

AFRICAN DEVELOPMENT BANK



BOTSWANA: MORUPULE B POWER PROJECT

ESIA EXECUTIVE SUMMARY

TABLE OF CONTENTS

1. INTRODUCTION	3
2. PROJECT DESCRIPTION	3
2.1. World Bank Components	4
2.2. AfDB Components	4
3. LEGAL REQUIREMENTS	5
4. PROJECT ALTERNATIVES	6
4.1 Transmission Lines	6
4.2 Morupule B Power Plant	7
5. JUSTIFICATION, BENEFITS & MOTIVATION OF THE OVERALL PROJECT	8
5.1. Key Development Issues	8
5.2. Rationale for Bank's Involvement	9
6. ENVIRONMENTAL SETTING OF THE PROJECT AREA	9
7. ENVIRONMENTAL IMPACTS AND MITIGATION	12
7.1 Transmission Line	12
7.2 Impacts and Mitigation for the Associated Facilities (Power Plant)	14
8. RESETTLEMENT ACTION PLANS	16
8.1 Transmission Lines	16
8.2 Power Plants	17
9. CUMMULATIVE IMPACTS	17
9.1 North and Southern Route Alternatives for the Transmission Lines	17
9.2 Power Plant	18
10. SOCIAL IMPACT ASSESSMENT	18
11. PUBLIC PARTICIPATION PROCESS	19
11.1 Transmission Lines	19
11.2 Power Plant	20
12. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS	21
13. INSTITUTIONAL ARRANGEMENTS	22
14. CONCLUSION	22
15. REFERENCES	22
16. CONTACTS	22

APPENDICES

Figure 1: Transmission Line Route	23
Table 1: Total number of affected assets for the southern transmission line funded by the AfDB	24
Table 2: Indicative replacement cost per type of homestead structure	26
Table 3: Indicative replacement cost for livestock enclosures agricultural assets, water structures and miscellaneous	27
Table 4: RAP implementation cost for the AfDB funded transmission line	28

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

EXECUTIVE SUMMARY

Project Name: Morupule B Power Project
Country: Botswana
Project Number: P-BW-FA0-001

Introduction

The Government and Botswana Power Corporation (BPC) have called on the World Bank and African Development Bank to partner in the country's energy sector development at the policy, strategy, and investment levels. This includes a request for provision of an IBRD and ADB loan and/or guarantees for the 600-MW coal-fired Morupule B Power Generation and Transmission project and other associated facilities. The Government and BPC desire that energy sector development, especially coal power projects, be implemented consistent with appropriate best practices for minimal environmental and social impacts, and that the cost of energy from the project to be affordable. Other DFIs and commercial banks are also expected to participate in the financing of the proposed project.

Digby Wells & Associates (DWA), a South African firm was appointed by BPC as independent environmental consultants to investigate the environmental and social aspects of a proposed transmission line project in Botswana. The ESIA for the Morupule Power Plant was conducted by Economic Survey of Botswana. All the ESIA's have been finalized, fully disclosed to the public and approved by the Botswana Department of Environmental Affairs (DEA). All the ESIA's have been posted in the BPC website www.bp.bw and also in the World Bank Infoshop. This summary will be posted in the Bank's Public Information Center (PIC) and also distributed to the AfDB Boards for the 120-day disclosure requirement.

2. Project Description

The overall project objectives are to (a) expand domestic power generation capacity that will support sustained economic growth in Botswana, and (b) build institutional capacity for sustainable development of the energy sector.

The proposed Morupule B Power Station is to be situated adjacent to the existing Morupule Power Station, which lies approximately 280 km north of Gaborone. Palapye is the nearest village, situated approximately 5 km to the east of the power station. The main road between Palapye and Serowe (A14) lies south of the proposed site. Serowe is situated approximately 30 km west of the site and is the administrative centre of the Central District. Both the existing Morupule Power Station site and the proposed site for the Morupule B Power Station are within the ownership of the Bamangwato Tribal Authority which is leased to BPC with the future demarcated land portion for the proposed Morupule B Power Station. The proposed site is 476 ha in extent according to the survey record. A railway servitude of 18 ha is registered across the site.

The overall scope includes (i) the Morupule B power station, (ii) transmission lines and substations, (iii) water supply connections, (iv) start-up fuel for commissioning of the plant, (v) Project supervision and Management and (vi) technical assistance (TA).

The World Bank is planning to finance components (i), part of (ii), (iii) and (vi), while the African Development Bank plans to finance part of component (ii), (iv) and part of (vi). The component (v) is being funded by BPC. It is further elaborated below.

From the existing mine currently supplying coal to Morupule A power plant, the coal will be transported by overland conveyors to a coal processing plant where the coal will be separated, the coarse coal washed, and transported to the power plant via another set of conveyors. The discard from the washing process (which constitutes coarse coal not suitable for the power plant) will be transported to a discard dump, while the wash-water will be re-used in the washing process. At the power plant, the coal will be milled and fed as pulverised coal into a boiler to raise steam as part of the generation of electricity. Ash, a waste product from this process, will be disposed of on an ash dump. The use of Circulating Fluidized Bed Combustion, as well as dry-cooling through the use of air cooled condensers as opposed to a wet cooling tower system will reduce environmental impacts, as will the installation of electrostatic precipitators to minimise the particulate emissions from the power plant. The use of air cooled condensers is the key technology used in the power plant to conserve water.

2.1 World Bank Components

The World Bank plans to provide their Partial Risk Guarantee (PRG) for the Morupule B power station consists of a 600 MW (4 x 150 MW) coal-fired circulating-fluidized-bed power plant, close to the existing Morupule A power station in the township of Palapye, northeast of Gaborone. The plant will include: coal yard and coal preparation equipment, coal crushers, limestone preparation and feed systems, boilers with associated particulate removal equipment, fans, steam turbine, and balance of plant. Also, the plant will be equipped with air-cooled condensers to minimize the use of water. Morupule B will be a new plant, but it would utilize existing infrastructure including roads, coal transport system, water supply, and solid waste disposal facilities. BPC will own and operate the power station.

The World Bank transmission line component includes the following (Fig.1):

- Morupule–Phukoje 400-kV line (102 km),
- Morupule–Isaang 220-kV tee in two lines, Morupule–Phukoje and Morupule–Isang fiber optic lines, reactive power compensation equipment and control equipment.

The World Bank funded components also include water supply component including an interconnection to the North-South Carrier under construction and, as a backup water supply, water wells and pipelines, all to be financed by the World Bank and the Botswana Power Company (BPC).

2.2 The AfDB transmission line component includes the following (Fig.1):

- Isang–Morupule 400-kV line (215 km),
- Isang 400/220-kV substation,

In addition, AfDB is to fund the supply of the start-up fuel for commissioning of the plant and a feasibility study of a 200 MW Concentrating Solar Power Plant.

This is an integrated Executive Summary combining the components to be financed by the World Bank and AfdB. The “ancillary” World Bank projects are considered as

“associated” facilities for which the Bank has ensured that the ESIA for these projects also conform to the international requirements.

The Bank staff participated in a joint pre-appraisal with the World Bank team and also jointly visited all the project sites in April 2009.

3. Legal Requirements

Botswana has seen significant changes to the environmental legislative and administrative frameworks within the last few years culminating in the promulgation of the Environmental Impact Assessment Act, Act 6 of 2005, and the creation of the Ministry of Environment, Wildlife and Tourism (MEWT) with a mandate to coordinate environmental conservation and protection. The Department of Environmental Affairs (DEA) is mandated to implement the Environmental Impact Assessment Act which requires that an Environmental and Social Impact Assessment (ESIA) be completed for the project area and an Environmental Impact Statement (EIS) subsequently approved. In addition to the DEA, several additional permits and licenses will be required from several Botswana Government Departments for the successful implementation of the project.

In addition to the ESIA requirements of Botswana, all the ESIA also conform to the Bank’s Environmental & Social Assessment Procedures (ESAP, 2001). The Project has been assigned **Category 1**. Other applicable Bank’s safeguard policies include Involuntary Resettlement, Consultations with CSOs/NGOs, Gender, Poverty Alleviation, and Information Disclosure.

The project is designated **Category A** under the World Bank OP 4.01 on Environmental Assessment reflecting the scale of potential environmental impacts. In addition, the Operational Policy regarding Involuntary Resettlement (OP 4.12) also applies, as does OP 4.37 on the Safety of Dams given the need to ensure sound management of the ash impoundment dam.

A number of environmental and social studies related to the development of coal-fired power generation and transmission at Morupule have been completed (see Table 1). The ESIA for the Morupule B Power Station was approved by the DEA in February 2008. The ESIA for the two transmission corridors have been completed and approved in November 2007. The ESIA for the Isang Substation is scheduled for completion in May 2009. The ESIA for (a) the MCL mine expansion and approved in 2008, (b) the well field proposed as a water source for Morupule B were approved in February 2008. The ESIA for the pipeline and power connections to the well field is under preparation. Each ESIA contains an Environmental Management Plan for ongoing monitoring and management. These ESIA have been made publicly available on the BPC and other public disclosure websites, as well as locally at Morupule/Palapye.

Table 1: Environmental and Social Impact Assessments

Report	Approval by DEA	Disclosure in Botswana
Morupule B Power Station	Feb. 2008	Dec. 2008

Transmission Lines	Nov 2008	Dec. 2008
Isang Substation	May 2009	May 2009
MCL Mine Expansion	Dec. 2008	May 2009
Paje Well Field	Dec 2008	Feb 2009
Well Field Pipeline & Power Connections	May 2009	May 2009

No significant adverse impacts are expected for the transmission lines as they follow the existing right-of-way. The power station ESIA indicates that current levels of emissions from the existing Morupule A cause occasional local exceedances of national and international standards for sulfur dioxide (SO₂), which under World Bank guidelines will require mitigation measures at Morupule A to offset the additional emissions from Morupule B.

4. Project Alternatives

4.1 Transmission lines (Fig. 1)

In order to transmit power from the proposed Mmamabula Power Plant (under consideration by Bank's private sector department), a number of route alternatives were considered in this study. Two alternatives were provided for the lines between the proposed Mmamabula Power Plant and the proposed Morupule B as well as between the proposed Mmamabula Power Plant and the proposed Isang substation. As the 66kV lines will share corridors with the proposed 400kV lines, similar route alternatives will apply. Four alternative corridors, with an additional fifth Limpopo River crossing point, for the lines to South Africa were also assessed.

Fewer impacts are anticipated for the route alternative running adjacent to the existing 220kV lines between Gaborone and Selebi Phikwe and this is recommended as the preferred route alignment for this section of the transmission lines. As the survey for the South African section of the transmission lines is in an early stage, the final route alignment for these lines has not been identified. Although a number of aspects will have to be taken into account in deciding on the preferred alternative, there is no fatal flaw for any of the alternatives within Botswana and all the options will remain a possibility until the South African route is fixed.

Alternative line voltages are also another variation that was considered for the project but increasing the line voltage will not affect the number of lines as this has been determined by risk of failure rather than carrying capacity.

Alternative land uses for the project area have been identified as housing, livestock grazing, various crops and tourism. Although the aesthetics of the area will be affected by the transmission lines, which may impact on tourism, all these land uses can continue relatively undisturbed once the lines have been strung.

The no project option for the transmission lines would mean the power from the proposed Morupule B Power Plant cannot be evacuated. If this occurred there would be none of the negative impacts associated with the project but there would also be no benefit to the Botswana economy, which would be substantial.

4.2 Alternatives for the World Bank financed Morupule B Power Plant

No-project alternative

Given the regional shortage of power, the no-project alternative implies that BPC will be unable to meet projected national demand for power. The benefits of this alternative are that most of the negative impacts associated with the proposed development option will be prevented; these benefits are out-weighed, however, by the economic costs of continued and worsening national power shortages.

Site alternatives

The main factors influencing the location of a coal-fired power plant are proximity to a coal resource of suitable quality and an appropriate water supply. Other important factors that influence location include availability of land, environmental suitability, proximity to the market and availability of infrastructure such as roads, railways and telecommunications. Establishment of the power station at any other location in Botswana would require significant additional infrastructure to be constructed such as roads, rail and the establishment of a new coalmine. Notwithstanding the financial cost associated with this additional infrastructure, the impact to the environment would be significantly greater than the proposed expansion of an existing footprint.

Technology alternatives

The electricity demand pattern in Botswana requires that a base-load generation technology be considered, as a peaking electricity generation technology will only limit the extent to which imported power will be needed at certain times of the day. Although this will assist in reducing reliance on imported power, it will not enable BPC to replace the current 70 % reliance on imported power with local generation capability, which is a key strategic objective of this project, given the renegotiation of the contract with ESKOM which will terminate any sales of electricity to Botswana by 2013. Recent developments in energy storage technologies are bringing renewable energy technologies such as solar thermal generation and wind energy closer to providing base-load requirements, however these new technologies cannot yet be considered to be commercially proven. Given the urgent need to establish base-load capacity in Botswana to replace imported power, and the prohibitive cost of an oil-fired plant, the only financially feasible option is a coal-fired plant.

Design alternatives

Design options considered for Morupule B Power Station focused on either the Circulating Fluidized-Bed Coal (CFBC) boiler design or the Pulverised Coal (PC) boiler design. The CFBC design is an advanced coal utilization technology which has the following benefits over conventional thermal power plants:

- Wide range of fuel adaptability which allows for the use of low grade coal, biomass and waste tires;
- Decreased emissions of NO_x and SO_x;
- High combustion efficiency; and
- Space saving and improved maintenance ability.

Selecting between PC and CFBC boiler designs is a complex decision and environmental performance is only one criterion which should influence this decision. CFBC boiler design is able to achieve a similar environmental performance with

respect to gaseous emissions to PC technology with emissions control, at a lower operating cost.

5. Justification, Benefits & Motivation of the Overall Project

5.1 Key Development Issues

Key to Botswana maintaining its successful development path is the energy sector. Botswana's energy demand was about 3660 GWh in 2008 (peak load of 500 MW), which is projected to grow at about 6 percent per annum reaching 5300 GWh by 2017 (peak load of 850 MW) and 6890 GWh by 2026 (peak load of 1130 MW). The mining sector accounts for about 50 percent of the demand, the commercial sector about 20 percent, and the residential sector about 25 percent. Between 2004 and 2007, rural access to electricity doubled to 44 percent, though short of the 60 percent target under the National Development Plan. The Government's "Vision-2016" aims at 100 percent rural access to support the broader development goals of access to education and health, as well as employment opportunities, to the rural and the disadvantaged population.

The deepening energy crisis across the Southern Africa sub-region is a major impediment to Botswana's economic growth plans, poses a threat to stability, and requires a major concerted effort at the national and regional levels to address the energy challenge. Botswana, like several other countries in the Southern Africa sub-region, have until now relied on inexpensive, abundant, and reliable electricity from South Africa. In 2008, Botswana imported about 2440 GWh (67 percent of its power requirements) from Eskom, the national electric utility of South Africa, while its own small 25-year-old coal power plant (Morupule A, 4 x 33 MW) provided about 22 percent.

The sub-region, including notably South Africa and other neighbors to Botswana, have been experiencing severe shortages of power since end-2007 due to high growth and lagging investments in new capacity. South Africa had started load-shedding intermittently since December 2007, a condition that is anticipated to worsen through the medium term until ample new generation capacity is built and commissioned. Botswana is also experiencing blackouts and is contemplating load-shedding due to its significant dependence on Eskom, which has reduced its supply commitments from current levels to zero in 2013 onwards under a new sales agreement. There is growing social and political pressure in South Africa to stop exports to other countries. Energy security has emerged as the major national imperative for the Government of Botswana. There is deep concern in the Government that the energy situation might lead to a crisis of confidence and political instability, which the country cannot afford.

The Government's strategy to respond to the challenge is comprehensive, addressing the short- to medium-term as well as long-term issues in energy. The main elements of the Government's strategy are summarized under three themes: (i) energy security aspects, including energy conservation and efficiency, prudent development of domestic energy resources, attracting private sector, etc.; (ii) natural resources and safeguards aspects to promote responsible use and approach to environmental and social impacts; and (iii) broader development aspects to address national, regional, and global concerns (*e.g.*, climate change).

5.2 *Rationale for Banks Involvement*

Morupule B is a large-scale coal power project for Botswana, which has no prior experience in financing and managing such a project, especially in a time of crisis. The Banks' involvement will help finalize an optimum financing package for the project to achieve lowest possible cost of energy, and through supervision will help BPC monitor the implementation of all aspects of the project. Botswana has limited experience in monitoring, evaluating, and enforcing environmental and social aspects for a project of this scale. Botswana also needs to develop policy and regulatory frameworks to enable public and private sector investors and operators in the energy sector. Through project supervision, the Banks will support these developmental aspects, as well as build capacity in the relevant Botswana institutions. The Banks will also support the Government's and BPC's efforts on short- to medium-term energy security options, including multi-fuel independent power producers, short-term leasing of generators, etc., with participation of the mining sector. The Banks' involvement in the project will support the Government's energy access, employment creation and poverty reduction goals.

Related to greenhouse gases management, the World Bank has an ongoing technical assistance grant to support Botswana's Designated National Authority to identify and promote Clean Development Mechanism projects. These include exploring energy efficiency in the mines and in households, among other opportunities. The Bank will also help Botswana examine new technologies (solar power for pre-heating of feedwater, coal-bed methane, carbon dioxide capture and storage, etc.) to develop a portfolio that lowers its carbon fuel impacts, which would help set feasible benchmarks for other countries in the sub-region for evaluation of these approaches in energy sector development. Botswana has indicated interest in accessing post-2012 resources of carbon finance through the Bank's proposed Carbon Partnership Facility as well as through the broader carbon markets.

Therefore, the Bank's support for the proposed project in Botswana would lay the foundation to help meet Africa's increasingly urgent need for generation from all sources in a manner that is consistent with the AfDB and World Bank's *Clean Energy for Investment Framework* and supports the World Bank's Africa Region energy strategy. It also supports the approach to provision of energy from coal presented in the draft Concept and Issues Paper on *Towards a Strategic Framework on Climate Change and Development for the World Bank Group*. The project would thus also support engagement with Botswana on issues of mitigation and adaptation to climate change.

6. **Environmental Setting of Project Areas (Power Plant and T-lines)**

The baseline environmental aspects that were studied included climate, topography, soil, surface and groundwater, air quality, noise, visual assessment, fauna and flora, archaeology, social aspects and economics.

Climate

The climate of the region, through which the proposed transmission line will pass, is semi-arid. Though it is hot and dry for much of the year, there is a rainy season, which runs through the summer months. Rainfall tends to be erratic, unpredictable and highly regional. Showers are often followed by strong sunshine so that large volumes

of rainfall do not penetrate the ground but are lost to evaporation and transpiration. The prevailing wind direction of the region is northeast. On average, the temperature ranges between 2.65°C in winter and up to 41.35°C in summer. Rainfall occurs between the months of October and March, with the dry season commencing in mid April continuing until September. The annual average rainfall recorded for the study area is 445 mm. The annual total evaporation is observed to be in the region of ~2 520 mm.

Topography

Apart from the Tswapong and Maifala Hills, the study area is dominated by a low relief plain and featureless veld. There are a number of perennial rivers draining the area that will have to be spanned by the transmission lines. These are the Bonwapitse, Limpopo, Ramatanka, Mhalatswe, Thangwane, Mahunwane, Dikabeya and Mmaitsokwane Rivers.

Soil

The major soil groups that will be crossed by the proposed transmission routes are mostly Arenosols and Luvisols, with small areas of Lixisols. They are mostly found on fine-grained and coarse-grained sedimentary rocks e.g. sandstone. Luvisols have an accumulation of clay (15- 25%) and a higher fertility, while Arenosols are coarse, sandy soils with weak structure and low fertility. In general the soils are sandy with a low clay content (<10%); this results in high water infiltration rates, low water holding capacity and fairly poor fertility. Lixisols are highly weathered and strongly leached soils and also have a zone of clay accumulation which may occur at some depth below the soil surface.

Land Capability and Land Use

Soils are mostly sandy, with poor structure and are extremely low in all essential nutrients especially phosphate. These soils are thus seldom farmed on a large scale, mainly due to the high cost of fertilization and low rainfall. The entire study area is classified as being veld or grazing land for purposes of its “pre-project” land capability. The land in the study area is used for grazing cattle, goats and sheep, with small areas of subsistence agriculture practised along the proposed routes. There is also a growing amount of focus on tourism within the Tuli block over which the proposed lines will cross.

Surface Water

There are eight rivers that will have to be spanned by the transmission lines. These all experience a zero flow during dry weather conditions and most only flow temporarily after large storms. Flood lines and volumes have been calculated and are presented in the report. A unique feature of this project is its transboundary nature i.e. it involves crossing the Limpopo River, which is the national border between Botswana and South Africa. The Limpopo River catchment is of interest to various government departments in the countries that border the river, namely Botswana, South Africa, Mozambique and Zimbabwe. The surface water quality in the area is unaffected by industrial activity and care must be taken to control all dirty surface water runoff generated by the proposed project and minimize the impact on surface water quality.

Groundwater

The sand layer associated with most of the study area has a high infiltration rate and a low storage capacity but can be considered an aquifer with sufficient water supply throughout the year. Hand dug wells along the riverbeds indicate that this aquifer is a good source of water supply for the local cattle farmers. The aquifer potential of the basalts in the study area has been described by Cheney (1981) and it was concluded that the basalts give a consistent yield of potable water within the fractured zone.

Air Quality

Existing sources of emissions include industrial sources and power generation; mining operations in the region; vehicle tailpipe emissions; household fuel combustion; agricultural activities; biomass burning and fugitive dust sources. Emissions arising from two operational coal-fired power stations fall within the region of concern, one located near Lephalale in South Africa (~100 km to the east) and one near Palapye in Botswana (~ 111 km north-northeast). Biomass burning; crop-residue burning and general wild fires represent significant sources of combustion related emissions associated with agricultural areas.

Noise

The topography of the area of the proposed development is very flat, i.e. there is little screening against the propagation of noise from the source to the receiver. The vegetation is, however that of densely grown bush and trees and the ground conditions are to a large degree very sandy. These conditions provide excess attenuation of noise sources as sound is absorbed as the noise propagates across the ground. The general description of the ambient noise climate, in the area, that will be affected by the proposed transmission lines is rural. Ambient levels in this rural environment are therefore low. The more urban areas along the route will have higher ambient noise levels, above which the noise from the transmission lines will have little impact.

Flora and Fauna

The typical vegetation in this region is savanna, containing a tree and shrub layer as well as a grass layer. Due to the extensive grazing by livestock in some areas along the proposed routes, the relationship between these two layers has been unbalanced, resulting in the tree and shrub layer becoming dominant over the grass layer. This then allows the tree and shrub layer to continually out-compete the grass layer, resulting in a dense tree and shrub layer and limited grass cover. The vegetation is in differing stages of succession, and this is reflected by the species that were found. The herbaceous component of the sampled area consisted mostly of pioneer or subclimax species. These were mostly increaser 2 species, which are grasses that are typically associated with overgrazed veld. The tree component encountered, varied between different degrees of bush encroachment to proper Savanna, depending on the proximity to human settlements. *Acacia tortillas*, *Dichrostachys cinerea*, *Grewia flava*, were the most common species found. Areas of potential significance are those where the transmission lines cross the rivers and streams. All the rivers and streams in this region are non-perennial. The vegetation supported by riparian environments differs from the surrounding vegetation. This is due to the increased availability of a water supply and different soil forms. Larger trees tend to be found in these zones. These zones are important as they provide habitat for animal species and generally support abundant bird life. Due to anthropogenic pressure, there is very little wildlife occurring along most of the proposed routes. The exceptions to this are the relatively healthy birdlife as well as the higher game counts in the privately owned Tuli block area, where smaller mammals as well as species such as impala, wildebeest, kudu, zebra and warthog are abundant.

Archaeological and Cultural

There are a number of archaeological sites located along the various transmission line routes. The located sites are representative of all the broad archaeological periods, namely the Stone Age, Iron Age and Historical period. The ceramic tradition of the first Iron Age communities has since been named the Toutswe tradition (Denbow 1984). The majority of documented archaeological and cultural sites are concentrated towards the north eastern border of Botswana, where the country shares rich

archaeological legacies with South Africa and Zimbabwe in the region of the World Heritage Site, Mapungubwe. Although the Project area is not located in close proximity to the Mapungubwe and K2 sites or Great Zimbabwe, the definite cultural association of the proposed development area with the renaissance of southern African civilization confirms the importance of the development area in furthering our understanding of this complex period of our past.

Socio-Economic

With a GDP of P48.6 billion in 2005 (about US\$ 7.6 billion), Botswana's economy is viewed as one of the strongest in Africa, bolstered mainly by revenues from mining, particularly diamond mining. Income per head has reached US\$8,700 on a purchasing power parity basis, making the country a middle income nation and one of the wealthiest in per capita terms in Africa (GDP on a purchasing power parity basis is over four times the sub-Saharan Africa average). Over the past three decades, Botswana's economy has recorded impressive growth rates. The economy grew at an annual average growth rate of 8.8% over this time, culminating in a real growth rate of 8.3% from 2003/04 to 2004/05. The investment in the MEP is likely to contribute to the sustained growth of the economy in future. The study area is predominantly rural so most of the residents are engaged in both arable and livestock agriculture. Most arable operations are at subsistence level, while cattle are farmed on a more commercial basis. In addition to agriculture there are commercial operations such as butcheries, shops, bars, bottle stores, wholesalers (existing in major villages), as well as hawkers and vendors. The idea of community based wildlife management areas has also gained momentum. Currently, the Nata Sanctuary and the Khama Rhino Sanctuary are in operation. Research is being conducted to establish viability of similar activities along the Tswapong Hills. A survey was undertaken by ERM and BIDPA in November 2006, focussing on businesses along the transmission lines. The survey included Mahalapye, Palapye, Serowe, Selebi-Phikwe and Mookane in the Central District, as well as Gaborone. The survey found that most businesses are small-scale and not well established. There is an extremely limited industrial and business base in the Central District. Almost 60 percent of businesses surveyed are in the wholesale and retail sector, with the majority of products and services sourced from South Africa or other countries and distributed within Botswana. Only a third of the businesses surveyed have any experience in dealing with mining, engineering or energy companies. In terms of weaknesses and constraints, competition from larger companies (41%) and availability of finance (23%) are cited as the major constraints of doing business in the Central District according to surveyed companies. Although goods and services produced by these businesses are mainly for domestic use and not for export, the bulk of the raw materials are imported from South Africa. These businesses are faced with high transaction costs for importing inputs, which limit their profitability and their capacity to meet the demand that would be generated by the transmission line project.

7. Environmental Impacts & Mitigation

7.1 Transmission Lines

It is anticipated that the majority of the environmental impacts associated with the transmission lines will occur during the construction phase. These will include vegetation clearing and cutting, movement of vehicles, increased presence and activity of construction personnel as well as the establishment of servitudes and access roads. Associated with the increase in vehicle and people activity there will also potentially be an impact of dust as well as pressure on the fauna, both domestic

and wild, along the proposed corridors. Although some of these impacts will be significant, they will all be short term or temporary and are relatively straightforward to manage and mitigate during and after construction.

There should be fewer impacts resulting from the operation of the lines, however, due to the long term nature of such a development, the significance of these impacts will potentially be greater. Although only affecting a small section of the total distance covered by the transmission lines, one of the major impacts will be the visual impact on the tourism potential of the area. Following farm boundaries, rather than dissecting farms is recommended as a means to lessen this impact as well as mitigate the effect of dividing farms. Concern from both communal and private pastoralists is the loss of grazing land, however, apart from a relatively narrow servitude, there should be no permanent loss of grazing or browsing and this impact is not, therefore, considered significant. One of the more significant impacts recorded on existing transmission lines is bird fatalities. The large clearance on 400kV lines means that electrocution is not an issue in this regard. Collisions are, however, responsible for a large number of avifauna fatalities. A fair amount of research has been conducted on reducing this impact and several mitigation mechanisms have been developed. These are detailed in the respective specialist report and will need to be implemented on areas of high bird movement such as near rivers, wetlands, roosting sites and open lands. Another concern often raised in relation to transmission lines is the health impact of electromagnetic fields (EMF). No experimental evidence exists to substantiate this impact, although anecdotal evidence may suggest otherwise. In order to err on the side of caution, safety limits for both occupational and environmental exposure have been established by the International Commission for non-ionising Radiation Protection (ICNIRP) and will be adhered to.

Key impacts associated with the transmission lines

Construction Phase

- Soil Compaction of soil may lead to reduced agricultural capability.
- Visual impact during construction to communities and visitors to the area results in a significant negative impact
- Flora Removal of vegetation during construction will result in habitat destruction and visual scarring. Damage of removal of red data species will result in a major impact.
- Fauna Damage to habitat and increased activity will cause animals and birds to move out of the area.
- Traffic Increase in traffic may disrupt local movement of people and livestock as well as pose a safety hazard.
- Population change and inflow and outflow of workers Moderate
- Moderate loss of arable land, agricultural land and communal grazing land loss of natural resources.
- Economic and/ or physical resettlement-loss of dwelling structures and loss of sense of place (Tuli block farmers), Decreased property value in Tuli Block.
- Relocation of graves, places of worship or archaeological sites.
- Decrease in safety & security
- Opportunities for employment creation. Indirect & induced employment during construction. Economic development in the project area, diversification of the economy and increased value. Increased government revenue.

Procurement of local goods and services during construction. Enhancement/upgrade of skills and experience. (*Positive*)

Most of the above would be temporary and be easily mitigated during the implementation of the ESMP.

Operation Phase

- Limit expansion of residential areas and Land Use
- Reduce tourism potential of the area
- Flora bush encroachment resulting in loss of diversity and loss of grazing
- Bird fatalities due to collision with lines. Bird fatalities due to electrocution
Moderate
- Fauna Loss of habitat through servitude maintenance.
- Visual Establishment of new infrastructure which is highly visible and decrease in land value due to aesthetic impact.
- Social Loss of sense of place, individual expression and way of life.
- Economic Increased foreign currency earnings.
- Decommissioning and Closure (*Positive*):
 - Flora Re-establish indigenous vegetation along servitude.
 - Revegetation and a decrease in anthropogenic activity will result in increase animal movement to the area.
 - Removal of transmission lines will remove obstruction to bird movement.
 - Visual Post closure visual environment enhanced by removal and rehabilitation of infrastructure

7.2 Impacts and Mitigation for the Associated Facilities (Power Plant)

The ESIA of the power plant considered environmental impacts under the following categories:

- Water resources, including (i) groundwater usage, (ii) surface water utilization, and (iii) community access to water;
- Ecological impacts, including impacts on (i) fauna, (ii) flora, and (iii) soils;
- Impact on the atmosphere, including health impacts of gaseous emissions, and noise impacts;
- Waste management practices;
- Social impacts including (i) resettlement, (ii) impacts on health and safety, (iii) traffic and safety, (iv) current and future planning, and (v) impacts on heritage resources; and,
- Institutional capacity requirements.

The Environmental and Social Management Plan is attached (Annex II), and will be included in the Tender and Contract documentation for Contractors working on the project.

Management of Air Quality

Specifications for the Morupule B Power Station include achievement of World Bank emissions standards. While Botswana has not established emissions standards for power stations, the *Air Pollution (Prevention) Act 1971* requires the application of

best practicable means to control emissions. World Bank emissions standards are more stringent than the maximum permissible limits specified by the Botswana authorities for Morupule A's current boiler operations. The EIA for Morupule B found that current emissions from Morupule A may be causing occasional local exceedances of Botswana air quality standards for ambient sulfur dioxide concentration, suggesting that it may not be possible for Morupule B to meet ambient air quality standards without reductions in emissions from Morupule A. Prior to making a decision regarding investment in sulfur dioxide emissions control at Morupule A, BPC intends to undertake both an environmental audit of current operations and a two-year air quality monitoring campaign to better define the issues to be addressed and possible solutions. Based on the results of the two-year air quality monitoring campaign, BPC will implement measures as necessary to ensure that the joint operation of Morupule A and B does not lead to exceedances of World Bank or Botswanan AQ standards.

Climate Change

Greenhouse gases, notably carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), nitrogen oxides (NO_x), carbon monoxide (CO) and sulphur hexafluoride (SF₆), all contribute to climate change through their ability to trap heat in the atmosphere. The BPC project will contribute to Greenhouse Gas emissions primarily as a result of the burning of coal. Currently, Botswana's Greenhouse Gas Footprint is negative and will remain negative after the addition of the CO₂ equivalents from this project. The gross Greenhouse Gas Footprint of the project is estimated to be approximately 4 million tonnes CO₂ equivalents per annum.

Two environmental studies are to be conducted during project implementation which include an air quality monitoring campaign focusing on the existing Morupule A Power Station, and a Regional Environmental and Social Assessment to consider the cumulative and trans-boundary impacts of all planned coal-fired power investments on both sides of the Botswana/South Africa border. The TORs for these two studies have been finalized and to be financed by the World Bank or BPC. It is expected that the study would recommend some retrofit to the existing Morupule (132 MW) plant to install emission reduction measures particularly for the SO₂, NO_x and PM₁₀.

Water Resources

Although both Morupule A and B are designed for air-cooling technology, significant amounts of water are still required for a variety of aspects of their operation, in particular as make-up water for blow-down losses. The estimated water requirement for the combined operation of Morupule A and B is two million cubic meters per year. Currently, about seven hundred thousand cubic meters per year are being supplied for the Morupule A Power Station from the Paje well field, some fifty kilometers to the north-west. A well field adjacent to Paje is proposed as a possible source of water for the combined Morupule A and B operations. The ESIA of the proposed new well field indicates that meeting the full water requirement from this source would draw down the aquifer by thirty percent in twenty years, potentially affecting a number of cattle post boreholes, as well as seeps feeding the Motloutse River.

An alternative source of water is the North-South Carrier (NSC), for which investment will be required in pretreatment facilities at Morupule to remove organic material from the water before demineralization. By adopting the NSC as the primary water source, BPC will reduce the risk of drawing down the aquifer. Nevertheless, the pipeline and power connections to the proposed well field will be installed to preserve this source as a backup. Ash from both Morupule A and B will be disposed of in a new, compartmentalized, LDPE-lined ash pond, with water recovery for reuse.

8. Resettlement Action Plans

8.1 Transmission Lines

Physical Displacement

A Resettlement Action Plan has been developed and estimates some 7.7 Million Pula in form of compensation. (See Table 4 for details).

There are a total of 27 households who have one or more homestead structures that may be affected (physical displacement) by the construction of the lines. In line with the African Development Bank's Policy on involuntary resettlement and displacement, it has been the intention of BPC to align the lines in such a manner so as to avoid physical resettlement where possible. In comparison to other resettlements, the impact of physical displacement for this Project is expected to be low if the compensation measures are properly implemented. This is mostly due to the possibility that the majority of people will not have to be physically resettled to an entirely new area. Where resettlement is unavoidable, it will be possible in many cases for the affected homestead structures to be moved to an alternative area on their current field to an acceptable distance from the line. This will simplify the livelihood restoration process as the community will be able to continue farming i.e. planting crops and/or herding cattle.

Economic displacement

Right of way construction activities will affect portions of agricultural fields, some livestock enclosures and some water structures that cannot be moved (boreholes, cement reservoirs and a well). The asset survey found that there are 28 households who have livestock enclosures that may be affected and 54 households whose fields are affected (excluding fields that are not cleared or fenced). There are 8 households whose non-movable water structures may be affected. As is the case with homestead structures, it will in most cases be possible to move the livestock enclosures to an alternative area on their current field to an acceptable distance from the line. As far as the impacts on agricultural fields are concerned, if the construction activities take place prior to the harvesting season, some crops will also be damaged / destroyed by the construction of the lines. In some instances, the fences demarcating agricultural fields and grazing areas will be affected. Farmers should be compensated for the portion of their field that will be lost due to the lines and for damage to field fences. If construction of the lines takes place prior to the harvesting season, farmers will have to be compensated for damage to and/or loss of crops. In some isolated cases, a farmer's fields may be impacted on to such an extent that it may be better to find a new field for the farmer.

Tables 1, 2 3 and 4 contain details on the number of affected households, plots and estimated compensation costs.

8.2 Power Plant

Construction of the **Power Station** will require resettlement of one household for which a separate abbreviated Resettlement Action Plan has been prepared. Construction of the **water supply** may require some minor land acquisition, affecting primarily cultivated areas. Land acquisition and possible resettlement will be required for the construction of the **transmission lines**, but the precise routing has yet to be determined. BPC has already altered the initial proposed routing of part of the transmission line to avoid adverse social impacts, land acquisition and resettlement. The relatively **flat topography** and the **low population density** allow for additional adjustments in the routing, and the final routing is still being adjusted to minimize impact, both in terms of resettlement and in the avoidance of cultivated areas. Therefore, a Resettlement Policy Framework has been prepared following the World Bank policy on involuntary resettlement, Operational Policy 4.12. Resettlement Action Plans will be prepared for the specific areas along the transmission lines where there is land acquisition and/or resettlement in accordance with this Resettlement Policy Framework. The Resettlement Policy Framework, addresses adverse social impacts that may result due to involuntary acquisition of assets and changes in land use and includes provision for compensation and rehabilitation assistance.

9. Cumulative Impacts: Route Alternatives Impacts and Recommendations

9.1 Northern and Southern Route Alternatives for the Transmission Lines

Two route alternatives were assessed between the proposed Mmamabula power plant and the Morupule power station, outside Palapye. The indication from the specialist studies is that the western alternative i.e. following the existing 220kV servitude adjacent to the A1 is the preferred alternative. Similarly for the alternative routes between the proposed Mmamabula power plant and the proposed Mosaditshweni sub-station. The justification for this recommendation is:

- The cumulative effect of the additional line will be positive as it will provide a more obvious design structure for the tower that birds are more likely to avoid, thus reducing the potential for bird fatalities.
- The addition of another transmission line along this route will have less of a visual impact where there are existing linear developments such as the 220kV lines and railways. There will thus not be a substantial altering of the sense of place as there will be should the lines traverse a more pristine area.
- This route already has a number of established access roads and servitudes and there will, therefore, be less disturbance of the environment in providing these facilities. It is also in relatively close proximity to the Route A1, thereby facilitating easier access.
- The vegetation along this route is more highly disturbed as a result of overgrazing and past clearing, with bush encroachment evident in many areas. There will thus be less of an impact on flora should this alternative be selected, with possibly a positive impact should rehabilitation be conducted correctly.
- The greater human and livestock activity along this route has already resulted in large disturbance to wildlife, with very little still present in the area.

Although there will be a cumulative impact from construction of an additional line, this impact will be less than if disturbance is created in an area with higher numbers of wildlife i.e. the eastern route.

9.2 Power Plant

The air emission modeling carried out cumulative air quality impacts considering the regional airshed. As discussed earlier, the ambient air quality will be exceeded for a short duration as a result of emissions from the existing Morupule A plant. Two environmental studies are to be conducted during project implementation which include an air quality monitoring campaign focusing on the existing Morupule A Power Station, and a Regional Environmental and Social Assessment to consider the cumulative and transboundary impacts of all planned coal-fired power investments on both sides of the Botswana/South Africa border. The TORs for these two studies have been finalized and to be financed by the World Bank or BPC. It is expected that the study would recommend some retrofit to the existing Morupule (132 MW) plant to install emission reduction measures particularly for the SO₂, NO_x and PM₁₀. ESIA's for water also assessed cumulative impacts to ensure that the water supply to all the existing and future plants will be sustainable.

10. Social Impacts Assessment

Social impact assessments (SIA) have been carried out for both Morupule B and for the transmission lines. It is expected that the Morupule township would be adversely affected from a large influx of construction workers and informal job seekers from both inside of Botswana and adjacent countries. Municipal, health, and social services would be affected, and there are concerns about HIV/AIDS. Within the immediate area of the proposed Morupule B power station, there is reportedly one family of squatters; the process of re-locating that family is underway. BPC has fenced the area to be developed under Morupule B. With respect to the transmission lines, the SIA summary indicates that there is potential negative impact on land use and possible resettlement of a few individual households. As required by the World Bank OP4.01 and OP4.12, BPC has adopted a Resettlement Policy Framework with the intention to develop the full RAP before the commencement of the construction.

The proposed transmission line routes traverse through two districts, namely: the Central District and the Kgatleng District. Settlements are located in the transmission lines' area of influence are Selebi-Pikwe, Mahalapye, Mookane, Dibete, Mosomone, Dikabeya, Palapye, Tewane, Lose, Dinokwe, Maphashalala, Leshibitse, Temesele, Pitsetshweu, Radisele and Tamasane. There are also several scattered homesteads in the Molapo wa Dipitsi area, just south of Selebi-Pikwe, that fall within the area of influence. There are 10 privately owned farms along the eastern boundary in the Tuli Block that might be directly affected. These farms are Deepdale 6 LP, Annex Craignair 7 LP, Craignair 9 LP, Eloffsdale 8 LP, SaasPost 34 LQ, Darnaway, Dovedale 33 LQ, Basinghall 31 LQ, Holmlea 30 LQ and Riversdale 10 LP. The farms Teesdale 11 LP and Annex Palla 5 LP are in close proximity to the proposed corridors, but would most likely only be influenced as far as visual impacts are concerned.

The construction of the lines from Morupule B to Isang (215km) will take approximately two years, while the construction of the lines from the power station to the South African border will take a further year. It is most likely that these will be done at the same time by two different contractors. The construction of the lines from Morupule B to Phokoje will require a labour force of around 200, while the lines from the power station to the border will require around 150 people. Each contract will require around 40 to 50 skilled workers who will be brought in with the contractor. Most of the labor force will therefore be unskilled and sourced from a labor broker or labor department locally. Most of these will likely not have any experience with power lines, although some may have had experience on other projects of a similar nature and are now unemployed. A proper construction camp that is comprised of portable cabins will be built to accommodate the entire labor force during this time. These camps are usually fenced, have gate control and proper security. Various impacts have been identified for both the construction and operational phases of the project. Decommissioning has not been considered in great detail as although the expected life of the project is approximately 40 years, the transmission network will likely then be connected into power productions that are developed in the future.

Key impacts associated with the construction phase include the disturbance of agriculture, clearing of vegetation, increased vehicles and people, impacts associated with construction workers as well as dust and noise generation. Most of these impacts will be temporary and will be reduced or corrected after the construction phase. The most severe impacts associated with operation will be the visual intrusion on the landscape, the potential negative impact on tourism in the region, in particular the Tuli Block farms, and a limited amount of permanent vegetation removal, which will have the greatest impact in riparian habitats where trees greater than 4m may have to be removed. There may also be a few, isolated relocations of households where they are situated directly on a section of the proposed routes that cannot be deviated. According to the contractors, settlements and conservation areas will be avoided when the route alignment is finalized, treating them as “no go” areas. As a result, a few isolated cases of homestead resettlement might occur. The proposed ‘V’ tower pylons have a small footprint and will have a low localized impact in terms of loss of agricultural land. Some agricultural activities (for example cattle grazing and maize cultivation) are permitted within the transmission line servitude. Activities higher than 4m, however, will be restricted. The greatest positive impact will be the increased capacity of the Botswana grid and the export capability provided to South Africa. Physical and economic resettlement as a result of the proposed transmission lines might occur and it is proposed that the identification of affected people is primarily based on the recognition of rights and assessment of risks as a result of the proposed project. Additional baseline surveys are underway to determine the nature and extent of affected people’s rights and assets, agricultural activities, site improvements, as well as mitigation options and compensation packages. These tasks would form part of the Resettlement Action Plan (RAP) framework.

11. Public Participation Process

11.1 Transmission -Lines

A Public Participation Process (PPP) has been followed for the MEP. The process has been incorporated into a Public Consultation and Disclosure Plan (PCDP) which includes the findings of the authorities and public participatory meetings held at the national and district levels as well as meetings in the villages along the proposed

transmission line routes. Although this process was initiated during the ESIA phase of the project, it will continue through construction and operation. Below is the feedback received on the issues raised during the public consultations:

Land: Project footprint and loss of access to land will reduce the availability of agricultural and grazing land and will limit the choice of land use.

Cultural Heritage: Project activities in relation to sites of cultural significance: Project-related activities along the river will put iron and Stone Age sites at risk.

Social Change: Project-induced social change: The area will change from a rural and natural environment to an industrial/developing one. A potential influx of outsiders during construction may affect local culture and traditional structures. People's values and behaviors may be undermined. Potential increase in crime related to the influx of outsiders. There is likely to be a limitation of potential land-use. Visual impacts will affect the aesthetic attraction of the area.

Closure and Rehabilitation: Closure and post-closure potential for degradation of physical and social environments: The project will leave behind it a long-term legacy through permanent alterations to the landscape. Lack of capacity and resources to audit compliance may result in a number of breaches in procedures and contracts. Use of only outside auditors will risk inappropriate action taken as a result of inadequate local knowledge. A government underwritten guarantee is needed to ensure that, someone within the country is accountable for addressing impacts at closure.

Employment: Project activities and local employment opportunities: Give priority to local residents for employment where possible. Be sure to look for skills within tertiary institutions before importing existing skills.

Public Participation & Communication: Communication facilitates or hampers local participation. Inadequate information about the project reduces people's ability to make decisions about their futures. Inadequate information creates mistrust between local residents and the developer.

11.2 Public Consultations for the Power Plant

Public consultations were conducted for the project as part of the various environmental and social assessments indicated in Table 1. The stakeholder engagement process for the ESIA of the power plant commenced in August 2007 with the publication of an advertisement in English and Setswana announcing the project. An invitation to attend the scheduled public meeting regarding the project was included in the advertisements, and at these meetings a background information document was presented in both Setswana and English.

A public meeting was held at Palapye main Khotla on September 4, 2007, and was conducted in Setswana as all the participants could speak and understand the language. The meeting was attended by 31 people including the consultations team and representatives from BPC. A meeting with key local and central government officers was also convened in Palapye in September 2007, and the stakeholder engagement team undertook consultations with focus groups comprised of local farmers in the following lands areas within 10 km of the proposed power station site:

- Morupule;
- Mantshadidi;
- Mmalenakana;

- Dikabeana; and
- Molapowadipitse.

The principal comments received during these consultations are indicated below and which the BPC have agreed to:

- i) Public, farmers and livestock owners meetings – (a) preference should be given to local people for non-skilled and semi-skilled labor requirements and the hiring should be done in a transparent manner, such as through use of the Khotla, (b) concern was expressed regarding the increased probability of illegal occupiers of land who will come in as job seekers;
- ii) Business community - the contractor should source some of the materials and services locally; and,
- iii) Local government - construction phase may exert pressure on existing social amenities such as schools and clinics available in the town.

11.3 A Grievance Resolution Procedure has been developed, which describes the process whereby stakeholders can report their concerns and grievances related to BPC activities, and identifies processes for addressing these concerns. It also allows for stakeholder involvement at various points in the resolution process. The Grievance Resolution Procedure makes possible the lodging of a grievance in any appropriate format (written, verbal, telephonic, email, post etc). The process is designed to be easily accessible and not intimidating.

12. Environmental and Social Management Plans (ESMPs)

For the transmission lines, as the majority of impacts will be associated with the construction phase a preliminary management plan for this phase has been outlined in the ESIA. However, the final design profile is being established. When this information becomes available, a profile specific ESMP will be developed before construction commences. This should be to a level of detail that identifies and provides management recommendations for specific sensitive sites such as graves, river crossings habitats and for red data species. The ESMP will be incorporated into the construction and maintenance contracts and to be monitored by the DEA as well as through the Banks' supervision missions.

The ESMP for the power plant have also been developed.

The various ESMPs will address: Physical disturbances, Hydrocarbon management, Social impacts and public awareness, Biological impacts, Cultural impacts, Closure and rehabilitation, waste and risk management, Community enterprise development, Human resource development and training, and Community Health & safety Plans.

Project Timing and Implementation

Construction of the transmission lines should begin in 2009, with the final project commissioning anticipated in December 2011. Construction will begin on the 66kV lines as these will be required for construction of the mine and power plant as well as commissioning. The 400kV lines will, however, have to be complete in order to transmit power generated by the Morupule B Power Plant. Although the planned life

of the coal mine is 50 years, the transmission lines may well remain in use as a component of the regional power grid after closure of the mine.

13. Institutional Arrangements

BPC will be responsible for the overall implementation, administration and enforcement of the ESMPs. BPC has appointed an Engineering Consultant, who in turn will:

- Ensure that the ESMP specifications are included in all tender documents issued for building works and activities on site, and will monitor and enforce adherence to these requirements by Contractors;
- Appoint an Environmental Liaison Officer (ELO) to monitor implementation of and compliance with the ESMP for the duration of the works;
- Issue fines or stop work orders for contravention of the ESMP and give instructions regarding corrective action.

In addition, BPC will appoint an Environmental Manager (EM) who will undertake regular audits of the construction site. During the operational phase the EM will be responsible for ensuring BPC's continuing compliance with the ESMP.

14. Conclusion

Both the Power Plant and the transmission lines are essential components of the project as they will enable the generation and evacuation of power from the proposed Morupule power plant. During the ESIA process, various specialists assessed the impacts of the proposed plan and the 400kV lines running both north to Selebi Phikwe, south to the proposed Isang sub-station as well as east to the Limpopo River and the South African border. No fatal flaws were identified by any of the specialist for the project and the recommendation from the ESIA team is that the project can proceed. A number of impacts are, however, anticipated for the project, which will require mitigation to minimize the impacts. It is therefore critical that the measures described in the ESMP are strictly adhered to and a profile specific ESMP is compiled once the profile design is available. All the ESIA have been publicly disclosed and approved by the DEA.

15. References:

1. Environmental Impacts Statement for Botswana Transmission Lines for the Mmamabula Energy Project BOTSWANA POWER CORPORATION March , 2007.
2. Resettlement Action Plan (RAP) for the proposed MORUPULE B – ISANG 400 kV transmission line, Botswana; BPC

16. Contacts:

- (i). Mr. Dennis Aupa Olaotse, Botswana Power Corporation, Macheng Way, Motlakase House P.O Box 48, Gaborone BOTSWANA Tel: 267 360 3516
Email: olaotsed@bpc.bw Website: www.bpc.bw
- (ii) Mr. B. Ram, Chief Power Expert, African Development Bank,
Tel: 216 71 10 2266, B.Ram@afdb.org, www.afdb.org

Table 2: Total number of affected assets for the southern transmission line funded by the AfDB

	HOMESTEAD STRUCTURES								LIVESTOCK STRUCTURES				AGRICULTURAL ASSETS			WATER	OTHER
	FENCING	SQUARE MUD HUTS	ROUND MUD HUTS	CEMENT BRICK STRUCTURE	MODERN BRICK STRUCTURE	TEMPORARY (COMBINATION)	NATURAL WOOD STRUCTURE	ZINC STRUCTURE	CATTLE	GOAT	DON KEY	CHICKEN	FENCING	CULTIVATED FIELD	UNCULTIVATED BUT CLEARED	WATER STRUCTURES	
OLD TOTAL (previous alternative)	32	26	29	36	4	10	25	9	22	19	4	7	56	37	32	8	11
NEW TOTAL	22	21	25	29	4	7	19	9	22	18	3	6	54	35	30	8	10
Affected structures reduced by:	10	5	4	7	0	3	6	0	0	1	1	1	2	2	2	0	1

Table 2: Indicative replacement cost per type of homestead structure

	HOMESTEAD STRUCTURES								
	FENCING	SQUARE MUD HUTS	ROUND MUD HUTS	CEMENT BRICK STRUCTURE	MODERN BRICK STRUCTURE	TEMPORARY (COMBINATION)	NATURAL WOOD STRUCTURE	ZINC STRUCTURE	TOTAL
TOTAL NUMBER OF STRUCTURES AFFECTED	22	21	25	29	4	7	19	9	
COMPENSATION RATE PER ASSET (Pula)	4,490	24,000	18,750	43,040	213,600	32,000	1,080	1,350	
INDICATIVE REPLACEMENT COST (Pula)	98,780	504,000	468,750	1,248,160	854,400	224,000	20,520	12,150	<u>3,430,760</u>
COMMENT (Average structure size and compensation rate selected from the Compensation Rates document)	Based on average homestead fence being 40mx40m Using P25 per meter run for diamond mesh option under fencing category and, 32 poles (75mm-100mm) at P15.29 per pole	Based on average structure being 4mx8m Using P750 per square meter option under traditional house category	Based on average structure being 5mx5m Using P750 per square meter option under traditional house category	Based on average structure being 4mx8m Using P1,345 per square meter option under 'house' category	Based on average structure being 10mx12m Using P1,780 per square meter option under 'house' category	Based on average structure being 5mx8m Using P800 per square meter (no rate provided in the compensation rates document)	Based on average structure being 4mx6m Using P45 per metre run option for wood panelling	Based on average structure being 4mx4m, at an approx cost of R1,500	

Table 3: Indicative replacement cost for livestock enclosures agricultural assets, water structures and miscellaneous

LIVESTOCK STRUCTURES				AGRICULTURAL ASSETS			WATER	OTHER	
	CATTLE	GOAT	DONKEY	CHICKEN	FENCING	CULTIVATED FIELD	UNCULTIVATED BUT CLEARED	WATER STRUCTURES	
TOTAL NUMBER OF AFFECTED ASSETS	22	18	3	6	54	35	30	8	10
COMPENSATION RATE PER ASSET	1,900	710	710	357 (4 x normal) 30,000 (2 x large)	1,250	605	550	43,600 (5 x equipped borehole) 3,000 (2 x cement reservoir) 10,000 (1 x well)	
INDICATIVE REPLACEMENT COST	41,800	12,780	2,130	61,428	67,500	21,175	16,500	234,000	226,350
COMMENT	Based on average cattle enclosure being 30mx30m, requiring 24 treated 2.1m poles at P50 per pole and two rolls of strain wire at P350 per roll. Very rough estimate, PAPs cattle enclosures differ significantly in terms of	Based on average goat enclosure being 5mx8m, requiring 40m of chicken mesh wire at P14.70 per meter and 8 poles (75mm-100mm) at P15.29 per pole	Based on average donkey enclosure being 5mx8m, requiring 40m of chicken mesh wire at P14.70 per meter and 8 poles (75mm-100mm) at P15.29 per pole	There are 2 chicken enclosures that will cost approx. P30,000 each. For the remainder, based on average chicken enclosure being 4mx4m requiring 16m of chicken mesh wire at P14.70 per meter and 8 poles (75mm-100mm) at	Based on average distance of fence being affected will be 50m Using P25 per meter run for diamond mesh. It is uncertain at this stage how many fences will be affected and whether gates will be affected	Based on P2420 per hectare option for fully de-bushed, partly distumped field. For the purpose of this costing, assumed that only ¼ of hectare will be affected (P605). Very rough estimate as it is not clear how much of a farmer's field will be affected and will only be affected temporarily The cost to compensate for damaged crops is not included in the costing. An	Based on P2200 per hectare option for partly developed field. For the purpose of this costing, assumed that only ¼ hectare will be affected (P550). Very rough estimate as it is not clear how much of a farmer's field will be	No cost provided in the Compensation Rate document. Based on assumption that two of the water tanks will be movable. Two cement water reservoirs will have to be rebuilt at @ P3,000 per reservoir One well will have to be compensated at P10,000 Five boreholes may have to be drilled, at P43, 600 per equipped borehole (difficult to accurately determine the cost for drilling as there is a lot of factors that need to be	One zinc water structure @ approx. P1,350 One 20mx40m greenhouse with shade netting @ P60,000 (cost might be reduced as some materials will be salvageable) Five large crop storage structures @ P24,000 each One large piggery @ approx. P40,000 One soccer field @ P5,000 (clearing one hectare) There is also a gravesite that was recorded. However,

LIVESTOCK STRUCTURES				AGRICULTURAL ASSETS			WATER	OTHER	
	CATTLE	GOAT	DONKEY	CHICKEN	FENCING	CULTIVATED FIELD	UNCULTIVATED BUT CLEARED	WATER STRUCTURES	
	size and materials used.			P15.29 per pole	on for gates has not been included in this costing. In most cases, it should be possible to temporarily remove gates.	agricultural specialist will need to provide advice. The agricultural season in which the line construction activities take place will affect the amount of crops to be affected.	affected and will only be affected temporarily	considered. Grounding of the metallic components of the boreholes can also be considered)	M&M indicated that this gravesite will be avoided at all cost, but will be fenced (same cost as goat enclosure)

Table 4: RAP implementation cost for the AfDB funded transmission line

Item	Cost (Pula)	Comment	Source of Funds	Channel of Disbursement
Operation				
Salaries	870,340	Management seconded from BPC staff and support staff	BPC	BPC
Office / administration	264,660	Equipment, supplies and communications	BPC	BPC
Consulting service	400,000	Full RAP preparation	BPC	BPC
Miscellaneous	300,000	Travel allowances, public meetings etc.	BPC	BPC
Compensation				
Compensation for homestead structures	3,430,760	Preliminary estimates, as provided in Table Based on the rates provided in the Compensation Rates document, where available.	BPC	BPC
Compensation for livestock structures, agricultural assets, water structures	683,663	Preliminary estimates, as provided in Table Based on the rates provided in the Compensation Rates document, where available.	BPC	BPC
Compensation for destroyed crops and trees	150,000	At the time of writing, the level of crop destruction and the number of trees that will be affected was not yet determined.	BPC	BPC
Compensation for lost crop production during construction	200,000	Once identified, will be based on average monthly production value of affected crops multiplied by 8 months.	BPC	BPC
General resettlement assistance (transport, etc.)	P52,200	With the information available, it seems unlikely that PAPs will have to be resettled to an entirely new area, but will be able to move to another portion of their field, making transport assistance	BPC	BPC

		unnecessary. PAPs will however need assistance to move some of their assets, e.g. water tanks and materials that can be salvaged.		
Land acquisition and Resettlement site planning (if required)				
Land acquisition	10,000	Unknown if and how many PAPs will need to move to an entirely new area.	BPC	BPC
Site planning and infrastructure	50,000	Unknown if and how many PAPs will need to move to an entirely new area.	BPC	BPC
Monitoring and evaluation				
Internal and external RAP monitoring	425,000	Quarterly monitoring for the first year.	BPC	BPC
RAP evaluation	120,000	Final quarter evaluation	BPC	BPC
Totals				
Sub-total cost known items	6,496,623		BPC	BPC
Contingency	1,299,325	20% of sub-total (due to high uncertainty of certain costs at this stage)	BPC	BPC
TOTAL	P 7,795,948			