

**PROJECT INFORMATION DOCUMENT (PID)**  
**APPRAISAL STAGE**

Report No.: AB4761

<b>Project Name</b>	Botswana - Morupule B Generation and Transmission Project
<b>Region</b>	AFRICA
<b>Sector</b>	Power (80%);Mining and other extractive (20%)
<b>Project ID</b>	P112516
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## Country and Sector Background

Botswana, a landlocked country of about 1.9 million inhabitants, is an African success story with an extraordinary record of economic growth and transformation. At independence from Britain in 1966, Botswana had a per capita gross domestic product (**GDP**) of about US\$70. Botswana has enjoyed one of the most rapid rates of economic growth in the world—at 9 percent per year for nearly four decades—and has transformed itself from one of the poorest nations on earth to an upper middle-income country with a per capita income of US\$6,150 today. Strong growth has allowed the halving of poverty over the past twenty years to an estimated 30 percent. Botswana’s remarkable development has been driven by the discovery and production of mineral resources (predominantly diamonds, but also nickel and copper), democratic governance, political stability, and sound macro-economic management. In terms of governance and transparency, Botswana ranks thirty-sixth internationally (according to the Transparency International Corruption Index) and regularly comes at the top of the continent in terms of governance, transparency, and business environment.

**Despite its economic success and Middle Income Country status, poverty, inequality, unemployment, and high incidence of HIV/AIDS are persistent development quandaries for Botswana.** The incidence of poverty in Botswana is deeper than in countries of similar income, with about one-third of the population still living on less than US\$1 a day. This is partly due to the country's narrow economic base which limits employment opportunities, particularly in rural areas where the majority of the population still resides. Unemployment has been persistently above 20 percent and unemployment continues to be a serious problem affecting the young in particular. Botswana ranks as the fifth most unequal country in the world.

**The diamond production is declining fast and Botswana needs to diversify its economy in order to sustain its economic development and create new employment opportunities.** The diamond and government sectors still dominate the economy. The relatively short horizon—ten to fifteen years—until the projected decline in diamond production implies that non-diamond growth must accelerate significantly in the coming years in order to avoid a contraction of the economy. In addition to constraints to competitiveness in the investment climate, a mismatch between the skills produced by the education sector and those required by a modern labor market, and growing infrastructure bottlenecks, including in the power sector, has hampered diversification. There is also a growing recognition that a greater focus on public sector effectiveness is needed in order to support diversification efforts, including more effective implementation of policies and programs, and more efficient and effective delivery of services to the population. The Government is aware that while the economic and development models used in the past have served the country well, their limitations have become increasingly evident.

Given the small size of its market, the foundation for diversification needs to rest on a private sector that can compete and thrive in regional and global markets. The historic dependence on mining will reach its limits as diamond revenues start to decline, and emerging resource constraints will mean that infrastructure and social services will have to be provided by a leaner public sector. The country's diversification strategy is founded on a number of pillars, including the strengthening of the enabling framework for private initiative and investment through continued political and economic stability, a strong education system and skills training, a constant strengthening of the business climate, and greater openness to the global economy. A number of sector initiatives have been identified in the diversification and growth strategy on the basis of the exploitation of regional opportunities tailored to Botswana's existing strengths, resources, and capacities. These focus on a range of activities, including, but not limited to: tourism initiatives to take further advantage of Botswana's unique resource base and track record in the industry; comprehensive downstream diversification of the diamond sector and related processing activities such as diamond sorting, valuing, cutting, polishing, and jewelry manufacturing; building further mining diversification around Botswana's coal and gas energy base together with the creation of a range of support industries and activities; commercializing, restructuring, and rebuilding the livestock sector to enhance its contribution to economic activity; and creating areas of excellence in services fields such as public health management in HIV/AIDS and training for the hospitality sector.<sup>1</sup>

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<sup>1</sup> *Botswana Excellence: A Strategy for Economic Diversification and Sustainable Growth*, Business and Economic Advisory Council, Government Implementation Coordination Office, Office of the President, November 2008.

**However, Botswana's economic diversification strategy is threatened by two serious challenges requiring urgent actions**, namely protecting its economy from the worst impacts of the global economic crisis and avoiding a looming energy crisis. The economic crisis could roll back Botswana's past gains and create hardship for not just the one-third of the population living below the poverty line today but could also plunge countless others into poverty. The energy crisis could cripple the existing economy, prevent diversification, and potentially create labor, social, and even political instability.

**The global economic crisis has hit Botswana severely.** Diamond exports have fallen by nearly 70 percent since the global crisis began and are not expected to recover their pre-crisis levels for a number of years. Quarterly GDP fell by 22 percent between the fourth quarter of 2008 and the first quarter of 2009 as diamond mines were shut down (some have since reopened). Current forecasts are for economic growth to slow substantially over the next three years, with a contraction of near 10 percent forecast for 2009, sharply down from an estimated growth of 2.9 percent in 2008.<sup>2</sup> The decline in diamond export income has also induced a fall in Government revenues of close to 20 percent, and significant fiscal deficits are expected through 2012, averaging 10 percent of GDP over the coming two budget years (2009/10 – 2010/11) according to Government estimates. The current account balance will shrink substantially from the 19 percent surplus seen in 2007. External public debt will expand from less than 3 percent of GDP to near 20 percent. While the expected decline in GDP growth is very large, the impact on most sectors of the economy—with the exception of mining sector and its suppliers—will be much smaller. The enclave nature of mining in the Botswana economy means that much of the non-mining sector has so far escaped relatively unscathed, with real output in the non-mining private sector growing at 9.4 percent in the first quarter of 2009 relative to a year earlier. Nevertheless, general conditions will remain challenging into the medium-term as Government spending comes to terms with the new reality of constrained revenues, and as the fall in exports and growing credit constraints filter through to the rest of the economy.

**Botswana's history of prudent economic management is now paying dividends.** Large international reserves and savings from previous years' surpluses have served their intended role as a cushion to support the economy and the exchange rate. Foreign exchange reserves have declined by about 10 percent (in US dollar terms) relative to pre-crisis levels, and in May 2009 stood at US\$8.4 billion or BWP57.5 billion. Reserves in May 2009 covered about nineteen months of imports, down from nearly twenty-four months in mid-2008. The level of reserves remains comfortable, however, and the decline reflects both draw-downs to finance balance of payments deficits as well as valuation changes. With an improving trade position expected for the remainder of the year, the rate of decline of reserves is expected to moderate. Botswana also entered the crisis with very low levels of Government debt, at 5.6 percent of GDP (2.9 percentage points of this being external debt) and enjoys the highest credit rating in Sub-Saharan Africa.

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<sup>2</sup> This scenario assumes a 40 percent decline in diamond production for both 2009 and 2010 and a 20 percent decline in 2011 (with respect to 2008 levels), only returning to 2008 levels in 2012. It is a fairly conservative scenario. Indications in Q2 2009 are that the fall in diamond sales has bottomed out and, while still very subdued, production and sales are beginning to rise, although export revenues remain far below pre-crisis levels and a recovery is expected to be gradual and slow.

**The Government is, however, facing serious fiscal constraints that are expected to endure through 2012.** The prospect of fiscal deficits after years of surplus has led the Government to realign its budget, reassess policy priorities, and implement reductions in capital spending in the medium-term through the tenth National Development Plan (**NDP**). The Government's strategy for financing projected deficits is evolving with the state of knowledge regarding the depth and duration of the crisis, but is premised on the importance of preserving the country's accumulated savings for future generations in order to generate an income stream in lieu of mineral wealth. The Government's financing strategy thus relies largely on external and domestic financing to fill the financing gap.<sup>3, 4</sup> External public sector debt will therefore rise sharply, to a projected 20 percent of GDP by the end of 2010, although this remains a relatively low level by international standards. Domestic debt is also likely to rise from very low levels, both as a result of long-standing Government policy to issue bonds to develop the domestic market and to meet the financing needs of State-Owned Enterprises embarking on large investment programs.<sup>5</sup> The Government is also taking actions to promote more innovative financing mechanisms such as public-private partnerships to share the financial burden and boost private sector activity. A longer recession or weaker recovery will require further selectivity in Government spending to preserve Botswana's strong macroeconomic standing and its position as a net international creditor with a high credit rating. In order to control the size of fiscal deficits and debt, a key challenge looking forward is to sharply focus public spending on priority items that are essential to maintaining Botswana's long-term growth and diversification strategy and that yield high returns.

**The Government's response to the economic crisis as well as the diversification strategy requires adequate and reliable energy.** Access to reliable and affordable energy is critical to new business growth and rural development. Energy access nationally is about 50 percent and rural electrification is about 54 percent, although this remains short of the 60 percent target under the ninth and tenth NDPs. The Government's *Vision 2016*<sup>6</sup> aims at 100 percent rural access to support the broader development goals of access to education and health, as well as employment opportunities for the rural and the disadvantaged population. Over the past five years, a one percent increase in non-mining GDP has been associated with a 1.6 percent increase in non-mining power consumption. Accelerated growth of non-mining business sector would therefore require similar growth in non-mining energy consumption, which now accounts for less than 25 percent of total power consumption.

**Eskom, the South African utility, has indicated that it can no longer provide sufficient power and that it will reduce supply through 2012, and will stop altogether from 2013 onwards.** Botswana has, as have several other Southern African countries, long relied on

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<sup>3</sup> A budget support loan for US\$1.5 billion has been secured from the African Development Bank to finance the 2009/10 fiscal deficit.

<sup>4</sup> The Government is working with Bank and other regional institutions to develop a Medium Term Debt Management Strategy (MTDS).

<sup>5</sup> Under the *Stocks, Bonds and Treasury Bills Act*, total public debt, which includes publicly guaranteed debt, is limited to 40 percent of GDP (with additional limits of 20 percent external and 20 percent domestic debt).

<sup>6</sup> *A Long Term Vision for Botswana*, Botswana National Vision Council Secretariat: Botswana Institute for Development Policy Analysis, 2005.

abundant and inexpensive electricity supplies from South Africa. About 70 percent of Botswana's power requirements<sup>7</sup> were met through imports from Eskom in 2008.

**Table 1: Botswana's ballooning energy deficit**

MW	2009	2010	2011	2012	2013
Demand	506	530	547	583	613
Eskom supply	325	250	150	150	0
Eskom as % of peak demand	64%	47%	27%	26%	0%
Morupule A	90	90	90	90	90
(Deficit)	(91)	(190)	(307)	(343)	(523)
As % of demand	18	36	56	59	85

**Botswana has to fill the supply gaps in the short-term and also ensure reliable supply from 2013 when Eskom stops exports to Botswana.** The energy deficits would not only hurt growth and diversification, but also pose threat of economic contraction at an already serious economic crisis situation. Botswana has already started regular load-shedding<sup>8</sup> which will worsen as deficits grow, unless urgent measures are taken now. Studies show that shortage of power has inhibited growth in Botswana, along with most Sub-Saharan Africa countries and that investment in power sector would enhance growth by around one percent per annum.<sup>9</sup> Further progress in fighting poverty and reducing inequality in the country is difficult to envisage without strong growth and without the success of Botswana's diversification efforts (*i.e.*, without secure energy supplies, among other ingredients). The diversification efforts rest on an increased focus on competitiveness in order to take advantage of larger regional and global markets. Power shortages have a major negative impact on competitiveness, productivity, business confidence, the investment climate, and economic growth in general. The energy crisis poses a serious threat to Botswana's stability, economic diversification and growth, and poverty reduction strategies.

**The economic cost of the energy deficit for Botswana's growing economy is enormous amounting to an average of US\$2-4 billion per year in lost production.** The value of lost sales and production due to each un-served kWh for other African economies ranges between US\$1 per kilowatt-hour (**kWh**) in Benin and Kenya and up to US\$3/kWh in Senegal, Zambia, and Uganda. Using these values as a reference, the economic cost of the energy deficit in Botswana can quickly increase from US\$0.5-1.6 billion in 2009 to US\$3-10 billion in 2013. In the most conservative scenario, the annual average loss is equivalent to ten percent of Botswana GDP, and even up to one-third of GDP if the energy deficit affects primarily the most productive industries. Inaction, therefore, is not an option for the authorities albeit temporary emergency power generation is also very costly and unsustainable.

**Short-term options are limited, costly, and inevitable.** Botswana Power Corporation (**BPC**), the power utility owned by the Government, has contracted 70 megawatt (**MW**) portable diesel

<sup>7</sup> The country's energy demand was about 3,073 gigawatt-hours (**GWh**) in 2008 (peak load of 517 MW). The mining sector presently accounts for about 45 percent of power demand, the commercial sector about 23 percent and the residential sector also about 23 percent. Botswana projects demand to grow at about 4 percent per year, reaching 5,400 GWh by 2017 (peak load of 850 MW) and 6,890 GWh by 2026 (peak load of 1,130 MW).

<sup>8</sup> See <http://www.bpc.bw/> for detailed schedule of BPC load shedding.

<sup>9</sup> C. Calderon (2008), *Infrastructure and Growth in Africa*, Working Paper 3, Africa Infrastructure Diagnostic, The World Bank, Washington, DC.

units (to be installed near Francistown) from APR Energy, LLC (USA). The contract is renewable on a yearly basis and the energy is costly at close to US¢50/kWh. BPC is also exploring with Debswana Diamond Company (Pty) Ltd on a diesel-gas dual-fired 90 MW independent power producer (**IPP**) project at the Orapa mine area. This facility is expected to use diesel initially and switch to coal bed methane gas when and if reliable supplies become available. These costly short-term supply arrangements will impact adversely on the economy and cannot be borne by small and new businesses and residential customers fully. The cost of bridging the energy deficit with this very costly emergency option would very quickly go from US\$0.3 billion in 2010 to about US\$1.5 billion in 2013 or the equivalent of an annual average of 5 percent of the projected GDP over the period. A cumulative cost of US\$4 billion can hardly be covered with fiscal resources particularly under the current adverse circumstances. The Government and BPC are examining how the increased costs can be recovered from large industrial and mining customers in the current economic environment and the arrangements for covering the remaining costs.

**Botswana is also facing increasing costs on the dwindling supplies from Eskom.** South Africa supplied power at or below US¢2/kWh until 2007, which is not only inexpensive but is also below global average costs for power even from coal power plants. Electricity tariffs in Botswana, like in the other importing countries in the region, have therefore remained generally low. However, South Africa began to gradually adjust prices to align with costs and enable Eskom to cover its increasing costs of supply and also support its large generation expansion program. Eskom's prices doubled between 2007 and 2008 to about US¢4/kWh, and resulted in financial loss for the previously profitable BPC. In addition to decreasing supply, Eskom prices are projected to increase to above US¢5/kWh in the coming years as per the revised sales agreement, and prices from other countries such as Mozambique and Namibia are also similar or higher. Botswana will need to adjust electricity prices<sup>10</sup> to cover the increasing costs of supply, but steep increases may affect the economic recovery and the poor should be protected from an adverse impact of price increases at the same time it is also essential to expand access to the rural population. The current tariff structure does not have mechanisms to protect the poor (e.g., lifeline block).

**There are no reliable sources in the Southern Africa Power Pool (SAPP) for Botswana to replace the substantial imports from Eskom in the medium-term as the other countries are also facing a similar situation and there is severe shortage of generation capacity.<sup>11</sup>** BPC has managed to obtain one-year supply contract of up to 50 MW from Cahora Bassa Hydro in Mozambique for 2009. Additional or extended period imports from Mozambique or other countries are uncertain at best and risky due to transmission via Zimbabwe. The SAPP optimal expansion plan<sup>12</sup> through 2025 identifies 39,000 MW new capacity additions across SAPP

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<sup>10</sup> Average tariffs vary considerably across the southern Africa countries: Zimbabwe, Zambia, South Africa, Mozambique, and Malawi are in the US¢1.3 to 3.7/kWh range while Namibia, Botswana, and Swaziland are in the US¢4.3 to 5.1/kWh range (source: based on 2008 data, compiled by BPC).

<sup>11</sup> South Africa alone suffered a shortfall of about 7,000 MW in 2007 and the low availability of capacity has eroded reserve margins to meet peak demand.

<sup>12</sup> *The Southern Africa Power Pool (SAPP) Generation Expansion Plan Study*, Nexant, October 2007. SAPP expansion of this scale has risks of delay and changes due to several factors. Only four out of twelve countries are investment grade and large capacities identified in DRC, Mozambique, etc., also need PPA with Eskom which timing remains uncertain.

countries, about 12,000 MW of which are intended to replace old coal power plants, mostly in South Africa. As indicated by this expansion plan, South Africa will soon cease to be a net exporter and become a significant importer of electricity from the rest of SAPP; Botswana, Namibia, Mozambique, and DRC are poised to become important exporters, mainly to South Africa, which continues to be the dominant player in the SAPP with nearly 85 percent of the demand. The new capacity additions in SAPP consist of 11,000 MW of new hydroelectric generation based on available potential notably in DRC, Mozambique, Zambia, Zimbabwe, and South Africa with the balance of 28,000 MW from thermal sources (mostly coal in South Africa, Botswana, and Zambia, and gas from Namibia, Mozambique, Angola, and South Africa). The medium-term expansion program through 2015 is about 21,500 MW which are at various stages of preparation.

**Table 2: Select SAPP priority generation projects planned through 2015**

	<b>Coal</b>	<b>Gas</b>	<b>Hydro</b>	<b>Total</b>
Botswana 1/	1,800			1,800
South Africa	6,400	2,760	2,331	11,491
Namibia	400	800	85	1,285
Mozambique	1,200	450		1,650
DRC			1,128	1,128
Zambia			1,280	1,280
Rest of SAPP	1,500	288	1,114	2,902
<b>Total</b>	<b>11,300</b>	<b>4,298</b>	<b>5,938</b>	<b>21,536</b>

1/: Morupule B 600 MW; Mmamabula IPP up to 2400 MW

**Many of the projects planned are likely to suffer delays, as has been common with such projects, and the financial crisis will be an added problem.** Many of the large scale projects are planned to supply Eskom on the basis of long-term Power Purchase Agreements (**PPAs**); these include the Mmamabula IPP in Botswana (reduced to 1,200 MW), the Kudu gas in Namibia (800 MW), the Moatize in Mozambique (1,200 MW). The Mmamabula IPP has already suffered significant delays due to the difficulty of finalizing a PPA with Eskom, which is also subject to regulatory approval in South Africa.<sup>13</sup> As PPAs are critical to financing, the timing and scale of these projects are uncertain. Therefore, the regional energy security situation in SAPP is unlikely to be resolved in the medium-term and importing energy is not an option for Botswana at this time.

**Botswana's own resource options include coal, solar, and prospective coal bed methane.** Coal is extensive (estimated at over 200 billion tonnes) but mostly undeveloped because of South Africa's already well developed and competitive coal mining industry. Botswana does not have hydropower resources and has limited wind power potential. Imported oil is available but is more expensive than coal and is subject to substantial price volatility. Botswana has considerable solar potential in the Kalahari Desert and solar is already used for off-grid power generation. Solar power is still expensive, and energy storage is unproven at large scale and hence requires back-up generation for night time supply. Botswana has large inferred coal-bed methane (**CBM**) resources which could potentially be also a low- to medium-cost source of power. But these are

<sup>13</sup> Mmamabula IPP has undergone several restructurings due to changes in size warranted by the financing constraints, changes in equity and financing partners resulting from changes in sourcing of main equipment and EPC contractor. Eskom has also put off discussions on PPA until funding gaps for its own large capital investment program is fully secured. Press reports indicate further delays and financial challenges to the project sponsor, CIC Energy Corp.

largely unexplored and thus not yet available for base-load generation. When proven, Botswana's CBM could be a very attractive low-carbon energy resource in the future, serving the sub-regional needs. Botswana also has favorable geological structures and thus promising potential for carbon storage. The Government's draft energy policy therefore emphasizes sustainable development of its energy resources and rapid exploration of CBM and CCS potential, promotion of CSP, etc. Details of these potential options and respective costs are summarized below.

**Table 3: Botswana power generation alternatives, costs, and feasibility**

Option	Cost US¢/kWh	Availability	Remarks
Existing Coal (Morupule A) <sup>14</sup>	5+	90 MW net	To be retired by 2020
Diesel units	50+	160 MW	Short-term gap fill only
Concentrating solar power (CSP)	~20	Up to 200 MW by 2020	50 MW targeted by 2016; needs donor support (e.g. Clean Technology Fund).
CBM	7 to 22	200 MW by 2020; 50 MW likely by 2015/16	Exploration yet to commence; costs, timing and capacity would be based on availability of CBM.
New coal plants	5+	Up to 3000 MW as per SAPP	4 year construction feasible for small and standard unit size

BPC's assessment, carried out by PB Power (Parsons Brinckerhoff Inc., USA) in 2004 and updated in 2006, shows that domestic coal is not only the least-cost option but also the only certain option to timely replace the imports from Eskom and meet Botswana's base-load power generation needs. This is also supported by the Bank team's analysis. Botswana coal projects are least cost and a part of the SAPP optimal expansion plan (2007). Thus coal is the only option in consideration of least-cost analysis and paucity of alternative base-load options. Botswana has the opportunity to diversify its economy and contribute to regional energy security by substituting for Eskom through its coal resources, as well as potential CBM, and solar energy, creating new growth and employment opportunities. In fact, Botswana could be in a position to play an important role in resolving supply bottlenecks in SAPP.

**Botswana's approach is therefore to develop an energy portfolio including low-carbon (e.g., CBM and possible coal gasification) and no-carbon (e.g., CSP) technologies and also examine carbon capture and storage (CCS), all of which support economic diversification and also have the potential to make demonstrative impact on the countries in the region in mitigating climate change.** Botswana's energy sector strategy is conceived on the premise of responsible development of coal and support a low-carbon growth path, which aims to minimize the climate change impacts. Even though Botswana is a low emitter and a net carbon sink with about annual negative 29.4 million tonnes of carbon dioxide (CO<sub>2</sub>),<sup>15</sup> Botswana's approach will lead the other countries in the sub-region towards adopting and developing low carbon growth strategies. In order to promote low-carbon growth options such as CSP, Botswana would need access to a large market like that of South Africa or SAPP and appropriate financing for commercial-scale development.

<sup>14</sup> BPC operates a small 25-year old coal power plant (Morupule A, 4x33 MW) using coal supplied by Morupule Collieries Ltd.

<sup>15</sup> Botswana National Communications to the UNFCCC, 2001.

**Collaboration among the key countries of the SAPP, especially Botswana, South Africa, Namibia, and Mozambique, would be necessary for realizing significant climate benefits from these initiatives.** Coal remains the most abundantly available and extracted resource in the region, especially in South Africa, which also happens to be the sixth largest producer of coal globally. South Africa accounts for significant energy related CO<sub>2</sub> emissions (about 211 out of 221 million tonnes for SAPP in 2007), almost entirely due to its dominant coal-based power generation. The emissions intensity of SAPP is expected to reduce gradually as coal-based capacity in the proposed additions through 2015 is only about 50 percent (Table 2), as old coal power plants are replaced by new technologies (*e.g.*, supercritical boilers<sup>16</sup>) and as more hydro- and gas-based capacities are added. Further reductions could be realized once new renewable energy technologies (*e.g.*, wind, solar) are implemented following attractive feed-in tariffs announced by South Africa in March 2009.

**Table 4: SAPP power generation capacity and CO<sub>2</sub> emissions, 2007**

	Coal	Gas	Hydro	Nuclear	Total
<b>Installed Capacity (MW)</b>					
SAPP total	37,020	1,278	10,796	1,800	50,894
Of which: South Africa	35,625	342	2,061	1,800	39,828
Botswana	132	0	0	0	132
Rest of SAPP	1,263	936	8,735	0	10,934
<b>CO<sub>2</sub> emissions (million tonnes)</b>					
SAPP total	219.70	1.75	0	0	221.45
Of which: South Africa	211.42	0.47	0	0	211.89
Botswana	0.87	0.0	0	0	0.87
Rest of SAPP	7.41	1.28	0	0	8.69

Source: Compiled by project team from Nexant report and other sources

**The proposed project is designed to support Botswana's portfolio approach to develop its energy resources through a low-carbon growth strategy and also achieve energy security.** The project will help Botswana fast track development of new technologies and enable regional collaboration for large-scale deployment, including mobilizing attractive financing, such as from the Clean Technology Fund, carbon finance, etc. The energy security is to be achieved through expansion of the existing Morupule A Power Station (*i.e.*, Morupule B Power Station).

**Botswana has a short window to develop new generation capacity for energy security.** In view of the Eskom deadline, timely construction and commissioning before end-2012 is essential to meet energy security needs, but based on international experience, power plant construction is complex and prone to delays. In order to ensure dispatch ready power station as soon as possible, Botswana has opted to utilize readily available, proven technology, design, and size which also meet the technical and operating requirements of Botswana's power system, which is relatively small (less than 600 MW peak load) by international standards. BPC issued a competitive international tender in 2007 for the construction of a new 600 MW (530 MW net) power station (four units of 150 MW each) at Morupule, with coal to be supplied by expansion of the adjacent Morupule Colliery Limited (MCL),<sup>17</sup> the only operating coal mine in Botswana. MCL has over

<sup>16</sup> Power plant sizes are expected to be large (>1,000 MW) and hence allows adoption of supercritical boiler technology which is more efficient than conventional technology and thus reduces carbon dioxide emissions also by about 10 percent.

<sup>17</sup> MCL is wholly owned by Debswana Diamond Company (Pty) Ltd.

5 billion tonnes of estimated mineable coal resources in its lease area with relatively good mining conditions and low mining costs. The consortium led by China National Electric Equipment Corporation (**CNEEC**) won the tender and the offer was finalized and signed in November 2008. CNEEC will design, supply, and install the power station using circulating fluidized bed (**CFB**) boiler technology adopting air cooling to minimize water use.<sup>18</sup> CFB is a superior technology compared to standard pulverized coal technology and also allows co-firing of alternative fuels such as biomass, CBM, etc., with minimal retrofits.<sup>19</sup> The contract price at about US\$ 1,615 per kilowatt (**kW**) is competitive and is thus the least-cost replacement for imports from Eskom.

**CFB is the most appropriate available technology for the project.** PB Power as expert consultants examined various configurations in the feasibility study and determined that Botswana's power system with peak load of about 600 MW can support unit sizes no larger than 150 MW<sup>20</sup> based on system stability, operations, maintenance, etc. The technology options examined included the standard pulverized coal (**PC**), CFB and supercritical (**SC**). The PC and CFB were both technically feasible, though the CFB was found to be more cost effective taking into account available coal characteristics and water constraints. CFB also enables efficient control of local emissions and potentially allows multi-fuel utilization (*e.g.*, CBM, biomass, waste tires, etc.) to reduce coal use. The more efficient SC technology requires unit sizes of at least 500 MW each (typically 600 MW and above) and hence unsuitable for the project. Building a larger capacity plant (*e.g.*, two units of 600 MW each with SC technology) would need to be export oriented (a la Mmamabula IPP), would critically depend on Eskom for financing and PPA which has already proved to be very difficult. Furthermore, such option would entail the following additional risks to Botswana: (i) the technology and size would be too complex and risky for BPC to manage and operate, as its experience is limited to operating a conventional 33 MW size unit; (ii) the unit size being more than Botswana's national peak load itself, it would affect system stability critically and also pose problems for maintenance; (iii) BPC is in no better position than an experienced private sector developer to construct and commission such a plant before 2012, thereby not addressing the national energy security concerns; and (iv) financing needs would double to about US\$3+ billion and BPC's balance sheet would not be able to support it, thereby causing large reliance on the Government for equity, possibly about US\$2+ billion when the Government finances are already stretched. The proposed project is structured minimally to address Botswana's energy security concerns, consistent with the SAPP optimal expansion plan.

## Objectives

The objectives of the project are to support Botswana in: (i) developing reliable and affordable supply of electricity for energy security; (ii) promoting alternative energy resources for low carbon growth; and (iii) building its institutional capacity in the energy sector. All these

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<sup>18</sup> Botswana is an extremely water-scarce country. The Botswana National Conservation Strategy recognizes the dependency of all sustainable development in the country upon water resources. CFB uses minimal water and controls local emissions cost effectively. Morupule B has sufficient water for operating at 600 MW capacity.

<sup>19</sup> The more efficient supercritical boiler technology is not suitable as it requires a minimum unit size of 600 MW, whereas Botswana's total demand is less than 600 MW.

<sup>20</sup> Technical requirements dictate that largest unit size should be no more than 25 percent of peak demand for system stability and optimal operation.

objectives are key to Botswana's development strategy aimed at further reducing poverty and spreading the dividends of progress more equitably among all sections of society.

The first objective will be achieved by adding 600 MW new capacity through four units of 150 MW each, adjacent to the existing Morupule A Power Station, and associated transmission lines and substations. Greater availability of affordable electricity to households and industry will benefit the economy as a whole. New electricity connections bring new economic opportunities. The economic growth made possible by increased and secure access to electricity will enhance social welfare, help create jobs, and allow some of the country's rural populations to benefit from electricity for the first time.

The second objective will be achieved by preparing a low-carbon growth strategy to help the Government and private sector to fast track exploration of alternative energy sources (*e.g.*, CBM, CSP) and new technologies (*e.g.*, CCS) through feasibility studies and securing appropriate financing. In the short-term, this will enhance the Government's knowledge, capacity, and preparedness for new technologies; in the medium-term, this will enhance the prospects for private sector investment in new technologies and energy alternatives; in the long-term, this will benefit the local population by creating new "green collar" jobs and increasing Botswana's contribution to regional climate change mitigation.

The third objective will be achieved by improving the sector frameworks—policy, legal, and regulatory—for the electricity, coal, and CBM, and enhancing capacity of the relevant institutions, including setting up of a new independent electricity regulator.

Key performance indicators are the following:

- (a) improved domestic generation and transmission capacity;
- (b) improved prospect for low carbon growth strategy; and
- (c) improved regulatory capacity.

## Rationale for Bank Involvement

The proposed operation is fully consistent with the first-ever World Bank Group Country Partnership Strategy (CPS) with Botswana discussed by the Board on May 21, 2009. The project directly supports the third pillar of CPS, namely, *Increased Competitiveness—Infrastructure and the Climate for Investment and Growth*, which is crucial for Botswana's economic diversification and poverty reduction strategy. The project, *inter alia*, supports Botswana's pro-poor development strategy by: (i) preventing a major economic contraction after 2013 when Eskom will stop exports to Botswana, (ii) creating employment opportunities (both direct and indirect), and (iii) make possible the rural access expansion to bring power to where bulk of poverty is situated. In the short run, about 1,300 direct jobs will be created during the construction phase (2009-12), and about 310 jobs thereafter for the power station and mine operations. Additional jobs for support services would also be gained. At a time in the country where opportunities are limited, such employment creation would contribute to social welfare and economic gains. In the long run, increased generation capacity and energy security would make Botswana an attractive destination for investment and increased productivity would lead to further reduction in poverty.

The Government and BPC have called on the Bank to partner in the country's energy sector development at the policy, strategy, and investment levels. The main drivers for this request are to benefit from the Bank's global knowledge and technical expertise as the country faces complex and multiple development challenges and the Bank's convening power to promote regional initiatives. Botswana is also relying on the Bank's financial support in light of the economic crisis. The Bank's involvement will help Botswana implement its portfolio approach for mitigating climate change impacts by preparing clean energy projects and thereby also support economic diversification through energy.

The Bank was instrumental in assisting BPC and the Government to conduct a competitive solicitation process for securing the best possible terms of financing and the Bank's support is essential to bring the terms of financing acceptable to the project's needs considering also the financial crisis. The Bank's support through the proposed partial credit guarantee (**IBRD Guarantee**) will improve the terms of the commercial financing obtained and thus reduce the pressure on tariff increases and the proposed IBRD Loan will complement the African Development Bank (**AfDB**) loan to achieve the lowest cost financing for the project. The Bank will also mobilize potential carbon finance and similar support for demand-side management and low-carbon initiatives.

Botswana has no prior experience in financing and managing a project such as Morupule B, especially in a time of crisis, and has limited experience in monitoring, evaluating, and enforcing environmental and social aspects for a project of this scale. Bank involvement will, therefore, assist BPC and the Government to: (i) finalize an optimum financing package; (ii) monitor all aspects of project implementation; and (iii) build capacity in relevant Botswana institutions. The Bank will help Botswana develop a new electricity tariff policy, including mechanisms for protecting the poor through targeted subsidies for life line users, which will also ensure financial viability of the sector and attract private sector financing for new initiatives. The Bank will help improve consultations with stakeholders through effective two-way communication and support to build capacity for transparent regulation of the sector through a new regulatory agency.

Botswana supports global efforts concerning climate change and could spearhead low-carbon growth strategies across the sub-region. The Bank will help Botswana examine and fast track new technologies for low-carbon (CBM exploration), no-carbon (commercial scale CSP) and carbon storage (pilot CCS), which would help set feasible benchmarks for other countries in the sub-region for evaluation of these approaches and also create new sources of growth and employment. The Bank will help develop a CBM road map and an enabling policy and regulatory framework that would include possible carbon sequestration. The Bank will work with BPC to examine how it can design its projects for carbon capture<sup>21</sup> readiness so that Botswana can pilot a CCS when storage option is found to be feasible. On carbon emissions management, the Bank has an ongoing technical assistance grant to support capacity building for the Designated National Authority to identify and promote Clean Development Mechanism projects. These include exploring energy efficiency in the mines, industry, and in household sectors, among other opportunities. Botswana has indicated interest in accessing post-2012 resources for carbon financing through the Bank's proposed Carbon Partnership Facility as well as through the broader carbon markets.

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<sup>21</sup> Readiness requires that adequate space be provided for installing carbon capture equipment in the future.

The Bank involvement would also facilitate collaborative efforts between Botswana and South Africa to carry out a Regional Environmental and Social Assessment (**RESA**) for examining the cumulative impacts of all the various energy projects planned and existing across their border. Future large-scale coal-fired power projects include the Mmamabula IPP (1,200 MW, and possibly expanding to 2400 MW later) in Botswana, plus Bravo (4,400 MW) and Medupi (4,400 MW) in South Africa.<sup>22</sup> Other planned projects in the region include the 1,000 MW power plant by Aviva Corporation in Botswana and a petrochemical complex on the South African side of the border. The cumulative impact of these projects on air quality and water would be significant and require joint and concerted actions by both Botswana and South Africa. The Bank is well placed to support multi-country dialogue on strategic issues. The RESA would support the Bank's policy dialogue with the two countries in addressing their shared concerns through mutual programs and measures. The RESA is proposed to be carried out in two phases and financed from the South Africa trust fund administered by the Bank.

The proposed project and intervention is consistent with Bank policies and strategies. The Bank's support for the proposed project in Botswana would help to meet Africa's increasingly urgent need for energy to support growth and poverty alleviation. For Africa, Bank strategies support energy generation from all sources in a responsible and sustainable manner. These strategies are consistent with the World Bank's *Africa Action Plan*,<sup>23</sup> *Clean Energy for Development Investment Framework*,<sup>24</sup> and *Management Response to the Extractive Industries Review*.<sup>25</sup> The project is also in line with the approach to provision of energy from coal presented in the *Development and Climate change, A Strategic Framework for the World Bank Group*,<sup>26</sup> which was reinforced by the Board during its discussion of the *World Bank Group Energy Strategy Concept Note*.<sup>27</sup> It would thus also support engagement by the Bank on issues of mitigation and adaptation to climate change with Botswana.

## Description

The proposed project has four components.

**Component 1—Morupule Generation Expansion:** This component includes three distinct and integral infrastructure subcomponents as follows:

**Component 1(A)**—The Morupule B Power Station (estimated cost US\$1,211.3 million, including taxes and duties of US\$ 138 million) involves construction of a 600 MW (4 x 150 MW) coal-fired power station, adjacent to the existing Morupule A Power Station in the township of Palapye, in the eastern part of the country. The scope includes, *inter alia*: (i) coal

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<sup>22</sup> Existing power plants in the region are the Morupule A (132 MW) in Botswana and Matimba (2,400 MW) in South Africa.

<sup>23</sup> *Meeting the Challenge of Africa's Development: A World Bank Group Action Plan*, World Bank, September 26, 2005

<sup>24</sup> *Clean Energy for Development Investment Framework: The World Bank Group Action Plan*, March 28, 2007.

<sup>25</sup> *Striking a Better Balance—The World Bank Group and Extractive Industries: The Final Report of the Extractive Industries Review, World Bank Group Management Response*, World Bank Group, September 17, 2004.

<sup>26</sup> *Development and Climate Change: A Strategic Framework for the World Bank Group: Technical Report*, World Bank Group, 2008.

<sup>27</sup> *World Bank Group Energy Strategy Concept Note*, CODE2009-0052, July 8, 2009.

conveyor, coal yard, coal crushers, and coal preparation equipment, (ii) limestone preparation and feed systems, (iii) ash disposal and handling system, (iv) CFB boilers with associated particulate removal equipment, (v) steam turbines and generators, (vi) fans and air cooled condensers, (vii) switchyard, and (viii) balance of plant.

**Component 1(B)**—A transmission system (estimated cost US\$275.2 million, including taxes and duties of US\$ 36 million) involves construction, through supply and installation, of: (i) Morupule–Phukoje 400 kV transmission line (102 kilometer (**km**)) and associated and associated communications equipment (OPGW), (ii) 400 KV line bay at Phukoje (iii) 315 MVA transformer intertie bay between Morupule A and Morupule B, (iv) 220 KV line deviation (5 km) near existing Moropule A station, (v) 3 315 MVA 400/220 KV transformers (2 at Isang substation and one at Moropule B station, (vi) automatic generation control (**AGC**) equipment, software, and associated training, (vii) Isang (formerly called Mosaditsheni) 400/220 kilovolt (**kV**) substation and 220 kV tie-in two lines, (viii) Morupule–Isang 400 kV transmission line (215 km), and (ix) reactive power compensation equipment.

**Component 1(C)**—A water supply system (estimated cost US\$53.0 million, including taxes and duties of US\$9.1 million) involves construction, through supply and installation, of: (i) gathering system, pumps and reservoir at the new section of the Paje well field and a pipeline from there to the Morupule B Power Station (80 km) for backup supply; (ii) power supply line for the new Paje well field; and (iii) an extension pipeline from the MCL reservoir to the Morupule B Power Station (5 km) for the main water supply.

**Component 2—Alternative Energy Development:** This component (estimated cost US\$6.8 million, including taxes) includes preparation of alternative energy projects supporting low carbon growth strategy as follows: (i) low carbon study for growth and long-term mitigation strategy for Botswana; (ii) bankable feasibility study for a commercial scale CSP, including implementation approach and funding mobilization assistance; (iii) CBM and coal development strategy; and (iv) detailed feasibility study for pilot implementation of a CCS project.

**Component 3—Institution and Capacity Building:** This component (estimated cost US\$13.9 million, including taxes) covers project implementation assistance and institution and capacity building for BPC and the Ministry of Minerals, Energy, and Water Resources (**MMEWR**), as follows:

- (a) For BPC (power plant and transmission): (i) transmission system harmonic study; (ii) transmission control area establishment; (iii) transmission system operations training; (iv) air quality monitoring and management; (v) training and workshops for Project Management Unit (**PMU**) staff; and (vi) project management and supervision.
- (b) For MMEWR (sector development): (i) interim tariff policy study; (ii) tariff policy and regulatory agency for the power sector, including capacity building; (iii) design and implementation of a communications program; and (iv) training for safeguards monitoring.

**Component 4—Guarantee Fee:** This component (estimated cost US\$6.6 million) covers provision of funds towards BPC’s payment of fees on the IBRD Guarantee.

**Associated infrastructure.** Beyond the scope of the project are two elements of associated infrastructure: (1) MCL is undertaking an expansion of their underground coal mine, which also supplies coal to the Morupule A Power Station, for the dual purposes of supplying coal to (i) the proposed Morupule B Power Station and (ii) the export market; and (2) MCL has constructed a twenty-two kilometer underground water pipeline from the North-South Carrier (NSC) for the dual purposes of supplying water to (i) the Morupule Colliery and (ii) the proposed Morupule B Power Station. Both of these undertakings also serve other customers, not just BPC or the project. Given their importance to the project, however, Environmental and Social Impact Assessments (**EIA**s) for both have been included in the project documentation.

## Financing

Source:	(\$m.)
Borrower	492
ICBC (supported by Sinosure)	582
ICBC (supported by IBRD Guarantee)	243
International Bank for Reconstruction and Development	162
African Development Bank	203
Total	1,681

## Implementation

The project will be financed by a combination of loans. The power station (Component 1(A)) will be financed substantially (85 percent of EPC cost) by a loan from the Industrial & Commercial Bank of China (**ICBC**), supported by Government, Sinosure, and IBRD guarantees. The transmission system (Component 1(B)) will be financed by IBRD (32 percent) and AfDB (59 percent) loans under parallel co-financing arrangements. The water supply system (Component 1(C)) and institutional and capacity building TA (Component 3) will be substantially financed by the proposed IBRD Loan (95 percent and 64 percent, respectively). The alternative energy project development (Component 2) will be financed 100 percent by the Bank. The Government and BPC will finance the remaining costs of the project.

Day-to-day project implementation responsibility rests with BPC and MMEWR, in coordination with the Ministry of Finance and Development Planning, the Ministry of Environment, Wildlife, and Tourism (**MEWT**), and other parts/agencies of the Government. BPC will implement Components 1 and 3(a) and MMEWR will implement the Components 2 and 3(b). BPC will be responsible for all procurement under the project and ensuring timely conclusion of agreements with MCL for coal supply, with MCL and the Water Utility Corporation for water supply and imports of limestone for the power plant.

BPC has set up a PMU and designated a Director-level person as Project Manager to oversee and coordinate four functional units. The Project Manager previously was with Debswana and has considerable experience with managing large and complex projects. The four functional units under the Project Manager are: power plant, transmission, administration and finance, and safeguards, headed by the Engineering Manager, Transmission Director, and Manager Finance and Administration, respectively; the Project Manager directly oversees safeguards team in the PMU. Several existing staff of BPC have been seconded to the PMU in a matrix structure of responsibilities. Additional staff will be hired to support various functions.

For the alternative energy and sector development parts (Components 2 and 3(b)), MMEWR has designated the Permanent Secretary to oversee and manage the implementation. The Permanent Secretary will be supported by two Deputy Permanent Secretaries and their department staff. The Deputy Permanent Secretary (Power) will oversee the implementation of: (i) low-carbon strategy study; (ii) tariff policy and regulatory agency development; (iii) communications program; and (iv) feasibility studies for CSP and CCS. He will also assist with provision of training to MEWT staff on safeguards monitoring. The Deputy Permanent Secretary (Coal/CBM) will oversee the implementation of the coal/CBM strategy.

The PMU will provide assistance to MMEWR for procurement and contracting of the above TA subcomponents, while supervision responsibility would be as described above. The relevant implementing units in MMEWR will be responsible for preparing and finalizing the terms of reference for their respective TA parts, in consultation with the World Bank.

## **Sustainability**

Project sustainability depends on several key aspects. First, it hinges on the Government's commitment to its policy for ensuring BPC's continuing viability through timely and required adjustments to tariffs. The Government's track record already shows this commitment and BPC has been able to cover its costs and also earmark some funds over the years as equity for the project. The Government has also committed to the following: (i) provide additional equity to BPC to strengthen its balance sheet and hence support the borrowings needed; (ii) adopt an appropriate electricity tariff policy, recognizing the substantial increases anticipated and the need for balancing the economic, social, and financial concerns; and (iii) establish an independent regulator to ensure transparent regulation of the sector.

Second, it depends upon BPC's ability to ensure smooth operation of a new technology plant, conforming to good international practice and applicable safeguards standards. BPC will be supported by both the EPC Contractor and consulting engineers for proper operation of the power plant. BPC has committed to the following: (i) remedy any emission exceedence from Morupule A plant before commissioning of the new plant to ensure that air quality is maintained to acceptable standards; and (ii) ensure that water use from the new section of the Paje well field to stay within sustainable limits and take early measures as warranted to avoid any adverse impact on other users of the same water resources (*e.g.*, farmers, cattle, etc).

## **Lessons Learned from Past Operations in the Country/Sector**

The Bank's worldwide experience with power sector projects (generation, transmission, sector reforms, etc) and coal-to-power projects in particular (*e.g.*, China, Romania, Kosovo) has been suitably incorporated in the proposed project. For public sector implemented projects, these include the following: (i) client has adequate capacity for all phases from pre-construction to operation; (ii) an experienced owners engineer is in place to support implementation, especially in supervision; (iii) adopt turnkey approach wherever feasible and ensure early actions on procurement; (iv) there is adequate consultation with affected communities and their concerns are properly reflected in remedial measures; (v) project benefits are adequately shared with affected communities; (vi) for high risk and sensitive projects, there is adequate capacity in the client country to undertake proactive communications to inform stakeholders of the benefits and how specific concerns are being addressed; (vii) contractors and suppliers fully comply with

safeguards requirements through their contracts, and monitor conformance; (viii) there is satisfactory policy framework, especially regulations, for timely and adequate tariff setting to ensure financial viability of utility/sector; (ix) there is strong ownership of the project and reforms in the client country.

For high risk projects, such as the proposed project, experience recommends that Bank supervision is adequately resourced and staffed, including field-presence as necessary. The proposed project design also includes support for the Government to address climate change aspects in a significant manner.

## Safeguard Policies (including public consultation)

Safeguard Policies Triggered by the Project	Yes	No
<a href="#">Environmental Assessment (OP/BP 4.01)</a>	[X]	[ ]
Natural Habitats ( <a href="#">OP/BP 4.04</a> )	[ ]	[X]
Pest Management ( <a href="#">OP 4.09</a> )	[X]	[ ]
Physical Cultural Resources ( <a href="#">OP/BP 4.11</a> )	[ ]	[X]
Involuntary Resettlement ( <a href="#">OP/BP 4.12</a> )	[X]	[ ]
Indigenous Peoples ( <a href="#">OP/BP 4.10</a> )	[ ]	[X]
Forests ( <a href="#">OP/BP 4.36</a> )	[ ]	[X]
Safety of Dams ( <a href="#">OP/BP 4.37</a> )	[X]	[ ]
Projects in Disputed Areas ( <a href="#">OP/BP 7.60</a> )*	[ ]	[X]
Projects on International Waterways ( <a href="#">OP/BP 7.50</a> )	[X]	[ ]

## List of Factual Technical Documents

1. EIA for Morupule B Power Station
2. EIA for the transmission lines
3. EIA for the Isang substation (pending)
4. EIA for the Paje well field
5. EMP for the pipeline and power connections to the Paje well field (pending)
6. EIA for the expansion of the MCL mine
7. EIA for the NSC-1 to MCL water pipeline
8. Resettlement Policy Framework
9. Abbreviated Resettlement Action Plan – power plant site
10. Morupule B Feasibility Study, 2004 and 2006
11. Ash dam safety review report, April 2009
12. Pre-feasibility Study for CSP, Fichtner Solar GmbH, October 2008

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\* By supporting the proposed project, the Bank does not intend to prejudice the final determination of the parties' claims on the disputed areas

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