Source: Field Survey 2008

6.3.3 Land Use

6.3.3.1 Settlement areas

Due to the fact that no buildings will be permitted within the wayleave, some areas potentially suitable for settlements will be lost. Counting the area within settlements or near settled areas, about 34 km of line will be affected, i.e. 250 ha of potential settlement area will be lost. Additionally, there are a few areas which will be sandwiched, which means that land will be dissected between linear infrastructures as power lines and / or traffic lines. Such sandwiched areas will have reduced value for the construction of residential houses, if the remaining area is too small for this purpose. A reasonable limit size between the wayleaves of such infrastructures may be some 100 m. Such a situation will occur e.g. at Igumbilo, Makatapora, Mlowa, Solya, Manga, Kibigiri and Kizonzo (without mitigation measures). With suitable mitigation measures, the occupation of potential settlement areas will be reduced by 40% (see Table 6-2), and sandwiching will be avoided in 5 out of 7 villages mentioned above.

The issue of scarcity of land for resettlement was raised only in villages close to larger cities, i.e. in

- Igumbilo (no more affected after re-routing) and Kigonzile near Iringa
- Mkonze near Dodoma
- Misuna and Puma (the latter due to topographical reasons) near Singida, and
- Ibadakuli near Shinyanga.

Suitable mitigation measures are described in Chapter 7.

Impact rating: -3 / -3 without mitigation, - 2 / -2 with mitigation

6.3.3.2 Cultivated areas

Agricultural use of the wayleave area is generally tolerated (but not formally allowed), as long as the height of plants does not exceed 3 m. Hence, the area lost for cultivation will be limited to areas needed for work camps, substations, tower foundations, access ways and the ways for inspection and maintenance along the line, altogether about 262 ha during construction time, and 174 ha during operation time (see Table 6-2). Taking into account that access roads and ways will be useful (and also used) for agricultural purposes, these losses will be reduced to 122 ha during construction time and 35 ha during operation time. The benefit the farmers will have from using the new ways / roads for their purposes may reduce or even over-compensate their losses in the long term. The rating below will also take into account the loss of field crops in case the clearance of the wayleave takes place during the vegetation period.

Suitable mitigation measures are described in Chapter 7.

Impact rating: -3 / 0 without mitigation, 0 / 0 with mitigation

Figure 6-6: Affected Fertile Fields (near Mlowa Barabarani)

Figure 6-7: Wayleave Not Used for Agriculture (near Fufu)

Figure 6-8: Wayleave Completely Cleared (near Mtera)

6.3.4 Cultural Heritage

A lot of graves and even graveyards, altogether more than 200 graves, have been found inside the wayleave of the existing line (altogether about 40%, some even established after construction) as well as of the new line. Graveyards and larger agglomeration of graves have been observed at

- Kising'a (Iringa Rural) 25 graves
- Ikungi (Singida Rural) larger graveyard
- Kibigiri (Iramba) 30 graves.

Obviously, TANESCO tolerates these graves. Hence, there will be only a very limited risk that a handful of these graves may have to be relocated for technical reasons, i.e., that just the site of a grave will be required for a tower construction, as the distance between the towers is quite variable (+/- up to 100 m). Beliefs and traditions in the project area allow graves to be relocated if it is done in a culturally sensitive way. Suitable mitigation measures are described in Chapter 7.

The proposed transmission line may also affect other cultural sites. Neither did the field survey show any indication for this, nor did contacts with the Antiquities Department. Discussions with this authority highlighted the importance of conserving any archaeological feature that will be found within the wayleave. More detailed investigations on possible archaeological or paleontological sites will be part of a field survey in course of monitoring.

Impact rating: -1 / -1 without mitigation, 0 / 0 with mitigation

Figure 6-9: Grave within the Wayleave (Solya)
(Built 2003 in the wayleave of the existing 220 kV line)

6.3.5 Employment and Income Level

The contractor will employ local people living in the neighbourhood of the project area to work as casual labourers. However, a rough estimation shows that on the average not more than 0.5 workers out of 1,000 people living in villages along and near the transmission line will get a job for a 2-years-term. The recruiting of local workers is the responsibility of the Contractor, as he will be responsible for the working schedule, quality of the work, budget, safety etc. A work camp will serve about 250 employ-

ees; but only about 20% are supposed to be recruited locally.

Besides direct part time employment, other temporary job opportunities will be possible such as the provision of small commerce and services, e.g. sale of agricultural and livestock products. It is also expected that TANESCO will enter into an agreement with local communities for clearing the wayleave as well as security services. Discussions with local communities revealed that there is currently such an agreement, although there were complaints that wages were sometimes delayed or not paid at all.

The net income per month per worker may be assessed at 150.000 TSh. Assumed that about 50% hereof will be spent locally, and taken into account the regional income level per household (see Annex 4.7), the income level in the project area as a whole will be raised by 1% for two years.

Altogether, the effects on employment level as well as on the average income will be minor. Suitable mitigation measures are described in Chapter 7.

Impact rating: +1 / +1 without mitigation, +1 / +1 with mitigation

6.3.6 Complaints of Stakeholders

The surveys performed in the villages concerned showed that most people do not see the proposed project as a benefit to them. Basically, the discussion focussed on the sentence "We only see the towers and the transmission line going through our villages and we provide security services to this very important infrastructure, but we don't have the opportunity to utilize this service".

Another big issue was complaints about compensation practices, often as experiences during the construction of the existing 220 kV line some 20 years ago. For more details see Chapter 5.8.

Some stakeholders consulted are concerned that the value of their land might decrease due to the presence of towers close to their houses, land or even place of business. Other stakeholders were concerned about being "sandwiched" between two power lines or between the lines and the road. At Misuna village, near the Singida Substation, the District Land Officer had difficulties offering title deeds to some of the landowners simply because the piece of land that is owned by these individuals lies between two existing transmission lines. Although this area is not within the TANESCO wayleave, the land office still categorizes the land as a risk area especially with regard to health implications.

Most of the stakeholders were concerned about how the graves will be compensated, i. e. that they may not be included in the process of relocating the graves and their culture and values may not be taken into account.

It has to be emphasized, that there is no proof that complains of stakeholders always have a factual background. The complains concerning grave relocation do not match with the fact that such new graves and even graveyards have been established in the wayleave of the existing 220 kV line, Chapter 6.2.4 and Figure 6-9).

Suitable mitigation measures are described in Chapter 7.

Impact rating: -3 / -3 without mitigation, -1 / -1 with mitigation

6.4 Impacts on Safety and Health

6.4.1 Noise, Dust and Vibrations

During the construction phase, activities, such as excavations, blasting, movement of vehicles and the operation of heavy machinery will cause noise, vibrations and dust emissions which may have impacts on people living nearby access roads as well as in the neighbourhood of the construction site. However, these nuisances will be short-term effects restricted to day time and a period of some weeks along distinct line stretches of a few km,, mainly around the tower sites and the access roads. Blasting will only be necessary very rarely, in average only 1 blasting per 5 km line, due to the geological conditions along the proposed line. Traffic movements may be estimated to 50 movements per day.

Compared with the usual background noise and dust levels along roads, the additional nuisances caused by construction activities will not be perceptible to people but only to instruments. What will be perceptible will be the presence of additional traffic as well as short term noise and vibration impulses, both having a more psychological effect.

Another noise source during the operation phase will be the transmission wires: the electromagnetic field of high voltage lines will cause a „buzzing" named corona noise, to be heard mostly within the wayleave only, especially during high air humidity in the rainy season.

Suitable mitigation measures are described in Chapter 7.

Impact rating: -1 / 0 without mitigation, -1 / 0 with mitigation

6.4.2 Electrocution

The transmission towers are often seen as a challenge for playing kids. The extreme danger connected to this activity is often not understood or respected by adventurous youngsters. This impact is relevant to all places where the transmission line is found close to inhabited areas and in particular in areas where the population has a low level of literacy. On the other hand, it would be a major effort to climb up the towers near the conductors, even for adventurous youngsters. As the new line runs parallel to the existing line about 82% (initially 90%) of the line length, most villagers will be familiar will such an infrastructure and its inherent risk. A statistic on electrocution cases is not available.

Impact rating: 0 / -1 (permanent risk)

6.4.3 Electromagnetic Fields

There has been a lot of public concern related to suspicions that the radiation of the electromagnetic field (EMF) created by power lines and substations might cause serious health impacts on people living or working close to such structures. A number of health problems have been claimed to be caused by EMF. The focus has in particular been on the alleged excess frequency of leukaemia with children living near power lines. Several institutions and countries have developed guidelines and standards for exposure to EMF, referring to the recommendation of the International Commission on Non-Ionising Radiation Protection (ICNIRP) accepting a magnetic field of 100 micro Tesla (µT). To scrutinize such recommendations will be surely not the job of TANESCO. Therefore, TANESCO's Engineering Instructions take this view and assume that there will be no impact or risk for people outside the wayleave.

Some serious organisations as well as industrialized countries are more cautious, e .g.

- EPA (Environmental Protection Agency, USA) recommended a limit of 0.2 µT, following the rec ommendations of IARC (International Agency for Research on Cancer, sub organisation of WHO) in 1996
- Sweden also requests 0.2 µT for kindergarten and schools
- WHO classifies 0.3-0.4 µT as a potential cancer risk, following the TCO-norm for e.g. computer work places.

Some epidemiological studies performed in Sweden and recently (2002) in Japan indicate a raised rate of children's leukaemia for levels higher than 0.2 to 0.4 µT.

It has to be taken into account that ICNIRP

- is a private organization not authorized by any government or UN organization (also not by WHO)
- accepts only the effect that EMF may warm up the tissue
- neglects the basic fact (known since 1935) that EMF may interfere with biological systems working within the same frequency band, e. g. the human brain, the nervous system and cellular processes including cell division (the latter effect might explain the raise of children's leukaemia).

Therefore, the precautionary principle should be applied, which means that the field strength should be kept as low as technically possible and economically reasonable, as the scientific community as well as governmental organization still have very different opinions about the maximal acceptable field strength: the legal limits in European countries vary by a factor of at least 500 (see above).

The strength of the magnetic field depends within a broad range on the configuration of the conductors (spacing and AC- phases), the operational mode (e.g. load) of the line and the distance from the line. According to literature, the magnetic field strength at a distance of 50 m from the centre of a 380 / 400 kV line may range between 2 and 8 µT.

Impact rating: 0 / -1 only during operation phase

6.4.4 Accidents

With some exceptions, the transmission line will run not far from the Principle Main Road Iringa-Dodoma-Singida-Shinyanga (T 5 / T 3), which already today has a remarkable traffic volume of heavy trucks. The additional traffic induced by construction works may be assessed at 50 - 100 movements per day raising the existing traffic volume by a few percent only. The risk of traffic accidents may be assessed (due to experiences from similar projects in Eastern Africa) to 2 to 5 accidents per year.

Working accidents may be assessed (by experience again) to amount to 5 accidents per year and 100 km of transmission line, generally affecting workers employed in the line construction and very rarely people from the population around the construction site.

Issues of concern associated with construction work include traffic accidents. However, the rate of traffic on the access road for construction vehicles and other cars may be estimated to be around 50 movements per day, with a concentration during peaks in the morning and in the evening, and during a time period of about 3 weeks to 2 months. With these estimates, it is possible that fewer accidents - about 2.5 per year may be recorded and about five accidents per year associated with the work itself. These estimates however are based on conventional practice and may be subject to variations.

Compliance with national as well as international Health & Safety regulations belongs to the contrac-

tual obligations of the contractor, therefore additional mitigation measures will be not necessary.

Impact rating: -1/ 0 only during operation phase

6.4.5 HIV/AIDS and Other STDs

The possible influx of workers, recruited for the construction of the transmission line, and people looking for work could create a new social situation for a short period of time in the project area, before they move away for the next section of the line. This could increase the risk for an accelerated spread of HIV, AIDS and other STDs. Experience has shown that work force influx has often increased the problem of HIV/AIDS, as single men earning money and local girls struggling for their livelihood will be a risky combination. Even if these contacts between external workers and local people are of temporary character (some weeks) they may lead to permanent impacts as increased HIV/AIDS rates or children born out of these brief social relationships.

The magnitude of this increased risk will depend on the number of people that migrate into the project area. The number of workers needed for the construction of a certain line stretch may be estimated to be maximally about 120 people; hereof some 20 to 25% will be recruited from the neighbouring villages. The resultant in-migration into the project area is therefore expected to be limited, taking into account that in average about 10.000 people live within a distance of 10 km from the construction site. 85% of the villages with 97% of the population concerned are located along or near the Principal Main Road Iringa-Dodoma-Singida-Shinyanga. Hence the contact with travelling people will be a daily experience for the villagers.

Suitable mitigation measures are described in Chapter 7.

Impact rating: -3 / -3 without mitigation, -2 / -2 with mitigation

7. Mitigation Measures

Remarks

Some mitigation measures may concern different aspects resp. subsections. In order to avoid repetitions, cross-references will be used.

In respect of potential impacts by technical equipment, working conditions, operation methods, handling of hazardous substances etc. on health, safety and environment, the contractor has to comply with a lot of national regulations from his home country and his guest country as well as from the donating organizations. There is neither the necessity nor is it within the scope of this report to deal with these regulations here again, which will be, by the way, not always consistent. Therefore, the statements concerning these aspects will not present any details.

7.1 Natural Environment

Vegetation Cover

- Clearing of the wayleave should be selective: vegetation should be cut only to the extent absolutely necessary for construction work, inspection and maintenance purposes and security, in terms of the area to be cleared and the admissible height of the remaining vegetation.
- If possible, the initial clearing as well as further pruning in the phase of operation should be done manually instead of using heavy machinery. This will reduce unnecessary large scale trampling of vegetation as well as soil compaction and will give some people a permanent job.
- Where both transmission lines will run parallel, and this will be the case along 82% of the new line (including all routing alternatives), the chance to use a single common way for inspection and maintenance should be examined.
- After finalisation of construction work, areas not needed anymore should be revegetated / reforested as far as the line security is not impeded; that means, that the ways for controlling and maintenance will be kept free from all vegetation for a maximum width of 2 - 3 m; plant only vegetation which does not grow higher than 3 m in the core area due to the site-specific conditions and the swing-out of the conductors; use indigenous species.
- Permanent loss of vegetation should be compensated by adequate planting activities (and permanent maintenance) in neighbouring areas, especially for species that are rare or endemic.
- These measures should also be performed in the wayleave of the existing 220 kV line, above all, where both lines are running parallel crossing undisturbed areas and valuable habitats.
- Forest authorities in the areas concerned should devise ways to increase protection of the areas in collaboration with local communities.
- Reforested and revegetated areas and areas with natural succession have to be protected against (over)exploitation; therefore TANESCO should engage and adequately pay the village administration.

It is safe to say that these measures will more than fully compensate the project related impacts on vegetation cover and herewith related impacts (e. g. on Forest Reserves and valuable habitats).

Soil Erosion

- Sensitive planning of access ways above all in susceptible areas, careful construction work as well as adequate mitigation measures have to be performed; if possible, access ways have to be recultivated after the construction phase.
- Use of heavy machinery in the clearance of the wayleave should be avoided in order to minimize soil compaction, which makes the soil susceptible for erosion.
- Use better gabions instead of stone walls; stonewalls will often increase the erosion risk nearby

and may become instable, whereas gabions will be covered with vegetation in the long run.
- In areas prone to soil erosion suitable sediment binding grasses such as Cynodon dactylon, Pennisetum clandestinum, Cenchrus ciliaris, Chloris roxburghania and Eragrostis superba have to be planted in degraded substrates. in the long term, the natural vegetation cover should be reconstituted. The plantations will have to be preserved against grazing during the first years; charge people or administration for suitable surveillance.

Climate Change and Landscape Aesthetics
- No mitigation measures are recommended.

Valuable Areas without International Accepted Protection Status, Habitats and Wildlife Barriers
- The measures 1 to 8 recommended in the subsection "vegetation cover" will be mandatory in these areas to rehabilitate degraded natural habitats; see also measures 15 to 17 below.
- The contractor shall be obliged to prevent poaching by workers.

It is safe to say that these measures will more than fully compensate the impact on these areas.

Collision of Birds with the Line
- Minimise the number of conductor levels taking into account also the 220 kV line where running parallel; this will require a different type of towers for the concerned line stretches.
- The vertical distance between shield wire and the highest conductor shall be as narrow as possible.
- Fitting of flapper devices on the shield wires will make them more visible and reduces collisions by over 80%, following an ESCOM study concerning the Eastern Cape Region of South Africa

These measures are mandatory where the line crossing the wetland areas named in Chapter 6.2; In the Wembere area, where the old and the new line will run parallel, this measure should be realized also along the old 220 kV line.

Hydrocarbons
- Construct and use oil resistant sealing of all surfaces in the camps where hydrocarbons (fuels and lubricants) are permanently handled and stored; these areas have to be sheltered and protected against storm water
- Store hydrocarbons in oil resistant containments in the field, refuelling of vehicles and machines in the field should be done using portable oil collection pans only.
- Use well-maintained equipment and good environmental practices during construction and operation in order to reduce the risk of hydrocarbon pollution; this will be mandatory when operating close to or in areas of special ecological value or close to water bodies and ground water sources used for drinking water.

Waste
- Collect separately materials suitable for recycling and composting. Other not hazardous wastes have to be deposited at specific landfill sites already used for this purpose in compliance with Tanzanian regulations. No open air incineration should be allowed at all (even if this is common for all kinds of waste).
- Hazardous materials to be handled properly and far away from water bodies, hazardous wastes have to be brought to facilities, which are officially approved for the treatment of such stuff, or at least exported to such facilities in industrialized countries.

7.2 Socioeconomic Issues

Housing and resettlement

- The most important mitigation measures for impact on private houses will be the development of alternatives in line routing in order to reduce the number of effected houses; this has been done already (see Chapter 8)
- Compensation of all assets and grievances to the project affected people as well as to the villages concerned.

More details on compensation will be presented in the Resettlement Action Plan.

Public infrastructure

- Compensation should be paid early enough in order to allow the construction and commissioning of a suitable alternative prior to demolition of the facility or infrastructure
- All procedures for valuation, compensation and reallocation of any affected public infrastructure should be participatory i.e. involve responsible village authorities, local people and relevant district authority.

More details on compensation will be presented in the Resettlement Action Plan.

Land use

- Clarify that every use of the wayleave area will be allowed as far as security, inspection and maintenance issues are not hindered; develop a negative catalogue of activities forbidden in the wayleave
- Compensate individuals whose properties will be sandwiched
- Compensate fairly and timely the households loosing land.
- Work camps (equipment yards and workers' camps) no longer needed for construction purposes shall be cleaned and then transferred to the village administration for further use.

More details on compensation will be presented in the Resettlement Action Plan.

Cultural heritage

- Compensation of graves to be removed should include all expenses related to the relocation such as for ceremonies and labour in connection with exhumation and reburial
- Beliefs and traditions should be taken on board, as the practices of relocating graves differ from one tribe to another or even from one religious denomination to another.
- Report relevant observations during exploration and construction work immediately to the Antiquity Department
- Interrupt the work at the sites concerned and not restart without approval from the Antiquity Department.

More details on compensation will be presented in the Resettlement Action Plan.

Employment

The expected level of local participation in the workforce will be not satisfying. The contractor should be encouraged to raise this level as far as possible on several reasons:

- Villagers already perceive that T-lines do not provide much benefit to the communities through which they pass;
- Creating a climate of goodwill for the project will also contribute to better safety for it; and
- Land clearing will be done selectively and, as far as possible, without heavy equipment, i.e., by labour-intensive means, for which local citizens in this generally agricultural area already possess the necessary skills.

Complaints of Stakeholders

- As mentioned in Chapter 6.3.6, one major complaint of the project affected people and village ad-

ministrations was that they will not participate at the benefits of electrification. The following description may be taken as an example for an adequate, very fast and very cheap response to this complaint:

- The technique of deployment of shield wire systems (SWS) will be best suited for rural electrification in sparsely populated territories traversed by HV transmission lines, and is best implemented with the construction of new transmission lines. In SWS, the sky wire which normally is firmly connected to the grounded steel tower body is now insulated from the tower body for MV operation. The insulated shield wire is energized at a level between 20 kV and 34 kV from the sending high voltage substation; take-off towers are erected at points close to human settlements for this power and fed into regular distribution networks within the settlements. The SWS uses earth return so that when one shield wire is installed on the HV transmission system, a single-phase supply is possible. Where there are two shield wires on the transmission tower, a three-phase supply can be provided.
- The most significant deviation of SWS from the conventional MV system is the installation of an interposing transformer. Other minor equipment with special specification/requirements includes lightning arrestors, capacitors and the insulators with arcing horns. SWS has a higher phase to ground voltage than the normal MV system. This requires a nominal increase in equipment insulation of about 20 percent. The SWS replaces the MV sub-transmission line with an overall cost saving of around 85%. The load-carrying capacity of the SWS using the smaller 76 sq mm ACSR shield wire is in excess of 9 MW. The load-carrying capacity at a distance of 100 km is about 4 MW. It has been computed that at the extreme distance of about 150 km from the sending substation, the capacity of the SWS is limited to about 3 MW.
- An electrification of affected villages will reduce the resistance against the HT line as well as vandalism as the villagers will identify themselves better with this new infrastructure. But first of all, this electrification will boost the local and regional economy, the value of houses and areas suitable for settlement, the employment and income level as well as tax revenues and hereby also the means for improvement of public and social infrastructures. All in all, the positive effects of rural electrification will by far over-compensate the losses and grievances of the villages and the broad majority of the villagers.
- Other complains not yet mentioned above:
  - Ensure that affected persons as well as the village government are paid their compensation fairly and in a timely manner in order to minimize conflicts with communities as well as with TANESCO.
  - Village government should exercise open and transparent use of payments from TANESCO for their services and other services for the control and maintenance and the wayleave
  - Memorandum of Understanding between TANESCO and village government should be simple, understandable and fair.

7.3 Health and Safety

- The contractor shall be obliged to apply the best practices regarding health and safety for the workers and population in the project area.
- Potentially dangerous construction sites shall be fenced off and guarded so that people are prevented from entering.
- Provision of safety gear and equipment to the workers such as helmets, gloves, protective boots, goggles and hearing protection.
- Warning signs shall be put up around the construction sites.
- Moisturize open surfaces when and where high dust emissions are observed.
- Select sites for work camps (for storage and handling of materials as well as for workers accommodation) in close cooperation with the villages and district authorities
- Accommodation camps shall have a reliable supply of safe drinking water as well as proper sani-

tary facilities such as latrines and showers, look for alternative sources of water in areas that have no water or limited water.
- Establish mobile hospital services that can be used by the workers while on site.
- A proper first aid and referral system shall be set up to stabilise patients and transport them to a good standard hospital.
- Periodic medical examination should be performed on all workers.
- The contractor shall be obliged to train his drivers in respect to careful driving behaviour.
- The contractor will be required to prepare and present for approval by TANESCO a Health, Safety, Environmental and Social Plan (HSES) that shows how management measures will be implemented.
- Ensuring cooperate responsibility TANESCO may share/provide social services that will be established during construction phase with local communities concerned.
- Raise payments to local people for provision of security services; this will be an incentive to local people and village governments.
- Districts shall improve existing social services in villages with work camps.

HIV/AIDS

There will be two groups with higher risk for HIV/AIDS infection: the workers (about 300 - 400 men) and the villagers with some 100,000 female people in the critical age. Considering this enormous numerical difference and the facts, that

- the construction site will be changed nearly weekly, and
- the non-local workers will return every evening to their work camp
- it seems to be the most efficient strategy to concentrate awareness and information campaigns on the group of workers and the villages / cities, where the work camps will be established. However, awareness campaigns should be performed in all villages along the line. The contractor shall be obliged to test all workers periodically on HIV/AIDS, to oblige them to participate at periodical information meetings, and to offer them condoms for free.
- District councils, NGOs/CBOs and TANESCO should continue to inform workers and local communities on HIV/AIDS pathways that cause the spread of the disease.
- NGOs should perform awareness campaigns, establish and support voluntary counselling and testing centres for HIV/AIDS as well as encourage local people and workers to use such services.
- Information materials on HIV/AIDS should be posted at all work sites and villages along the wayleave.

In order to gain reliable information on the efficiency of the mitigation measures performed, the consultant suggests an accompanying study on HIV/AIDS incidence rates. These rates should be stated before starting and about one year after finalization of construction works in a few representative villages with similar socio-economical conditions, but separated into at least two groups: concerned / not concerned by the construction works. A statistically accurate selection and grouping of the villages surveyed will be crucial for the reliability of this exercise.

7.4 Balance of Impacts Without / With Mitigation Measures

Table 7-1 indicates the effects of mitigation measures as estimated on the basis of available information. The mitigation effect of line routing alternatives, Resettlement Action Plan and all compensations will be already considered.

Of course the summation of not strictly cardinal figures (grey lines) will be a methodically questionable step, but anyway, the results presented reflects the "educated guess" of the consultant quite well, based also on some hard facts:

- The main impacts will be associated with the clearance of the wayleave and the relocation of some 1300 houses (840 with line routing alternatives).
- The mitigation measures, above all the resettlement action plan, the mandatory arrangements for compensation and last but not least the development of alternative alignments for the transmission line (see Chapter 8.2), will result in an essential reduction of impacts.
- The proposed technique to supply the villages along the line with electricity will clearly more than fully compensate the remaining impacts on socioeconomic issues and will boost the local economy.

The balance demonstrates that impacts on the natural environment will be fully compensated. However, for safety and health aspects the balance will remain negative.

The negative impacts on the socioeconomic conditions of the villages and local people living close to the line might be more than fully compensate if these villages will be connected to the grid. Otherwise this balance will also be slightly negative.

Table 7-1: Balance of Impacts Without and With Mitigation Measures
"with mitigation" includes the effects of routing alternatives, RAP and full compensation

	Impact on	without mitigation		with mitigation		add. RE *
		short term	long term	short term	long term	long term
Natural environment	Vegetation cover	-5	-5	-2	+1	+1
	Soil erosion	-1	-3	-1	-1	-1
	Climate change	0	+3	0	+3	+3
	Landscape aesthetics	-1	-1	-1	-1	-1
	Valuable habitats without protection status	-3	-3	-2	+1	+1
	Diversity of habitats, wildlife barriers	-1	0	-1	0	0
	Collision of birds with the Line	0	-4	0	-2	-2
	Hydrocarbons	-2	-2	-1	-1	-1
	Waste and waste water	-1	-1	0	0	0
	sum 1	-14	-16	-7	0	0
Socioeconomic issues	Housing and resettlement	-5	-5	-2	-1	+2
	Public infrastructures and services	-2	-2	-1	+1	+5
	Settlement areas	-3	-3	-2	-2	+2
	Cultivated areas	-3	0	0	0	0
	Cultural heritage	-1	-1	0	0	0
	Employment and income	2	1	2	1	+5
	Complaints of stakeholders	-3	-3	-1	-1	+5
	sum 2	-15	-13	-4	-2	+19
Safety & health	Noise, dust and vibrations	-1	0	-1	0	0
	Electrocution	0	-1	0	-1	-1
	Electromagnetic fields	0	-1	0	-1	-1
	Accidents	-1	0	-1	0	0
	HIV/AIDS and other STD's	-3	-3	-2	-2	-2
	sum 3	-5	-5	-4	-4	-4
	total sum	-34	-34	-15	-6	+15

Legend

* Rural electrification of villages along the new line

Significance of impacts

0	neglectible	3	moderate
1	very low	4	high
2	low	5	very high
+	positive impact	-	negative impact

8. Alternatives

8.1 No Project Alternative

The no project alternative represents the scenario where the project is not implemented and the environment is left untouched or remains as it is. This alternative, however, entails missing all the positive impacts anticipated from the project such as improved power supply in the north-western region as well as the stability of power network. Similarly, this alternative will deny the benefits for the national economy in general and also in the project area, not least as the prospective rural electrification programmes the government is responding to will be hampered. Therefore the socio-economic consequences of the no project alternative may be significant. The results of the study on economic issues are presented in Chapter 11.

8.2 Routing Alternatives

The selection of line stretches for which routing alternatives might be favourable has been based on the findings of the investigations, considering the following criteria in order to reduce

- number of houses and herewith people to be affected
- valuable infrastructures to be affected
- conflicts with the plans of other authorities for further developments (such as planning of infrastructures or land use).

The development of routing alternatives has additionally been based on technical, ecological and socioeconomic criteria such as

- distance to existing infrastructures (wayleave)
- length of line
- angle towers and line angle
- access ways, above all to angle towers
- subsoil conditions for tower construction
- avoid areas prone to erosion
- avoid ecologically sensitive areas
- avoid land property conflicts
- avoid sandwiching settlement
- settlement structure (linear or compact) and last but not least
- construction costs.

The following description of alternatives will use some abbreviations in order to facilitate the description:

- **"Old"** means the existing 220 kV line Iringa - Dodoma - Singida - Shinyanga
- **"New"** means the routing of the 400 kV line as proposed by FICHTNER and accepted by TANESCO.
- **T/AT** followed by a number, means "towers"/"angle towers" with the same number as used in the project documents.
- **N, NNW, NW** etc. are abbreviations for North, North-Northwest etc., indicating the geographical direction.

More details as given below (e. g. the coordinates of towers) will be presented in Table 8-1. Table 8-2 presents a summary of all alternatives described below and their mitigation potential.

8.2.1 Igumbilo Alternative

The old routing will loop out from the Substation Iringa to N, will turn with an angle of 110° to T 1 ESE and will then run parallel to the old line to ENE to T5, diverts here from the old line to NNE dissecting Igumbilo village, and joins the old line again at T 9 (see Figure 8-1).

This routing with a length of 1.2 km will affect about 15 houses, and will sandwich Igumbilo village, by forming a triangle with the existing 220 kV line at a maximum distance of 300 m from the old line. Additionally, the line will cross a valuable riverine vegetation area with a length of 400 m and another 1.5 km stretch of farmland with lots of large trees.

The alternative proposed will run from the gantry and T A1 straight N, crossing the Little Ruaha River and the riverine vegetation belt with a length of 200 m, and about 500 m of farmland to T A2, where it will turn ENE to E to T A3 along the foot of the steep mountain slope N of the valley to T A3, then NE, joining the old line and crossing from T A2 to T A4 cropland scattered with some grassland. A straight routing from T A2 to T A4 would additionally spare about 2 km farmland with some scattered grassland, but will cross badlands with rocks and some eroded areas. Compared with the old solution, this alternative will

- avoid sandwiching Igumbilo village
- spare 200 m of very valuable vegetation, 500 m of potential settlement area and the trees mentioned above
- spare 6 houses
- save 3 AT.

The area in question has been allocated to the construction of a secondary school while the Municipal Council has surveyed the plots and already sold them to individuals for settlement. TANESCO has meanwhile discussed this alternative with Municipal Council officials; they are going to present this to the municipal decision meetings for no objection. No conflict is expected since all the projects are in the planning stage and will be accommodated.

Figure 8-1: Igumbilo Alternative

8.2.2 Mtera Alternative

The old routing follows the old line up to AT 231, will pass Makatapora village (affecting 41 houses), crosses and sandwiches the TANESCO Substation at Mtera between the old line and the TANESCO facilities (power station, switchyard, workshops, administration buildings, staff houses etc.), affecting 7 houses, then passes Mtera village (affecting some 120 houses) up to T 295. Along this line stretch with a total length of 25.7 km, about 4.5 km of settlement area, 1 km of farmland, 1.7 km of woodland and 1.5 km of valuable habitats (riverine vegetation) will be crossed.

At tower no. 238 near Mtera the new line will pass over the main road's 22.5 m clearance corridor. This problem could be solved by shifting 15 m laterally the curved gravel road on a length of around 0.5 km. TANROADS is planning an upgrading of the main road from Iringa to Dodoma. Negotiations between TANESCO and TANROADS to take the chance for rerouting this very short road segment failed until today.

Compared with the old solution, this alternative will:

- avoid any aggravation of the already existing situation of sandwiching Makatapora village
- avoid the conflict with the wayleave of the main road Iringa-Dodoma,
- avoid an enforced intersection of the TANESCO station
- spare 166 houses at Makatapora, TANESCO area (6 staff houses) and Mtera village
- spare about 1.5 km valuable habitat and 4.4 km settlement area
- spare 13.3 km of transmission line and 2 AT (hereof 1 AT with an angle of 85°)
- cross closed woodland at a length of 1.9 km, therewith opening a new access corridor down to Lake Mtera.

Spanning over the Mtera Reservoir with a line of 1000 m length will be neither a technical nor a financial problem, the necessary enforcement and height of the towers (130 m, i.e. the height of many communication towers) will be not extraordinary, and the higher costs will be compensated by savings in terms of 13.3 km of transmission line and 2 angle towers, compared with the old option. The span might be shortened when taking into account the topography of this site: the maximum water level in the reservoir is 698.5 m a.s.l., and the bottom of the reservoir more than 680 m a.s.l. Taking the 690 m a.s.l. level, the span may be reduced to 700 m (with a reduction of the tower height by 30 to 40 m), and maybe even less if landfill technique are used. The same might be true for the first mentioned span, as the island might allow a dry access at low water levels. In either case, this proposal will need further in situ investigation.

Figure 8-2: Mtera Alternative

8.2.3 Nala Alternative

The old routing will follow the old line from T 23 to T 54, will leave the TANROADS weigh bridge near T 24 within the wayleave, and will pass Nala village, while affecting about 23 houses, a primary court house and a water tank (which is serving Nala village). Along this line stretch with a total length of 12.5 km, about 1.7 km of settlement area will be crossed, aggravating the existing situation of sandwiching Nala village between the main road Dodoma-Singida and the old line.

In order to reduce these impacts, an alternative has been developed. This alternative will leave the old route at T 23 (AT), prolonging the line T 7-T 23 by about 2.0 km (N-NNW) to T A1 and then straight to T 54. Compared with the old solution, this alternative will

- avoid the conflict with the TANROADS weighting bridge
- avoid aggravation of sandwiching at Nala
- spare 1.4 km settlement area with 21 houses
- spare a primary court house and a water tank with pipes and tap
- save 1 AT, but lengthen the line by 800 m.

Figure 8-3: Nala Alternative

8.2.4 Bahi Alternative

The old routing follows the old line from T 113 to T 151, will cross Bahi Town and affect 85 houses (hereof about 20 with higher quality building materials), a church (important in quality of building structure and size), the area of a mission, a secondary school (3 larger teachers' houses) and a police station. Most of the houses have been constructed by squatters without land title. Along a line stretch with a total length of 16.1 km, about 1.3 km of settlement area will be crossed.

Bahi has been chosen as the district capital. Some larger complexes for administration purposes (DC, DEO and Police offices) are being constructed (but not yet in function). A master plan for the development of the township already exists, including a first draft of a land use plan. The location of at least one out of the three new buildings mentioned above doesn't fit with this plan (DEO office in the mid of a commercial area).

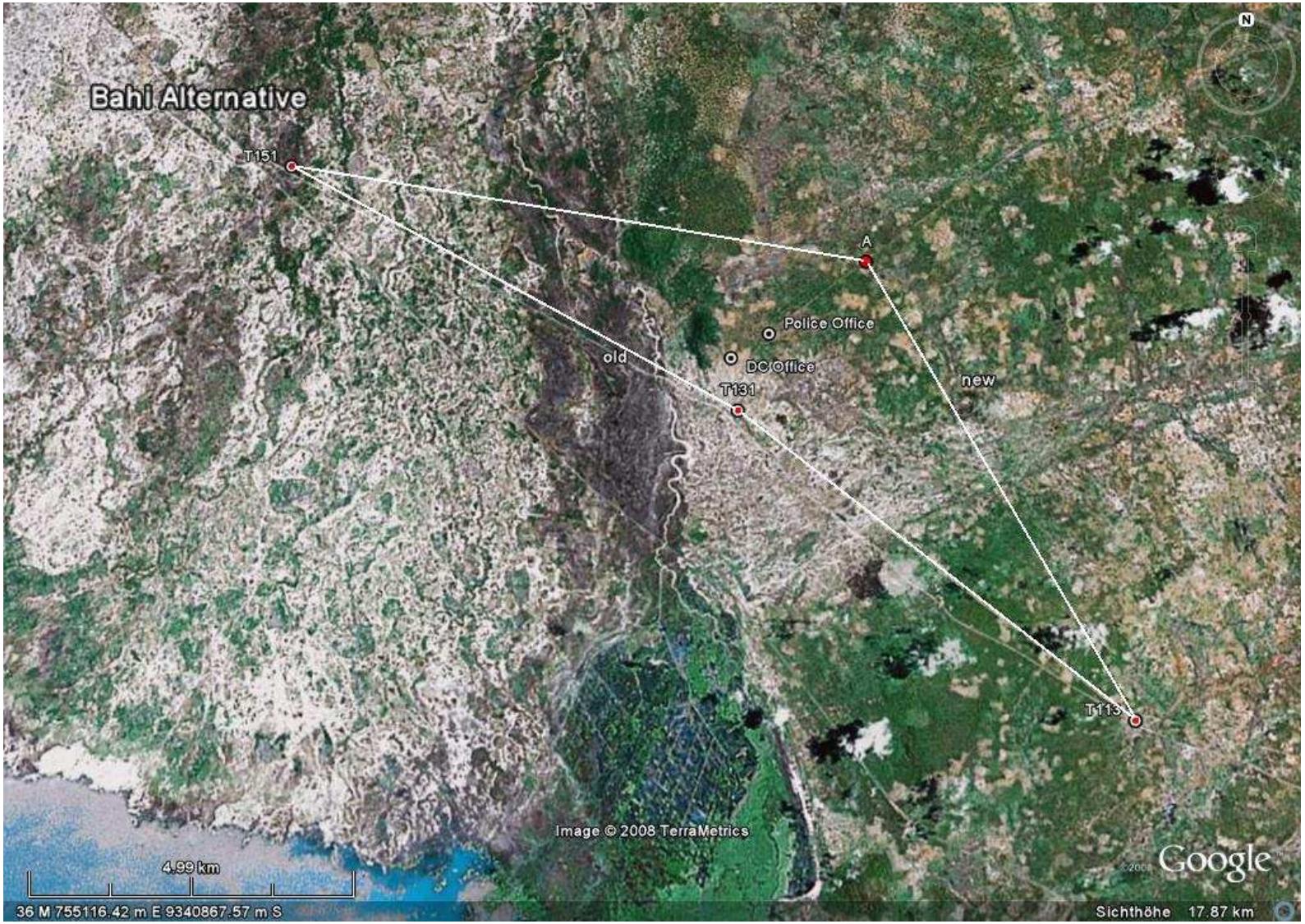
The alternative proposed in order to reduce all these impacts will leave the old route at T 113 straight forward to T A, turns there to ENE to E and joins the old line again near T 151. Along this stretch, a total length of 18 km, the line will cross predominantly open and closed bush land, partially with emergent trees, and some inundation areas adjacent to River Bubu. No houses, infrastructures, farmland etc. will be concerned. There will be no conflict with the Master Plan. Compared with the old solution, this alternative will

- spare 1.3 km of settlement area with 85 houses
- spare all objects named above (church, mission, secondary school and police station)
- not need an additional angle tower, but will extend the line length by 1,800 m.

Figure 8-4: Church (Bahi) which will be spared

Figure 8-5: Teachers houses (Bahi) which will be spared

Figure 8-6: Bahi Alternative



8.2.5 Puma Alternative

The old routing follows the old line from T 458 to T 496, will cross Puma village with a length of 1.8 km, will affect 50 houses (about 20 hereof with higher quality building structures) and a water tank, supplying Puma village and public institutions. To E the development of the village is quite restricted, due to the topography, as rocky hills and lots of outcrop rocks leave only little space for settlement and farming, consequently many of the affected people would have to be resettled to another site.

The alternative proposed in order to reduce all these impacts leaves the old route at T 475, with an angle of 45° to the right, to T A (to NNE), and wil l join the old line at T 496. Compared with the old solution, this alternative will

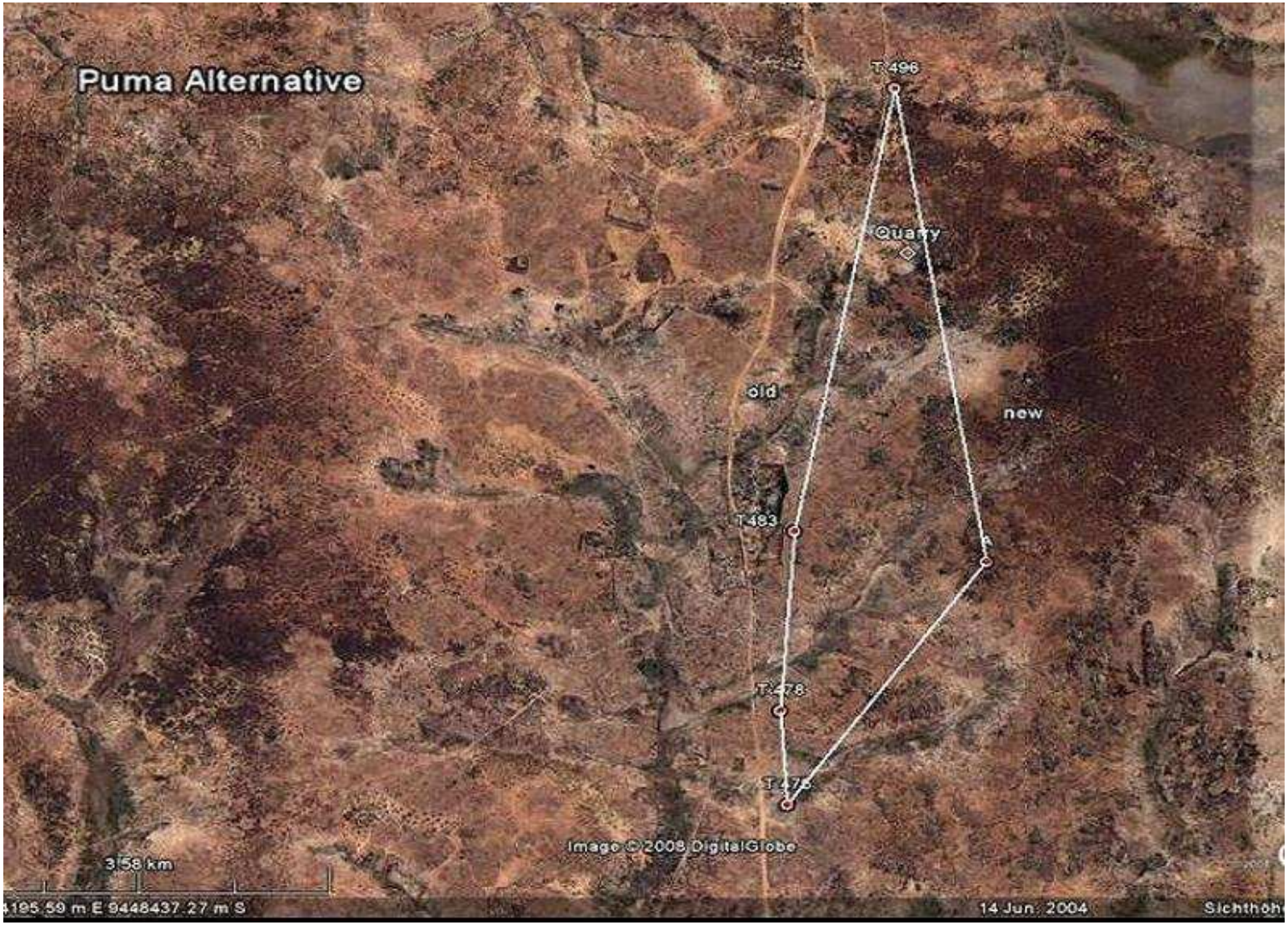
- spare about 1.8 km of settled area with 44 houses and 1.1 km of fields
- spare a water tank
- avoid a crossing of the quarry
- spare 1 angle tower, but will extend the line by 600 m.

Some 1.8 km ahead T 496 some 100 m west of the line there is a quarry area. The owner of this quarry should be contacted in order to check, whether there might be a potential legal conflict. In this case the line between T 458 to T 496 might be prolonged by a few 100 m in order to avoid this conflict.

Figure 8-7: Affected Mosque (Nkunikana)

Figure 8-8: Affected Secondary School under Construction (Nkunikana)

Figure 8-9: Puma alternative



8.2.6 Singida Alternative

The old routing loops out from the Singida Substation to the south, will cross the existing 220 kV line Singida-Arusha, will turn left at 90° and will run parallel to this line to the east. Along this line stretch, with a length of about 4.4 km, 47 houses, most of them of good standard, and a new dispensary will be affected. About 100 m east of T10, the line will turn with an angle of 80° to the left, will cross the Arusha line again, and will run NNE up to T A, will there turn again to the left with an angle of 80° to WNW to join the old line near T 42. This line stretch, with a length of 23.4 km, will cross about 8.0 km scattered settlements (affecting another 29 houses), 7.8 km of cultivated area, 400 m of forest plantation and some km of open area interrupted by rocky badlands and outcrop rocks, and will pass a small church and a big secondary school north of Mtipa which are near to, but outside the wayleave. South of T A a seasonal floodplain will be crossed, which is used for intensive cultivation. Some people are of the opinion that this area would be unsuitable for tower construction due to the high salt content of the lake, although this opinion does not comply with the following facts:

- during the rainy season, the storm water will flow into the lake which lies in a depression, i.e. the salt water will not be transported to the flooded plains
- salt water will be heavier than fresh water, so the salt water will be overlaid by fresh water
- the line crosses agricultural used area; such a use would be incompatible with a higher salt content in the soil
- a farmer on site reported that there is no diminution of yield or fodder quality observed
- no indication for salt deposition has been found visually.

The alternative proposed, in order to reduce the impacts mentioned above, will leave the old route at T A1 (in front of T 7), will then turn left with an angle of 75° to NNW, crosses an area with a wide scattered settlement, cultivated land and open area, interrupted by rocky badlands and outcrop rocks and a river bed with some gullies and a width of 400 m, up to T A2 and T A3 (each with 40° angle, in order to avoid one single tower with an angle of 85°), and runs to WNW, joining the old line at T 42. The lines will cross a Water Reserve area planted with tree seedlings. As this area may be spanned over, and the wayleave may be cultivated with low growing vegetation, the water resource will not be endangered in any way, and the conflict with the Water Authority is only a legal one, which may be solved by negotiations and compromises.

Compared with the old solution, this alternative will

- spare about 3.8 km of settled area with 88 houses
- spare a dispensary
- save 1 angle tower and 6.6 km of transmission line
- have an additional impact on 1.8 km of cultivated land and 200 m of forest plantations .

Figure 8-10: Dispensary (Mungumaji) which will be Spared

Figure 8-11: Wayleave of Singida Alternative from South

Figure 8-12: Route of Singida Alternative from North

Figure 8-13: Affected Water Reserve Area (Singida)

Figure 8-14: Singida Alternative

8.2.7 Kitusha Alternative

The old route diverts from the 220 kV line near T 134, prolonging the route T 115 to T 134 by about 2.5 km and will run for a stretch of 10.8 km length up to T 170 at 1.0 km distance N of the 220 kV line. Then it will pass quite densely populated and cultivated areas with many large trees for some km, and it will affect at least 2 schools, some water tanks, many boreholes and about 60 houses. These figures are estimations, but they indicate sufficiently the need for an alternative routing. Shifting the old line at least by 400 m N will avoid these impacts, leaving only 4 houses affected.

Figure 8-15: Kitusha Alternative

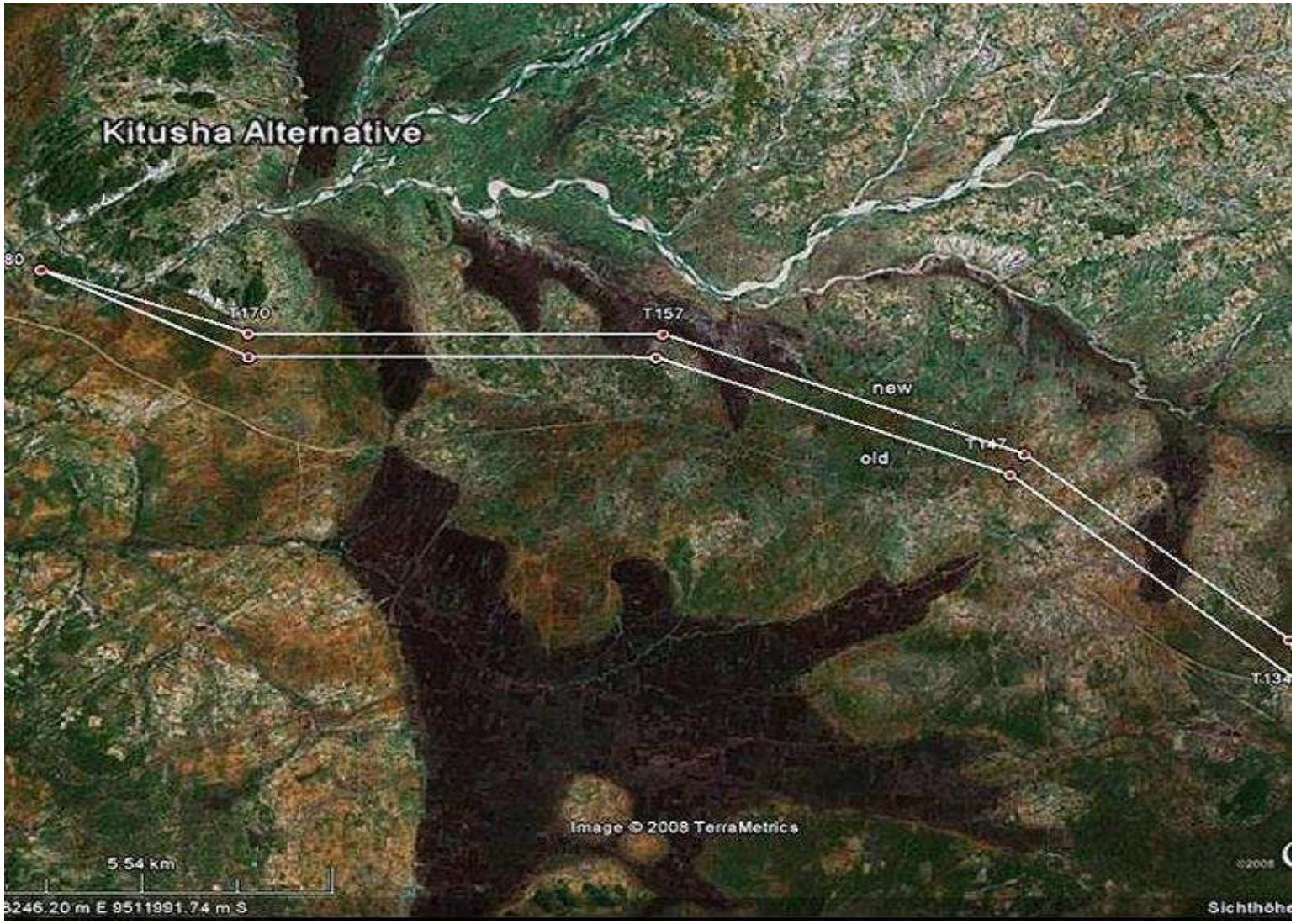


Table 8-1: Details of Line Routing Alternatives

Alternative		Towers	Angle	UTM Coordinates E	UTM Coordinates N	Annotations	Remarks
1	Igumbilo	S/S		801.030	9.138.070	Gantry	Planning conflict Ministry of Education / Mun. Iringa: school / health centre / residential houses planned between A1 and A2; contacts / negoc. required
		A1	35°	800.960	9.138.200	new AT	
		A2	80°	800.960	9.138.920	new AT	
		A3	40°	802.740	9.139.230	new AT	
		A4	40°	803.020	9.139.580	new AT	
		T9		803.200	9.138.850	next AT	
2	Makatapora-Mtera	T196		802.000	9.205.500	last AT	no connection to S/S Mtera, overspanning Lake Mtera for 1000 m + 600 m
		T231	10°	814.600	9.211.100	old AT, angle changed	
		A1	20°	817.650	9.213.250	new AT	
		A2	15°	818.300	9.214.950	new AT	
		T295		824.900	9.217.200	old AT, angle changed	
		T300		826.400	9.218.700	next AT	
3	Nala	T7		795.900	9.316.200	last AT	
		T23		795.100	9.322.900	old AT changed to T	
		A	55°	794.700	9.325.000	new AT, in line T7-T23	
		T54	30°	784.900	9.330.000	old AT, angle changed	
		T63		781.100	9.330.100	next AT	
4	Bahi	T83		774.200	9.334.200	last AT	Bahi Planning Authority in Dodoma and DC / DEO have to be contacted in respect to Bahi Municipal Master Plan
		T113	50°	762.400	9.334.300	old AT, angle changed	
		A	55°	758.500	9.345.000	new AT	
		T151	50°	749.100	9.346.200	old AT, angle changed	
		T154		748.300	9.345.900	next AT	
5	Puma-Isalanda	T458		695.900	9.438.100	last AT	
		T475	45°	695.200	9.444.900	old T changed to AT	
		B	45°	697.000	9.447.600	new AT	
		T496	5°	696.200	9.452.800	old AT, angle changed	
		T510		695.800	9.458.200	next AT	
6	Singida S/S-Manga	T1		695.000	9.464.900	last AT	crossing of water reserve area (400 m), futher investigations / negociations with water authority necessary
		T7	75°	696.850	9.464.800	new AT W of T7	
		A1	40°	700.200	9.473.700		
		A2	40°	699.800	9.474.600	new AT	
		T42	35°	689.400	9.479.400	old AT, angle changed	
		T106		672.100	9.498.000	next AT	
7	Kitusha-Kizaga	T115		670.000	9.500.400	last AT	
		T134	35°	667.050	9.509.250	new AT, in line T115-132	
		T147	20°	663.200	9.512.400	new AT	
		T157	20°	659.000	9.513.900	new AT	
		T170	25°	653.000	9.513.900	new AT	
		T180	15°	650.000	9.515.000	new AT	
		T197		643.000	9.516.400	next AT	

Legend

old T/AT	tower position as originally accepted by TANESCO
new T/AT	new tower position of alternatives proposed

8.2.8 Evaluation of Routing Alternatives

An overview of all alternatives; changes of structures and mitigated impacts is presented in Table 8-2.

Also a first estimation of costs and savings caused by the realisation of the proposed alternatives will be presented. The assumptions for specific costs (in the table left below) concerning houses and infrastructures present average values reflecting regional experiences and will be differentiated and adapted to local conditions in the course of the later evaluation process performed by legalized valuators. The assumptions for line elements will present first and course estimations, as essential technical details are not yet known; the same will be true for specific site conditions (as site specific details on the foundation soil). Anyway, major changes of the overall figures are not to be expected.

In summary, cost savings in the range of some million EUR might be realistic, above all due to saving about 14 km of line length. Another remarkable result is the number of about 460 houses to be spared, resulting in compensation savings of about 1,400 TEUR (and social grievances not rateable in monetary units).

Mentioning rateable and not rateable aspects (loss of woodland and valuable habitats) in the same table in order to facilitate a comparison of routing alternatives does not mean that any trade-off has been made. The valuation of the wayleave area refers to an average economic value per hectare land without discrimination of different land uses and vegetation types.

Table 8-2: Evaluation of Routing Alternatives

Alternative	Area / villages concerned		Changes of structures				Land cover / land use (km length of line)				Estimated Costs / Savings (TEUR)					
			AT	km length of line***	houses affected	other valuable structures affected	cropland	settlement	forest / woodland	valuable habitats	Change of towers	Way leave area	Line lenght	Houses	Other assets	Total
1	Igumbilo	*old*		*3,6*			*1,6*	*0,7*		*0,4*						
		new	-3	0,1	-6		1,6	0,2		0,2	-230	1	35	-18	0	**-212**
2	Makatapora-Mtera	*old*		*25,7*			*0*	*4,5*	*1,7*	*1,5*						
		new	-2	-13,3	-166				1,9		410	-14	-4.655	-498	0	**-4.757**
3	Nala	*old*		*12,5*		*WB, PC, WT*		*1,7*								
		new	-1	0,8	-21		0,5	0,4			-80	6	280	-63	-160	**-17**
4	Bahi **	*old*		*16,2*		*Ch, Mi, SS **		*1,3*								
		new		1,8	-85				1,8		70	10	613	-255	-50	**387**
5	Puma-Isalanda	*old*		*8,0*		*WT*	*2,2*	*1,8*								
		new		0,6	-44		1,1				140	4	210	-132	-50	**172**
6	Singida S/S-Manga	*old*		*27,8*		*Di*	*7,8*	*9,9*	*0,4*							
		new		-3,8	-88		9,5	4,7	0,6		50	-5	-1.365	-264	-50	**-1.634**
7	Kitusha-Kizaga	*old*		*20,4*		*PS, SS*	*20,4*	*20,4*								
		new		0,3	-56		?	?			0	1	105	-168	-450	**-512**
Sum recommended alternatives			-6	-13,6	-466						360	2	-4.778	-1.398	-760	**-6.573**

Legend

old	line routing as accepted by TANESCO	Ch	Church	average land /ha	200	Church	20.000
		Di	Dispensary	average house	3.000	Dispensary	50.000
new	proposed line routing alternative	Mi	Mission	normal tower	50.000	Primary court	10.000
**	Alternative developed with respect to the Masterplan for the Development of the District Capital	PC	Primary court	AT < = 30°	80.000	Primary school	150.000
		PS	Primary school	AT > 30-60°	150.000	Second. school	300.000
		SS *	Secondary school (teachers houses)	AT > 60°	250.000	Water tower	50.000
***	old: lenght old line; new: difference new line - old line	WB	Weighbridge	1 km line	350.000	Weighbridge	100.000
		WT	Water tower	add. for long spans	1.200.000	Teachers house	10.000

9. Environmental and Social Mitigation Plan

This chapter presents an overview of the mitigation measures for the impacts identified and analysed in Chapter 6. The description does not include all details as presented in Chapter 7 in to give a better overview. The institutions responsible for the implementation of the mitigation measures at different stages of the project are named in this chapter. Concerning the costs, a few explanations will be necessary.

- No. 3 to 6, 11 to 13: Costs for revegetating and reforestation are not yet known, as these costs will depend on the area to be planted, selection of species and above all the area concerned.
- No. 15 and 16: The measures for protecting birds against collision with conductors and shield wire will be required for line stretches within or near valuable wetlands recommended for RAMSAR site protection status. The length of these stretches (near Singida and across and along the floodplain of Wembere River) will be between 20 and 40 km, but may even be quite a bit shorter due to the results of monitoring activities described in Chapter 10. The additional costs for another tower type have been assessed for the medium length with 50% higher costs for the towers.
- Nr. 35: Costs for electrification of the villages along the line are calculated for the option of energizing the shield wire with 34 kV along the whole line, assuming additional costs of 15% from 15,000 EUR/km for a normal 34 kV line
- Compensation costs will be assessed in the RAP.

The total costs; as far as estimated here, accumulate to 2.65 MEUR. They include the electrification of the villages along the line, but not the costs for compensation. Costs declared as “open” depend on the results of field investigations mentioned above. These costs may be covered with a lump sum of 350,000 €, so the total costs for mitigation may accumulate to 3 MEUR.

Table 9-1: Environmental and Social Mitigation Plan

Impact on / by	No.	Mitigation / enhancement measures	Responsible institution	Project phase	Estimated costs (€)
Vegetation cover, protected areas, habitat diversity	1	Selective clearing of vegetation in the way-leave	Contractor	2, 3	25,000
	2	Manual clearing instead using heavy machinery			
	3	One single common way for inspection / maintenance with the old 220 kV line	TANESCO, Contractor		nil
	4	Reforest/replant areas not needed anymore after end of construction work		3	open
	5	Compensate permanent loss of vegetation by planting/forestation other areas nearby		2, 3	open
	6	Apply measures 1, 2 and 3 also in the old way-leave where crossing valuable / undisturbed habitats		2	open
	7	Forest authorities and communities shall communicate for better protection of forests	Forest auth. Communities	1, 2, 3	nil
	8	Protect reforestated/replanted areas and areas with natural succession against (over-) exploitation	TANESCO, Communities	3	5,000 p.a.
Soil erosion	9	Sensitive planning, construction and mitigation of access ways	Consultant, Contractor	1, 2	nil
	10	Use gabions instead of stone walls	Contractor		nil
	11	Apply measures 1 - 8	see No. 1		open
	12	Plant suitable sediment binding grasses in areas prone to soil erosion, charge people for surveillance	Contractor, TANESCO	2, 3	open
Valuable habitats	13	Measures 1 - 8 will be mandatory	see No. 1	2, 3	open
	14	Prevent poaching by workers	Contractor	2	g.p.
Bird collision (in wetlands)	15	Minimise number of conductor levels	Consultant, TANESCO	1	1,000,000
	16	Shield wire should be a low as possible			
	17	Fit flapper devices on the shield wire	Contractor	1, 2	10,000
Hydro-carbons	18	Oil resistant sealing of all surfaces where hydro-carbons are permanently handled and stored; shelter these areas and protect against storm water	Contractor	2	g.p.
	19	In the field, store hydrocarbons in oil resistant containments, use collection pans when refuelling		2	
	20	Use well-maintained equipment & good environ-mental practises during construction and operation		2	
Waste	21	Collect & re-use / recycle suitable materials, collect & dispose remaining waste properly		2	
	22	Hazardous materials to be handled properly and far away from water bodies		2	
Houses & resettlement	23	Compensation of all assets and grievances to PAP and villages concerned	TANESCO	1	RAP
Public infra-structures	24	Compensation paid early to allow construction and commissioning of alternative prior to demolition		1	
	25	Participatory procedures for valuation, compensation and reallocation		1	
Land use	26	Clarify that any use of way-leave will be allowed if compliance with security and maintenance issues		1	nil
	27	Compensate individuals whose properties will be sandwiched		1	RAP
	28	Compensate fairly and timely the households loosing land		1	RAP
	29	Work camps no more used should be cleaned and transferred to village administration		2	g.p.

Legend
g.p. good practise, no additional budget necessary
1 Planning phase
2 Construction phase
3 Operation phase

continued >>

Impact on / by		Mitigation / enhancement measures	Responsible institution	Project phase	Estimated costs (€)
Cultural heritage	30	Compensation of graves to be removed should include all expenses related to the relocation	TANESCO	1	RAP
	31	Respect believes and traditions at grave relocation			
	32	Report relevant observations during exploration & construction instantly to Antiquity Department	Contractor	2	nil
	33	In case of chance findings interrupt work at once, don't restart without consent by Antiquity Dep.		2	open
Employment	34	Raise the rate of local people in the workforces as high as possible	Consultant, TANESCO	2, 3	nil
Other complaints	35	Rural electrification of villages affected using energised shield wires or other techniques	Consultant, TANESCO	1	1,500,000
	36	Village government should exercise open and transparent use of payments from TANESCO	Communities	1, 2, 3	nil
	37	simple+understandable+fair Memorandum of Under-standing between TANESCO and communities	Consultant, TANESCO	1, 2, 3	nil
Safety & Health	38	Apply the best practices regarding health and safety for workers and population	Contractor	2	The contractor is obliged to comply with Safety & Health regulations of his homeland as well as of Tanzania and Donors; costs are included in his budget
	39	Potentially dangerous construction sites shall be fenced off and guarded			
	40	Provide safety gears as helmets, gloves, protective boots, goggles and hearing protection			
	41	Warning signs shall be put up around the construction sites			
	42	Moisturize open surfaces when and where high dust emissions are observed			
	43	Select sites for work camps in close cooperation with villages and district authorities			
	44	Camps shall have reliable supply of safe drinking water and proper sanitary facilities; look for alternative water sources in areas with limited water			
	45	Establish mobile hospital services open for workers on site			
	46	First aid and referral system to stabilise patients and transport them to hospital			
	47	Periodic medical examination for all workers			
	48	Training of drivers to careful driving behaviour			
	49	Preparation of a Health, Safety, Environmental and Social Plan for approval by TANESCO			10,000
	50	Provide + share social services with communities	TANESCO		open
	51	Raise payments to local people for provision of security services	TANESCO		open
	52	Districts shall improve existing social services in villages with work camps	District Councils		open
HIV / AIDS	53	Test all workers periodically on HIV/AIDS and offer them condoms for free	District Health Authorities, NGOs, TANESCO, Contractor		100,000
	54	Perform awareness and information campaigns with priority for the group of workers			
	55	Continue to sensitise workers and local communities on HIV/AIDS pathways			
	56	Establish and support voluntary counselling and testing centres for HIV/AIDS			
	57	Information materials on HIV/AIDS be posted at all work sites and villages along the way-leave			

Legend
g.p. good practise, no additional budget necessary
1 Planning phase
2 Construction phase
3 Operation phase

10. Environmental and Social Monitoring Plan

The main objectives of environmental monitoring are:

- to assess the changes in environmental conditions,
- to monitor the effective implementation of mitigation measures,
- to indicate potential problems in order to allow prompt implementation of effective corrective measures.

Monitoring will be particularly important where

- environmental impacts cannot be estimated with suitable certainty
- the efficiency of mitigation measures are uncertain
- impacts on socio-economic environment are expected and health and safety issues addressed.

Monitoring means that the effects of a project on environmental and socio-economic issues will be controlled from time to time. For monitoring, indicators and parameters have to be defined, allowing a comparison of the situation before implementation of the project with the situation at the point of time of monitoring. For some essential items of the project this precondition will be not fulfilled sufficiently regarding the local impact and adequate mitigation measures. For example, a change of the vegetation cover may not be monitored with acceptable accuracy in terms of spatial and factual detail, when the present situation is documented in a 20 year old map with a scale of 1:250.000, and a wayleave width of "only" 70 to 90 m (about 0.3 mm in the map). Changes of incidence rates of diseases may be interpretable only, if the actual rates have been monitored with an adequate number of individuals out of the same population and with comparable methods; additionally, a control group of not impacted people (i. e. from other villages far enough from the line) with comparable living conditions has to be monitored in the same way. Hence, in some aspects, the basic situation has to be monitored before the construction phase.

Monitoring of construction activities will be much simpler, as in general not the changes of the environment but the impact on environment will be monitored. This may be done by observations at work camps and construction sites in the field in order to verify the compliance of the installations and activities with relevant regulations as well as the measures proposed in Chap 7.

TANESCO and the contractor will have the main responsibility for monitoring during the construction phase, whereas District Councils with District Officers for Health Care, Natural Resources, Planning and Forests will coordinate and cooperate closely to enforce compliance of the developer/contractor with the mitigation measures proposed. NEMC will have overall monitoring responsibility as part of the EMA implementation.

In order to ensure that the resettlement and compensation activities are implemented successfully and that the PAP are treated equitably/fairly, an internal monitoring system will be defined and implemented by TANESCO in close collaboration with the implementing partners/agencies. This will provide the necessary monitoring data in an efficient and reliable manner. Monitoring will track:

- the progress of resettlement implementation;
- the compensation payment process; and
- Grievances made and resolved.

TANESCO will produce periodic monitoring reports regarding the implementation of resettlement and mitigation activities.

In order to assure an objective monitoring of the implementation of resettlement and compensation, monitoring should be performed by independent individuals or organisations, which will use the internal monitoring data and other information provided by TANESCO.

A monitoring body should be established at district level for all affected districts to carry out external monitoring of resettlement and compensation processes. Monitoring and reporting by this body should be carried out at regular intervals, tentatively every third or fourth month. These reports should go to the district executive directors and be shared and discussed with the RMU and the Regional Commissioner. The Ministry of Land and Human Settlements Development deals with land acquisition at a central level and should be invited to conduct external monitoring of the resettlement and compensation process. A representative of the Office of the Commissioner for Lands for instance may be invited to conduct monitoring trips a couple of times during the resettlement and compensation process and also at the end to verify that the developer has indeed compensated and assisted all PAP.

In general monitoring is a shared responsibility between the developer and involved ministries, districts and local authorities. It is anticipated that TANESCO, NEMC, the Ministry of Lands, Housing and Human Settlements Development, and the district authorities will jointly carry out the monitoring. Self-monitoring by the contractor in terms of record keeping and notification by TANESCO will be an important part of monitoring arrangements. However, this will have to be controlled by the developer and the responsible local authorities.

Chapters 6 and 7 have provided details of the impacts as well as mitigation measures. Table 10-1 summarizes monitoring tasks, time and frequency of monitoring, indicators and parameters to be monitored, responsible institutions for monitoring as well as estimated costs.

Table 10-1: Social and Environmental Monitoring Plan

Operation / activity	Monitoring tasks	Project Phase	Time and frequency	Parameter / indicators	Responsibility	Cost EUR
Clearance of wayleave and other areas	Detailed documentation of actual vegetation cover of areas concerned (mapping)	1	once	area (ha) / vegetation type mapping scale 1:5.000 (way-leave)	TANESCO Consultant	30,000
	Cutting of vegetation restricted to technical requirements ?	2	after cutting	area (ha) cleared / area exceeding technical requirements	Contractor Consultant	5,000
	Heavy machinery not used in sensitive areas ?	2	twice during activity	area (ha) where misuse stated	Contractor Communities	5,000
	Forest authorities and communities involved?	2	end of activity	contentedness of Authorities	Forest Auth., Communities	nil
	Replanting / reforestation completed ?	3	end of activity	% completed		5,000
Soil erosion prevention	Detailed documentation of sensitive areas and erosion damages (mapping)	1	once	mapping scale 1:10.000, area adapted to local situation	TANESCO Consultant	10,000
	Measures complied as proposed?	2	end of activity	observation	TANESCO	5,000
	Development of erosion, update of maps	2,3	annual	size of area, gullies	TANESCO	10,000
Valuable habitats, wildlife	Documentation of available information on wildlife in valuable habitats concerned	1	once	literature, Internet publications, wildlife NGO's, Authorities	Consultant	
Bird collision prevention	Monitoring of bird population / movements in / near the wetlands concerned *	1	once in rainy season	observation	Consultant	40,000
	Planning in compliance with proposed measures?	1	end of activity	check plans	Consultant NGO	nil
	Flappers fitted?	2	end of activity	observation	TANESCO	nil
Pollution prevention	Measures complied as proposed?	2	quarterly	observation	Consultant	nil

* delineation of line stretch concerned in cooperation with NGO BirdLife International, Tanzanian section

nil obligation of Public Authorities or contractor / current work of TANESCO

Phase 1 Planning
Phase 2 Construction
Phase 3 Operation

continued >>

Operation / activity	Monitoring tasks	Project Phase	Time and frequency	Parameter / indicators	Responsibility	Cost EUR
Houses and resettlement	Measures complied as proposed?	1,2	end of activities	rate of people resettled	TANESCO	nil
				rate of houses removed	Distr. Council	nil
Infrastructure	Measures complied as proposed?	1,2	end of activities	value of infrastructures	Communities	nil
Social services	Measures complied as proposed?	1,2	end of activities	employees per 1000 inhabitants	Distr. Council	nil
				visits per 1000 inhabitants	Communities	nil
Cultural Heritage	Documentation of cultural assets / sites within or nearby the way-leave	1, 2	ongoing	allocation, type and value of objects discovered	Contractor, Distr. Council, Communities, Antiquities A.	10,000
	Measures complied as proposed?	2	quarterly	no. of objects relocated/ compensated/secured		nil
Compensation of houses and assets	Compensation implemented in compliance with measures ?	1,2	end of activities	rate of assets compensated	TANESCO	nil
				rate of compensations paid (value)	Distr. Council	nil
					Communities	nil
Employment, income	Statistics on employment and income **	1,2	annual	employees per 1000 inhabitants	Communities	nil
				Man-month of local workers	Contractor	nil
				income per 1000 inhabitants	Communities	nil
Complaints of people concerned	Measures complied as proposed?	2	end of activities, annual updating	rate of complains total/per househ.	TANESCO	nil
				rate of complains attended	Communities	nil
Electrocution and other accidents	Statistics on cases by types of accidents **	2,3	before 2, annual during 3 for 10 years	accidents per 1000 inhabitants	Contractor Communities	nil
Crimes	Statistics on crimes by type of crimes **	2,3		crimes per 1000 inhabitants	Police Auth.	nil
HIV/AIDS and other STD's	Evaluation of statistics of incidents **	2,3		incidences per 1000 inhabitants	TANESCO, Min. of Health	10.000

** have to be compared with rates of control groups of not impacted people / villages with comparable living conditions; cooperation with sophisticated statisticians indispensable

nil obligation of Public Authorities or contractor / current work of TANESCO

Phase 1 Planning
Phase 2 Construction
Phase 3 Operation

11. Cost Benefit Analysis of the Project

In the frame of the overall project, a comparative economic analysis has been finalized recently (Fichtner, Comparative Analysis for the new Iringa-Shinyanga Transmission Project, 11/2008). It is important to mention that the comparative analysis was done in the context of Phase 1 of the project, where 3 technical alternatives have been compared, out of which for one alternative 2 sub-alternatives have been considered. The objective of this study was to reach a decision regarding the technical alternative to be realized. The Technical Alternative 1, Version 1 (full AC line with second circuit to be strung in the second phase of the project 2021/2022) has been recommended for a more detailed assessment in the context of a Feasibility Study. In the second phase of the project, the Feasibility Study will thus be conducted for the technical alternative finally selected.

Some results of the comparative analysis may be referred here in order to highlight the relevance of the proposed 400 kV transmission line for the national economy of Tanzania. For more detailed information, please consult the original report.

The assessment period of the economic analysis is 30 years. The lifetime of the line is supposed to be 50 years and the lifetime of the equipment 30 years. The overall investment costs have been calculated to be 520.260 TEUR.

The future costs, benefits and electricity deliveries have been discounted using a 10% discount rate in order to compare the present values (PV) of the costs, benefits and electricity deliveries over the 30 years reporting period. The numbers given below rely to Alternative 1, Version1 as named above.

- The energy transported over the proposed line in the 30 years assessment period can be summed up to more than 184.000 GWh total (present value of electricity deliveries: 34.258 GWh).
- The Present Value of costs amounts to 519.080 TEUR and includes:
  - The present value of investment costs calculated at 320.214 TEUR.
  - The present value of operation and management (O & M) costs calculated at 27.157 TEUR.
  - The present value of compensation for losses calculated at 171.709 TEUR.
- The levelized costs are calculated by dividing the present value of costs with the present value of electricity deliveries and will amount to 1.52 Euro-cents/kWh.
- The Net Present Value (NPV) amounts to 922.135 TEUR with an Internal Rate of Return (IRR) of 26.7%. The NPV and IRR are evaluation criteria based on the relation of discounted economic benefits and costs of the project. The benefits are calculated using the following parameters:
  - The present value of benefits of delivered energy is estimated to be 2.598.912 TEUR. The calculation of the benefits is based on the valuation of the transported energy over the line, using a lower boundary of the value of ENS (energy not supplied) given in the 2008 Master Plan.
  - The present value of costs of the energy supply (long-run marginal costs of generation of the 2008 Master Plan) is estimated to be 1.157.697 TEUR and has to be deducted from the above total benefits in order to determine the economic net benefit of electricity transmission over the line.
  - The economic net benefit will thus be around 1.441.215 TEUR.

The NPV can thus be determined by subtracting the PV of costs (519.080 TEUR) from the economic net benefit (1.441.215 TEUR) resulting in the NPV of 922.135 TEUR mentioned above.

12. Capacity Building

Institutions to be strengthened by capacity building measures will be TANESCO's Research and Environment Unit and officers from the District administration as mentioned in Table 10-1. The strengthening requirements of TANESCO take into account not only the present project but also future HVTL projects, e.g. the "missing links" for the backbone projects Singida-Nairobi, Mbeya-Dodoma and the line Chalinze-Arusha .

The present staff and the additional staff demand of TANESCO comprise:

- 1 Principal Environmental Engineer,
- 1 Senior surveyor and 2 surveyors; the demand comprises 2 additional technicians
- 1 Senior Environmental Engineer and 2 Environmental Officers; the demand comprises 1 additional Environmental engineer
- 1 Sociologist; the demand comprises 1 additional sociologist.

The staff demand will be covered by TANESCO. Requirements related to technical equipment see below:

Table 12-1 Demand on Technical Equipment with Cost Assessment

Pos.	Subject	Intended use	Price/unit €	Units	Price [1] €
1	Leica GPS 1200 Base Station	topographical survey	28.000	1	28.000
2	Rover Station		28.000	3	84.000
3	Leica TCA1205 Station		20.000	1	20.000
4	Leica Geo-office software	processing of survey data	6.000	1	6.000
5	ArcView software	processing and presentation of mapped information	2.500	1	2.500
6	Plotter for software hp designjet 500 series software	production of hard copies from mapped information	3.000	1	3.000
7	GARMIN GPSMAP 60CSx	handheld GPS for site allocation	250	3	750
8	Satellite based radio equipment	communication in areas without cell phone supply	1.500	6	9.000
9	Digital Camera	Documentation of field situation	200	3	600
10	Videocamera		200	1	200
				Total	**154.050**

1) VAT and import taxes excluded

Training requirements in respect of the monitoring tasks of TANESCO comprise:

- for TANESCO officers Environmental and Social Impact Assessment, project monitoring, review techniques (sociologist) and the operation of monitoring equipment (environmental officers),
- for surveyors the operation of hard- and software for the field work as well as for office work with the Geographical Information System ArcView.

The training measures may take place generally in Dar es Salaam. This will be refer to all technical issues, as branch offices with appropriate training capacities will be in operation in Eastern Africa (Nairobi resp. Kigali).

The training measures on environmental and social impact assessments, project monitoring and review techniques regarding the ESMP should also be performed in Tanzania (Dar es Salaam and in

field) in order to train the staff in their regional environment and under its specific conditions.

The training costs are assumed to total about 70,000 EUR under the condition that the trainees will have an adequate educational background as well as basic professional experience in the assessment of energy supply projects and “linear projects” in general.

The definition and performance of training measures for District Officers will be the obligation of the Engineering Consultant who will be engaged for the project management, and will be performed on the job, i.e. at District Capitals and in the field.

13. Summary and Recommendations

The proposed transmission line is a project of major importance for the infrastructure development and the socio-economic development of Tanzania in general and the north-western region in particular. However, by its nature, such a project will have a lot of impacts on environmental and socio-economic issues with a broad range of significance.

The most important impact for the natural environment will be the clearance of the line corridors and its consequences resulting in impacts of high significance. The area affected by changes of land cover and land use is assumed to be about 51 km² with diminished ecological functions, due to the removal or at least degradation of the vegetation cover within a cross-country corridor of 670 km length and 130 meters width, taking into account also the existing line corridor (without mitigation measures). This impact might be mitigated by adequate measures as proposed or even compensated, if these measures will also be applied within the line corridor of the old line.

Another serious issue is the fact that the line will cross three forest reserves (Nyang'oro, Sekenke - Tulya and Choda Forest Reserve) at a total length of 48 km. These reserves are habitats for species of high conservation value that are listed as threatened according to Species Survival Commission of the IUCN. This is also true for Lake Singida with the adjacent western wetland as well as for Wembere floodplain, both seasonally inundated and recommended as Ramsar sites. The last-mentioned wetland may be also an important corridor for migrating birds. Two parallel lines with different levels of conductors and shield wires (altogether up to 6 levels) will potentiate the risk of collision, compared with the existing line with 2 levels only. So the new line will mean a significant risk for birds, especially waterfowl. The proposed technical measures may reduce these impacts substantially, but will leave a considerable residual risk, requiring long term monitoring, starting as soon as possible already in the planning phase.

Soil erosion is also a problem, as longer sections of the line are located in areas, which are prone to it, due to natural conditions, as well as human behaviour and agricultural practices. Moreover, two parallel lines will potentiate this impact and double line corridors with poor vegetation cover only. Also this impact may be mitigated with a considerable residual risk only, and requires long term monitoring.

Supposed that all recommended mitigation measures will be implemented, the impacts on the natural environment will be fully compensated.

The most important negative socio-economic impact will be the removal of houses affected by the line corridors. Altogether, about 1,300 houses will be concerned, if no mitigation measures will be implemented. Proposed routing alternatives will reduce this number to about 840. This might be about 300 households and 1,500 people, i.e. about 4.3 people out of 1,000, living in villages affected by the line will have to be resettled. Given the easy availability of land in most of the concerned villages, most of the affected households should be able to relocate within their home village. The number and value of public infrastructure to be removed is quite limited, taking into account the length of the line and the chance to spare a reasonable percentage (36%) by the proposed line routing alternatives. Altogether, about 6 small objects (valued up to 10,000 Euro) and 2 large objects (valued more than 50,000 Euro) will be affected.

The loss of land used for agricultural activities will be minimal in case the proposed mitigation measures will be realised. This will be, finally after commissioning of the new line, in total some 180 ha lost for agricultural production and some 150 ha lost for settlements provided that the permanent line corridor clearance will be restricted to the minimum required for technical and security reasons.

Positive impacts like employment opportunities and income rising for local people along the line will normally be by far overestimated. Verifiable effects will be minimal, as long as the construction of this line will not be combined with an electrification of the villages along the line. A least cost solution in time for this issue is part of the recommendations.

In total, all socio-economic issues may be compensated or even more than fully compensated, disregarding social grievances not rateable in monetary terms.

Health effects focussing on HIV/AIDS problems are by nature challenging in respect to mitigation measures, therefore the balance after implementation of all AIDS related measures will be improved although remaining negative.

It is strongly recommended to start as soon as possible with the following monitoring activities:

- detailed large-scale mapping of the actual vegetation cover in the wayleave as well as of erosion prone areas, following the still pending demarcation of the new line;
- observation of bird population and migration at the line stretches crossing the seasonal wetlands near Singida and at Wembere floodplain; this will be possible during rainy season only, the results will be an input for tendering;
- documentation of available information on wildlife in areas where a high value for wildlife is indicated.
- documentation of representative HIV/AIDS rates in the villages along the proposed line

These activities have to be done by experienced specialists only.

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- URT 1997 - Mineral Policy of Tanzania
- URT 1999 - National Tourism
- URT 1996 - SID Policy
- URT 1996 - Community Development Policy
- URT 1997 - National Land Policy
- URT 2002 - Water Policy
- URT 2003 - National Energy Policy
- URT 2007 - Wildlife and Wetland Policy

- URT 2008 - SEA Regulations
- United Nation Convention on International Trade in endangered species of wild fauna and flora 1974
- United Nations Framework Convention on Climate Change (1992).