



1. Project Data

Project ID
P112516

Project Name
BW:Morupule Generation and Transmission

Country
Botswana

Practice Area(Lead)
Energy & Extractives

L/C/TF Number(s)
IBRD-78010,TF-13099

Closing Date (Original)
30-Jun-2014

Total Project Cost (USD)
1,662,000,000.00

Bank Approval Date
29-Oct-2009

Closing Date (Actual)
30-Jun-2014

	IBRD/IDA (USD)	Grants (USD)
Original Commitment	136,400,000.00	1,200,000.00
Revised Commitment	66,064,951.42	10,143.68
Actual	66,064,951.42	10,143.68

Sector(s)

Energy Transmission and Distribution(91%):Public Administration - Energy and Extractives(6%):Mining(3%)

Theme(s)

Infrastructure services for private sector development(76%):Rural services and infrastructure(22%):Regional integration(1%):Participation and civic engagement(1%)

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2. Project Objectives and Components

a. Objectives

The Project Development Objective (PDO) in the Loan Agreement (LA) (p.5) and the Project Appraisal Document (PAD) (p.14) was to support Botswana in: (a) developing reliable and affordable supply of electricity for energy security; (b) promoting alternative energy resources for low carbon growth; and (c) building its institutional capacity in the energy sector.



b. Were the project objectives/key associated outcome targets revised during implementation?

No

c. Components

Part A: Morupule Generation Expansion (to be implemented by the Botswana Power Corporation [BPC]; Appraisal cost US\$ 1,539.6 million, including taxes and duties of US\$ 180 million; actual/latest estimated cost US\$ 1,190.2 million, including taxes and duties of US\$ 101.7 million). This component included construction of (i) a coal-fired circulating fluidized bed (CFB) Morupule B power station, (ii) supply and installation of the transmission system, and (iii) a water supply system.

Part B: Alternative Energy Development (to be implemented by Ministry of Minerals, Energy, and Water Resources [MMEWR]; appraisal estimated cost US\$ 6.8 million, including taxes; actual/latest estimated cost US\$ 1 million). This component supported preparation of alternative energy projects supporting low carbon growth strategy, including (i) a low carbon strategy study for growth and long-term mitigation options, (ii) a bankable feasibility study for a commercial scale concentrating solar power (CSP), (iii) coal bed methane (CBM) and coal development strategy for efficient use and supply of CBM, and (iv) a pilot carbon capture and storage (CCS) study.

Part C: Institution and Capacity Building (Appraisal cost US\$ 13.9 million, including taxes; actual/latest estimated cost US\$ 62.8 million). This component supported BPC and MMEWR for implementing the project and for strengthening their capacity, including (i) for BPC (power plant and transmission): (a) technical assistance (TA) for transmission system (b) air quality monitoring and management; (c) training and workshops for project management unit (PMU) staff; and (d) project management and supervision; and (ii) for MMEWR (sector development), including: (a) interim tariff review study; (b) establishment of a tariff policy and regulatory agency for the power sector, including associated training; (c) design and implementation of a communications program; and (d) training for safeguards monitoring and management.

Cost of above project components Parts A-C excluded interest during construction (IDC), which was US\$ 102 million of appraisal estimated costs and US\$ 46.6 million of actual/latest estimates. Therefore, total actual/latest estimated cost of components and IDC does not add up to the total estimated actual/latest project cost of US\$ 1,298.98 million in the section 2.d. below.

d. Comments on Project Cost, Financing, Borrower Contribution, and Dates

Project Cost

Appraisal estimates of the total project cost was US\$ 1,662.3 million including contingencies, taxes, duties and IDC. Actual/latest estimates of the total project cost was US\$ 1,298.98 million including contingencies, taxes, duties and IDC.

Financing

The financing estimates at appraisal included International Bank for Reconstruction and Development (IBRD) US\$ 136.4 million, 8 percent; African Development Bank (AfDB) US\$ 202.5 million, 12 percent; and Industrial and Commercial Bank of China Limited (ICBC), US\$ 825 million, 50 percent, of the total project cost estimate at appraisal. The actual/latest estimates of financing of the total project cost were IBRD US\$ 66.06 million, 5 percent; AfDB US\$ 57.2 million, 4 percent; CCS TF US\$ 0.01 million, 0.001 percent; and ICBC US\$ 825 million, 64 percent. An original amount of US\$ 1.2 million CCS TF was approved in January 2013 and was not included in the PAD, but included in the ICR.

An IBRD Partial Credit Guarantee (PCG) (project code P116784), supported commercial bank financing for the power station construction. The BPC, through a competitive solicitation, arranged for a twenty-year loan (export credit facility of fifteen-year maturity without the PCG) from the ICBC, a state-owned commercial bank in China, in the amount of US\$ 825 million. China Export and Credit Insurance Corporation (Sinosure) guaranteed 95 percent of scheduled debt service amounts for the first fifteen years of the ICBC loan. The IBRD PCG guaranteed the payment of the scheduled outstanding principal amount and one accrued interest payment falling due and payable after the fifteenth year, on an accelerable basis on and after the beginning of the sixteenth year. The ICBC loan would be fully amortized over its twenty-year life. When the PCG is first callable at the beginning of the sixteenth year, the nominal value, and IBRD's exposure, was estimated to be US\$ 242.7 million at appraisal (i.e., 10/34 of the total principal amount of the loan). The actual/latest estimate of IBRD PCG was US\$ 224.8 million (pages vi and 18 of the ICR).

Borrower Contribution

Borrower contribution was estimated US\$ 498.4 million, 30 percent of the total project cost estimates at the appraisal. Actual borrower contribution was estimated at US\$ 350.7 million, 27 percent of actual/latest estimated total project cost.



Dates

IBRD loan and PCG were approved by the World Bank Board on October 29, 2009. The original and actual IBRD loan closing date was June 30, 2014. The original IBRD PCG closing date was on September 9, 2013 and extended to September 9, 2015 (page vi, the ICR), for which a letter was approved by a World Bank vice president. This extension of the PCG closing date followed an extension of the availability period for the ICBC loan from September 9, 2013 to September 9, 2015 (page 18, the ICR). The CCS TF, grant-funded by Ministry of Finance of the Russian Federation, was approved on January 17, 2013 and closed on August 31, 2014. A Level II restructuring was approved on March 8, 2013 to enable the use of IBRD loan proceeds to finance contracts for international technical and legal advisors. As a result, US\$ 1.8 million was reallocated from funds allocated for goods and works to funds allocated for consultants' services.

3. Relevance of Objectives & Design

a. Relevance of Objectives

Relevance of the PDO remained high for the development priorities of the county and the Bank's recent Country Partnership Framework (CPF) for Botswana for the period FY2016-20. The CPF's objective 3.3: Strengthening natural resource management noted the World Bank Group (WBG)'s support to (i) building detailed accounts about Botswana's energy resources and energy use to assess the optimal energy mix for the future and examine the role of Botswana's coal in a green economy and (ii) other relevant energy areas such as to renewable energy, energy efficiency, rural energy access, grid infrastructure and regional integration. In order to ensure increased sector contribution to economic growth, the Botswana Tenth National Development Plan for 2009-2016 (NDP 10) aimed at (i) an adequate supply of reliable energy; (ii) sustainable energy resources; (iii) economic efficiency; (iv) access and affordability of energy services and (v) security of supply and diversified supply sources. The International Monetary Fund's (IMF's) March 2016 report[1] highlighted that Botswana's authorities saw a need to reduce electricity shortages, and improve the efficiency of government operations. According to the most updated data of the Sustainable Energy for All (SE4ALL) database from World Bank, only 53 percent of the Botswana's population had the access to electricity in 2012. According to the International Energy Agency (IEA), per capita electricity consumption was 1,564 kilo-watt hours (kWh) in 2013.

The PDO was relevant to the country priorities at appraisal due to (i) the expected cut off of electricity import from South Africa in 2012, (ii) increasing South African electricity import prices and load shedding, (iii) limited import options for other neighboring countries, and (iv) declining performance and reliability of Morupule A. The PDO remained relevant by the close of the project. Separately from this project, the Government of Botswana (GoB) has initiated a pilot program to develop 100 MW of solar energy by the private sector and has engaged the World Bank to help develop strategies for renewable energy and energy efficiency, under a technical assistance initiated in 2015. In addition, some pilot activities were being carried out to explore the technical and economic feasibility of using CBM in power generation. Overall, the GoB continued to investigate options and pilot programs to diversify future energy supply toward an environmentally more sustainable mix. The additional electricity generation would reduce electricity shortages, outages and Botswana's reliance on costly and unsustainable imports. Botswana has regularly imported more than 40 percent, and sometimes up to 90 percent, of its electricity needs, mainly from South Africa. This import dependence made Botswana vulnerable to South Africa's inefficient power supply and shortages, making electricity imports from South Africa increasingly costly and unreliable. The rising import bill worsened Botswana's current account and the budget through subsidies.[2]

[1] International Monetary Fund (IMF) 2016. Botswana : 2015 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Botswana .

[2] <http://southernafrican.news/2016/08/29/bots-seen-easing-power-imports/>

Rating

High

b. Relevance of Design

The PDO were to support Botswana in: (i) developing a 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. The first objective was to be achieved through the construction of a 600 MW coal-fired power plant, together with the associated transmission lines and substations. The second objective was to be achieved by preparing a low-carbon growth strategy to accelerate the assessment of alternative energy sources and possible new technologies, all with the longer term goal of increasing Botswana's contribution to regional climate mitigation. The third objective



was to be attained by strengthening the policy, legal, and regulatory framework, in particular by setting up an independent electricity regulatory agency.

The project design combined a specific investment loan (SIL) and a partial credit guarantee (PCG) to support commercial bank financing for the power station construction. The IBRD PCG would support commercial lenders to BPC by covering them against certain specified portion of debt service default: (i) resulting from the nonpayment by BPC and (ii) upon the nonpayment by the Government under its own state guarantee (Government Guarantee). IBRD would be obligated to pay out under the PCG regardless of the cause of such debt service default (PAD, Annex 11). The constrained lending environment following the financial crisis in 2008 and the perception of higher credit risks caused difficulties in attracting lenders on terms that matched more closely the economic life of the project. The IBRD PCG, in conjunction with Sinasure, helped mobilize a substantial amount of long-term debt. The financing supported by the IBRD PCG was the first commercial borrowing by BPC of this size.

While the linkages between the activities, outcomes, and the project objectives were convincing, the project design seriously underestimated the local capacity to manage the project, including achieving important institutional milestones within the project timeframe.

Rating
Modest

4. Achievement of Objectives (Efficacy)

Objective 1

Objective

Developing reliable and affordable supply of electricity for energy security.

Rationale

Outputs

1 The Morupule B power station was constructed and is operational. It was taken over by the BPC on May 2014 but with significant defects. The most serious concerns about performance and reliability were the boilers and some elements of the balance of plant; the turbine and generator sets generally performed well.

2 The electricity transmission infrastructure connecting the plant to the national transmission network were completed and operating, which included the construction of Morupule–Phokoje and Morupule–Isang 400 kV transmission lines, and 400/220 kV transformers at Morupule B and Isang substations.

3 Construction works on the water well field and associated storage reservoirs, the water pipelines to the power station, and a power line to the Mmamashoro well field for the backup water supply network, were completed and the project team confirmed it was operational as of November 2016.

Outcomes

The Morupule B plant is operational, however, the plant has been performing well below the expected level. It was expected to operate at the annual capacity factor of about 80 percent, with annual gross generation of about 4,200 gigawatt-hour (GWh). However, the plant had been operating with the overall plant's capacity factor closer to 50 percent, reflecting poor availability and unreliability of the units due to forced outages. No indicators were being tracked to capture the reliability of electricity supply. The consequence has been resorting to more expensive electricity imports and domestic diesel fuel based power plants instead of providing affordable and reliable domestic power supply.

Botswana continued to rely heavily on electricity imports, which was possible due to South Africa experiencing a stagnant electricity demand, at least temporarily. The BPC data's unserved demand was 0.5 percent of the total demand in 2013, 1 percent in 2014, 0.1 percent in 2015, and 0.5 percent in 2016 (source: reviewer's comments on the draft ICR). The BPC's revenue grant from the Government increased from US\$ 40 million (455 million Pula) in 2011 to US\$ 132 million (1,488 million Pula) in 2014 (page 49, the ICR).



Rating
Modest

Objective 2

Objective

Promoting alternative energy resources for low carbon growth.

Rationale

Outputs

- Low carbon strategy report was not produced as planned.
- Coal bed methane (CBM) study's inception report was approved on March 12, 2013 but no further reports produced due to data collection problems.
- Concentrating solar power (CSP) feasibility study was completed on April 2013.
- Carbon capture and storage (CCS) pilot feasibility study was completed on February 27, 2015.

Outcomes

Improved prospect for low carbon growth strategy was achieved partially as some outputs were generated but none of the following PDO outcome indicators were achieved: Low-carbon growth strategy, CBM utilization for energy, CSP project and CCS Pilot project. Both the CSP feasibility study and CCS (a preliminary assessment study) have been completed, although no project proceeded to the investment phase.

Rating
Modest

Objective 3

Objective

Building Botswana's institutional capacity in the energy sector.

Rationale

Outputs

Activities implemented by the BPC included the following:

- Transmission system and harmonics study were completed in June 2012. Transmission system control area establishment. The study recommended an upgrade of the system control and data acquisition (SCADA) system but did not proceed to the investment phase.
- Transmission system operations capacity building: training of 17 BPC officers was completed.
- Air quality monitoring and management was not implemented for the establishment of an integrated system of monitoring stations for ambient air quality monitoring and management around Morupule A and B power plants. Only one ambient air-quality monitoring station had been installed by August 2015, which was relocated from the Morupule A power plant.
- Training and workshops for PMU staff was provided.

Activities Implemented by MMEWR included the following:



- Interim tariff policy study was completed. A study of Renewable Energy Feed-in Tariffs was completed in January 2011 and a Review of Electricity Tariffs in Botswana was completed in September 2011. The GoB implemented several tariff increases between 2010 and 2014. In response to the FY14 Cabinet Tariff Directive, the BPC engaged an external consultant to review financial sustainability of BPC and develop a 10-year financial plan.
- Establishment of an independent electricity regulator: A report on the Establishment of an Energy and Water Regulatory Authority in Botswana was completed in April 2011. Stakeholder workshops and other consultations were held on the draft legislation and a Bill to establish the Energy Regulatory Authority was passed by National Assembly in August 2016 (water was dropped in the final Bill), after project closure.
- Communications and consultations support helped design and implement a public communication plan on the GoB's energy policy and electricity supply situation in the country.
- Capacity building for safeguards monitoring was not completed. The objective was to strengthen the capacity of the Department of Waste Management and Pollution Control (DWMPC) to monitor the environmental performance (emission) of power plants. It was to be done in conjunction with BPC's activity on air quality monitoring and management, which was delayed.

Outcome

PDO outcome target of a functioning energy regulatory agency in place with staff and resources was not achieved. The energy regulatory agency is yet to become established and become functional after passage of the bill in August 2016, after project closure.

Rating
Modest

5. Efficiency

Economic Analysis

An ex-ante analysis, covering capital cost of 67 percent of the total project cost, was conducted. An economic internal rate of return (EIRR) of the project was governed by the capacity factor of Morupule B and the value of the electricity produced. The appraisal in the PAD assumed Morupule B's completion in FY 2013 and its capacity factor increasing to an annual level of 80 percent by FY2014 and beyond. Ex-ante analysis compared with alternative options and discussed various benefits such as employment and poverty but was not clear what was actually included in the scope of the analysis, what were the counterfactual scenario (or business as usual or without project scenario) to arrive at the net cost/benefit of each option. The generation cost of Morupule B power plant was not clear in the PAD because 5.43 US cent per kilo-watt hour (USc/kWh) was noted in the table 39, page 135, but page 36 noted 6 USc/kWh for Morupule B. The assumptions were not clear if major maintenance or repair costs and salvage or residual values were included in the analysis. The ex-ante EIRR was 14.1 percent in the PAD. The importance of the tariff rebalancing and the potential introduction of lifeline tariff for the poor was emphasized in the PAD, which was important for Botswana and World Bank Group's twin goals.

An ex-post analysis used the same methodology of the ex-ante analysis in principle but adapted to the actual scenario. The project team confirmed that the analysis covered all the project costs. The base case of the analysis assumed that the plant had a period of remediation of defects, with the capacity factor starting at the current level of about 50 percent, rising to 60 percent by 2018, and reaching 70 percent by 2020 and additional investment costs of US\$ 200 million would be required and incurred between 2017 and 2019. The ex-ante analysis used the tariff level for the BPC breaking even, about 14 USc/kWh. The ex-post analysis was also not clear about the scope and the counterfactual scenario. The ex-post analysis in the base case EIRR was 10.5 percent. When the cost of carbon (US\$ 30 per ton of carbon) was included, the EIRR declined to 5.1 percent.

Financial analysis of this project was not conducted in the PAD and ICR while it was conducted for the BPC. At appraisal, the BPC's financial performance was assessed as generally satisfactory, though its reported profits had been on the decline in the recent years mainly due to significant increases in power import costs. The negative impact of the economic crisis on businesses and population and the undue burden on the poor necessitated careful approach to tariff adjustment during 2009-11. At project closure, the BPC had been recording financial losses since FY2009 and, in FY2011 the GoB started extending operating subsidies to keep the company afloat. In FY2014, the subsidies reached 66 percent of BPC revenues. The GoB has been periodically increasing electricity tariffs, which however could not cover rising costs due to high costs of electricity imports and diesel-based domestic and rental plants and the depreciation of local currency, caused by delays in completing the Morupule B power plant, its under-performance, the closure of Morupule A for rehabilitation in FY2014. In FY2014, the average tariff was covering only about 63 percent of the costs. The BPC significantly increased long-term debt over a five-year period, from Pula119 million in FY2009 to Pula 6,331 million in FY2014 due to financing Morupule B Project. BPC's current liabilities also increased



sharply in FY2014 close to the level of annual revenues from electricity sales. Future remained uncertain due to the performance of Morupule B. Nevertheless, the BPC had been servicing its debts, including the ICBC loan, which financed the construction of Morupule B power plant. The loan repayment began in September 2013 as originally established, and BPC has been punctual in its repayments.

Administrative/Implementation Efficiency

Morupule B was operating less about half of the expected capacity and required an estimated additional US\$ 200 million to remedy after the project closure, which implied an inefficient use of resources. On the other hand, competitive biddings resulted in the cost savings of subcomponents, i.e., Part A2 transmission had cost saving of US\$ 177.1 million or 64 percent less than the estimates at the appraisal, and Part A3 water supply had cost saving of US\$ 26 million or 49 percent less than the appraisal estimate, which implied efficient use of resource. At the same time, the cost of "Part C1(f) Project management consultants" was significantly increased by 853 percent from the appraisal estimate of US\$ 7 million to US\$ 59.7 million mainly due to underestimation of the safety and environmental management and general project management as a result of technical defects. Notable fatal accidents occurred (see Section 11 below). However, the total actual cost of these management costs was of the order of 5 percent of the total project cost, not out of line for similar projects. This project was completed without an extension of closing date.

The power supply gap has been met by import and rental diesel power plants, which increased the GoB's subsidy to the BPC to US\$ 132 million (1,488 million Pula) in 2014 (page 49, the ICR).

Efficiency Rating Modest

a. If available, enter the Economic Rate of Return (ERR) and/or Financial Rate of Return (FRR) at appraisal and the re-estimated value at evaluation:

	Rate Available?	Point value (%)	*Coverage/Scope (%)
Appraisal	✓	14.10	67.00 <input type="checkbox"/> Not Applicable
ICR Estimate	✓	10.50	100.00 <input type="checkbox"/> Not Applicable

* Refers to percent of total project cost for which ERR/FRR was calculated.

6. Outcome

The relevance of the PDO remained high for the development priorities of the GoB and the WBG. The relevance of design was assessed as modest. The PDO of developing a reliable and affordable supply of electricity for energy security for Botswana was achieved only to a modest extent. Botswana continued importing higher cost electricity supplies from other countries in the region to meet its domestic requirements. More than four years after the first unit was connected to the grid, the plant was operating with frequent outages and poor availability due to a number of recurring problems, with the long term operational performance of the plant remaining highly uncertain and increasing costs to the GoB and the society. According to the IMF April 2016 report [1], the electricity and water crises have limited private sector growth owing to problems with Morupule B and other inefficiencies in service provision. As a result, in 2015 the country had to import 39 percent of its electricity needs. In addition, following the end of a long-term purchase agreement with a major provider, it had to import electricity at premium tariffs and without a guaranteed supply. This contributed to shortfalls, sizable fiscal transfers to the BPC, and rising tariffs. The IMF report expected that the economy of Botswana to recover gradually, driven by a gradual pick up in global diamond prices and fiscal stimulus, but identified delays in restoring reliability and self-sufficiency in electricity as one of the main risks to the outlook. The other two objectives of promoting alternative energy resources for low carbon growth and building institutional capacity were also achieved only modestly, as many activities had not been implemented. Efficiency is assessed as modest, due to the substantial increase in costs to remedy technical defects in the construction of the power plant.



- a. Outcome Rating
Unsatisfactory

7. Rationale for Risk to Development Outcome Rating

Technical risk is high. The deficiencies in design and quality of construction of a number of subsystems, especially in the boiler areas and in the balance of plant, became evident in early 2012, after the first unit started operating. If not resolved, these problems could further worsen the operating performance and shortening the plant life.

Financial risk is high and depends on the performance of the power plant, which has a high technical risk; the plant would still require additional investments to correct the deficiencies. The Government continues to subsidize the BPC whose wholesale supply costs have been significantly higher than expected due to the plant's delays in commissioning and underperformance.

Economic risk both at country and global level is substantial especially if Botswana needs to continue electricity imports and diesel fuels. As discussed in section 5 above, the depreciation of local currency contributed to increases in power supply costs due to the need for the electricity imports.

Social risk in terms of the strength of stakeholder support is high due to the environmental, social and health impacts of the power supply and the potential future tariff rebalancing. Mitigation of any negative social impacts would require further strengthening.

Institutional risk is modest, as demonstrated during the project, such as tariff increases, increased revenue grant to BPC, approval of the regulatory agency, etc.. In general, Botswana is known for its stable political environment and good governance record. The World Justice Project Rule of Law index, a global report that ranked countries' adherence to the rule of law, put Botswana in the top spot for Africa in 2015.[1] The country was thirty-first on the 2014 Transparency International Corruption Perceptions Index, the highest ranking in Africa. According to the 2015 Ibrahim Index of African Governance, Botswana ranked third in the continent, after Mauritius and Cape Verde. Still, the IMF noted that there was room for further improvement, especially on business and labor regulations.[2]

Environmental risk is high and the mitigation efforts in terms of local and global (carbon dioxides emissions) impacts needs further strengthening. Natural disasters exposure risk is substantial especially due the lack of safety measures. The mitigation, management and resilience measures would be essential.

[1] Source: <http://www.economist.com/news/middle-east-and-africa/21653584-botswana-comes-top-continent-governance-and-rule-law-again-law-first>

[2] International Monetary Fund (IMF) 2016. Botswana : 2015 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Botswana .

- a. Risk to Development Outcome Rating
High

8. Assessment of Bank Performance

- a. Quality-at-Entry

The Bank's strategic relevance and approach was to meet the urgent and long term needs of Botswana and the NDP 10. The World Bank first became involved in Botswana's energy sector in 2007 in the context of the country's need to develop domestic power generation to mitigate the risk of potentially severe power shortages after 2012, when the imports were expected to be significantly curtailed due to the rising demand in South Africa. Botswana could not realistically count on alternative sources of electricity imports as the entire region was becoming increasingly short of supply; thus, domestic sources of power generation were the most feasible options for strengthening the country's electricity supply.

Specific lessons based on the Bank's worldwide experience with other power projects, including coal-fired power projects, were referred to in



the Project Appraisal Document (PAD). These lessons included: (i) ensuring that the implementing agencies have adequate capacity for all phases of the project, with an experienced owner's engineer in place to support implementation; (ii) adopting a turnkey approach wherever feasible; (iii) taking early procurement action; (iv) giving thorough attention to environmental and social safeguard concerns; (v) providing a satisfactory policy framework, especially regulations, for timely and adequate tariff setting to ensure financial viability of utility/sector; and (vi) ensuring strong ownership of the project and reforms in the client country. Past Bank experience also recommended that Bank supervision be adequately resourced and staffed, including having a field-presence if necessary.

The Bank had a large project preparation team with variety of expertise but had shortcomings in assessing procurement, and technical and project management requirements of the project, especially the power plant. The EPC contract for the power plant, financed by the loan guaranteed by the Bank's PCG, was awarded by BPC assisted by the OE, following BPC's procurement procedures. The Bank approved the project when the procurement was finalized. The Bank was to establish that the EPC contract was procured with due attention to economy and efficiency; that the power plant project would be carried out diligently and efficiently; and that the goods, works, and non-consulting services procured under the guaranteed loan were of satisfactory quality, and would be delivered or completed timely. The Bank review overlooked the weaknesses in the process for selecting the EPC contractor, including the discrepancy in the technology requirements between the prequalification (PQ) document and the Request for Proposal (RfP) document. The Bank recognized that the lack of experience was a major concern but it did not suggest adequate mitigation measures (ICR, p.33, para 114). The Bank's appraisal did not suggest adequate mitigation measures to address risks related to the BPC's lack of experience in managing large generation projects nor CFB technology. An OE team was significantly understaffed and inadequate in SHE supervision, which later necessitated hiring a SHE firm.

Financial and economic aspects were adequately covered, although the macro-and micro-economic and financial impacts on the potential risk of sub-optimal power generation impacts could have been assessed. Social development and environmental aspects were addressed but not sufficiently. Poverty issues were discussed in general and gender issues were noted on CBM benefit sharing in the scope of the CBM study. Institutional aspects were weakly addressed regarding the capacity. Monitoring and evaluation (M&E) arrangements were weak in terms of construction and safeguards. Implementation arrangements on staffing was inadequate to fill the capacity gap.

Quality-at-Entry Rating
Unsatisfactory

b. Quality of supervision

During the early implementation period up to September 2012, Bank supervision missions were on average about twice a year, with 45 staff weeks per year. The focus of the early supervision was more on safeguards than on the technical and project management. Following the fatal accidents in February and August 2011, supervision missions' focus on safety increased. The Bank also strongly advised the BPC to engage a safety and risk assessment firm to audit the construction site and to supplement BPC's limited capacity in safety enforcement. Technical and project management risks continued to be under-rated and received little attention by the Bank's supervision missions until the units connected to the grid and began failing in the second half of 2012. The failure to identify these risks early amplified difficulties in mitigation as construction advanced. The Implementation Status and Results Reports (ISRs) rated the implementation of the project as 'Satisfactory' until early 2013.

Following another safety accident in September 2012 and growing technical problems after commissioning of the first units, the Bank supervision focused on safety, construction quality, and project management, followed by four successive missions to Botswana in the period October 2012 – January 2013. The Bank commissioned an independent engineering and project management firm to review technically construction status of the plant. Its findings raised deficiencies in the construction quality with high risk of adverse impacts on the plant's performance and sustainability. The Bank supervision team was strengthened, starting in late 2012, with additional expertise in technical areas, construction safety, environmental safeguards, and project management. The Bank sector management, at the headquarter and in the Pretoria field office became actively involved. Supervision resources allocated to the project in FY13 and FY14 increased, as did the frequency of Bank missions. The project performance ratings were downgraded, reflecting the unsatisfactory status with safety, construction quality, implementation progress, and the risks to the project achieving its objectives.

The quality of Bank supervision improved over the final years of project implementation. Nevertheless, with three units already commissioned and the construction of the fourth almost completed by end of 2012, addressing the plant's deficiencies was challenging yet to be resolved at the project closing. BPC hired a power plant operator with international experience to operate the plant, which was consistent with World Bank recommendations. According to the project team, although the Bank did not have a follow up operation, the Bank has been informally follow up the status of the power stations' performance.



Quality of Supervision Rating
Unsatisfactory

Overall Bank Performance Rating
Unsatisfactory

9. Assessment of Borrower Performance

a. Government Performance

The Borrower of the IBRD loan was the Republic of Botswana. The Government on-lent to BPC the loan proceeds that were to finance the project components implemented by BPC. The direct responsibilities of the Government in project implementation were the formulation of a low-carbon growth strategy, the establishment of an energy regulatory agency, implementation of different sub-components under the loan for alternative energy development, and institution building. The Government also monitored implementation of the components implemented by BPC.

Overall, Government performance fell short of expectations. Project components, including studies, under its responsibility were either implemented with delays or not implemented. The combined effect has been extensive delays in the implementation of the different sub-components under the Alternative Energy Development component, including the formulation of a low carbon growth strategy. However, the Government did carry out a number of activities, initiated pilot programs, and its commitment to developing the country's alternative energy potential remains strong. A significant progress was also made towards establishing the Botswana Energy Regulatory Authority (BERA), with the National Assembly passing the BERA Bill on August 8, 2016. The Government also took a proactive role in supporting BPC to address the problems with the performance of the EPC contractor, especially during the last several years of project implementation. Finally, the Government extended significant subsidies to the power sector to compensate for the higher costs of supply, on account of the higher costs of electricity purchases that BPC had to make to compensate for the under-performing Morupule B plant.

Three of the four covenants in the LA were complied with but the covenant on establishment of the electricity regulator (Section V.(c)(ii)) was partially complied with. According to the project team, MMEWR regularly held meetings among stakeholders involved in the project (e.g., BPC, Bank, AfDB, the project's contractors, ICBC, etc.) to review the implementation status of the project. AfDB and World Bank had some joint missions during project implementation.

Government Performance Rating
Moderately Unsatisfactory

b. Implementing Agency Performance

The implementing agency for Part A, the 600 MW coal fired power plant, transmission lines and water supply as well as for Component C1 Institutional and Capacity Building was the BPC. The BPC's small project management team at the power plant site was generally competent in the specific areas of expertise, and very dedicated and committed to the project, as described by the ICR p.36. However, the level of staffing was far below what the project required and the team did not have all the required competencies. The team became overwhelmed with the problems, especially after commissioning of the units and the ensuing construction-related operating problems.

The BPC had limited experience in implementing an investment of this magnitude and complexity. A project management unit (PMU) was set up and a project manager hired at start up from outside BPC. The project manager resigned in 2012 and was replaced by a BPC staff member. An international firm (the OE) was employed from the outset to assist the PMU in the selection of the EPC contractor and construction supervision. TA was provided to strengthen BPC's capacity. The BPC lacked readiness in implementation and their implementation arrangements and appointment of key staff were inadequate.

The BPC did not manage well the process of selecting the EPC contractor and enforcing the contract. The qualifications and experience of the bidders should have been scrutinized more carefully with regard to their own experience and capacity with CFB technology. Rather, the EPC contractor was qualified on the basis of reference plants of the subcontractor for general design. The BPC underestimated the level of resources and staffing for project management to enforce quality control on engineering designs, materials, manufacturing, construction, and workmanship, and health and safety standards. During the last three years of the project implementation, the BPC improved in the project management, although its team remained understaffed. The BPC has been punctual in its servicing of the commercial loan guaranteed by the PCG while dependent on large government subsidies. The operation and management (O&M) contractor would train BPC staff and gradually include them in the O&M team. The key post-completion issue was resolving the plant's technical defects and



bringing its operational performance to the standards. The BPC would need to strengthen the technical capacity of its project management team and the OE would need more site staff to ensure proper remediation measures.

IBRD loan ISRs listed six covenants whereas the PAD listed five in the Project Agreement (PA), sharing three covenants. The project team provided the following updated status as of December 2016. Four of the six covenants in the ISRs were complied with. PCG ISRs listed nine covenants from a long covenant list in the section 8 Covenant of the PCG PA between IBRD and BPC. Six covenants listed in the ISR were complied with but the other three were partially complied with. Guarantee Agreement between IBRD and ICBC included the covenants and the supervision mission did not find evidence that the covenants were not complied with.

Implementing Agency Performance Rating
Unsatisfactory

Overall Borrower Performance Rating
Unsatisfactory

10. M&E Design, Implementation, & Utilization

a. M&E Design

PDO was clearly specified. The M&E arrangement was presented in Table 24 of Annex 3 of the PAD. The PDO outcome indicator for the PDO (i) developing reliable and affordable supply of electricity for energy security was Botswana's domestic electricity generating capacity, with the target goal of that capacity reaching the level of 102 percent of peak demand by 2013. This indicator extended into areas beyond the project's control (as domestic generation capacity had other contributing plants over which the project had no influence) and may not be fully attributable to this project. Instead, measuring annual power generation of Morupule B, for example, could be more attributable to this project. This indicator did not measure the reliability and affordability of power supply from Morupule B, such as outages, generation costs, etc. The intermediate outcome indicators of this PDO (i) were rather outputs indicators.

The PDO outcome indicators for the PDO (ii) promoting alternative energy resources for low carbon growth were Low-carbon growth strategy, CBM utilization for energy, CSP project and CCS Pilot project. CBM utilization for energy may be a little optimistic to achieve during the project life especially because the description of this component was basically developing a strategy, preparation of regulatory and institutional reforms and resources assessments. The intermediate outcome indicators were Low carbon strategy formulated, CBM production license(s) issued, and CSP/CCS implementation issues deliberated. The indicator of CBM production licenses issued appeared rather optimistic achievement during the project life. The other two intermediate outcome indicators were almost the same as outcome indicators.

The PDO outcome indicator for the PDO (iii) building its institutional capacity in the energy sector was Functioning energy regulatory agency, scope, staff, resources. This outcome indicator only measured the regulation and appeared too optimistic to achieve during the project life. The intermediate outcome indicators of this PDO (iii) were Electricity tariff policy adopted, Regulatory agency defined and Air quality measurements. The tariff policy adopted appears to be too optimistic to achieve during the project life. The indicators were mostly measurable in terms of numbers, timing, and location but functioning of the regulatory agency may require definition of "functioning" and the benchmarks to measure "scope", "staff" and "resources". The M&E framework also lacked appropriate intermediate indicators to report and monitor the quality of project implementation in its early stages, including the adequacy of the project management, the quality of plant design, the quality of construction, safety, etc.

The project coordinator was responsible for coordination and monitoring of project progress and performance and prepare reports. Specific data for gathering and reporting, including responsibility thereof were identified and agreed with the BPC and the GoB. The M&E design was mostly project specific and did not well-embedded institutionally except the PDO (i) outcome indicator which was system level and collected from the BPC annual report, but did not measure the project specific performance.

b. M&E Implementation

Given the M&E design and the list of the PDO and the intermediate outcome indicators, little data related to the quality of power plant



construction was reported by the World Bank supervision missions before construction of the individual units was completed. Thus, there were no early warning signals on the project's quality and safety. Once the units were connected to the grid, the operating statistics were continuously collected and reported, including a broader list of the operating indicators (downtimes of the units; energy produced; consumption of fuel, limestone, and water; emission data; etc.). Indicators that capture not only the nominal installed capacity, but also the available capacity (operational reliability) of the units and the plant were fundamental to properly judging the performance of the project and the achievement of the PDOs. Regarding the missing baseline of CBM intermediate outcome indicator in the PAD, the ICR did not report this indicator.

c. M&E Utilization

The data from the performance indicators were utilized to measure energy generation and plant availability from each unit during their operations, and monitor closely improvements in unit operating performance. The M&E did not focus on assessing whether the theory of change within the project causality logic was sound and did this lead to any reframing of strategy. The findings of M&E measured outcomes and input application or outputs. Shifts in the project's direction and outcome were partly attributed to the M&E activities on the operating performance. However, according to the project team, formal M&E designed in the PAD was not sufficient and the Bank team had separate M&E indicators (e.g., power generation, coal usage, etc.) to monitor the performance of the power stations (for the reasons discussed in above section 10.a). The M&E did not impact subsequent interventions as there were no follow up projects as of October 2016.

M&E Quality Rating
Modest

11. Other Issues

a. Safeguards

The project was classified as a "Category A". The following World Bank safeguard policies were triggered (the last ISR safeguard compliance ratings are indicated): Environmental Assessment (OP 4.01) – Moderately Unsatisfactory; Pest Management (OP 4.09) – Satisfactory; Involuntary Resettlement (OP 4.12) – Satisfactory; Safety of Dams (OP 4.37) – Satisfactory; and Projects on International Waterways (OP 7.50) – Satisfactory.

The ISR overall safeguards compliance ratings became unsatisfactory in March 2013, and the rest of the project Moderately Unsatisfactory. The main safeguard concerns during implementation were the following:

Environmental: implementation and monitoring of the Environmental Impact Assessments (EIA) and Environmental Management Plan (EMP) for the power plant and the associated infrastructure (transmission corridors and water supply pipelines), as well as for the coal mine expansion during the construction and operational phases of the project;

Social: implementation of the social impact assessments (SIA) and mitigation plan for the power plant and the associated infrastructure, with a focus on resettlement and other social issues associated with a major construction work such as the influx of job seekers, mitigating potential conflicts and related issues;

Health and Safety: measures to ensure the safety at the construction site and the ash dams. Concerns with safeguard compliance on safety increased in 2011 with safety fatal accidents.

The last ISR sequence number 9 in May 2012 noted a number of remaining health and safety hazards and safeguards risks that remain to be addressed and the end of the contract with a firm that supported monitoring health, safety, and safeguards issues, weakening the overall capacity for safeguards supervision. The concerns and the key related compliance issues are summarized below.

Environmental

The EMPs for transmission line, water pipelines, and the coal mine expansion were implemented satisfactorily and in compliance with the safeguard requirements. However, enforcement of certain provisions of the EMP for the power plant encountered problems during construction and frequent plant site visits were made by the Department of Environmental Affairs (DEA) and the Department of Waste Management and Pollution Control (DWMP) to ensure compliance with Botswana environmental laws and regulations. Fines were levied on BPC and the EPC contractor for violations related to hygiene, waste disposal, sewage ponds, oil and acid storage, insufficient dust suppression, etc. The DEA recommended an update on the operational phase EMP for the power plant, which was being finalized at the project close. In regard to *water* availability, during operation of the first units, the plant had been using much more water than forecast. Leaking valves were repaired and the BPC has been reporting water consumption in compliance with the design specifications. Control and



monitoring of *air emissions* remained difficult in compliance with air emission standards. Emissions from the plant stacks had not been measured reliably due to malfunctioning or non-calibrated measuring instruments. As the limestone injection system frequently breaks down, SOx stack emissions were likely non-compliant with the emission standards when limestone was not injected. Due to delays in installing ambient air quality monitoring stations, ambient air quality data were not available until August 2015, when one monitoring station, relocated from Morupule A plant, was set up to monitor SO2 and PM10. BPC reported that the measurements showed that ambient air quality was within the prescribed limits. High *acoustic noise* in certain areas of the plant recorded sound levels exceed contractual requirements and industry standards and compliance was rated 'unsatisfactory'.

Cumulative impacts of coal power plants in the Botswana-South Africa border region: The long-term investment plans for new power plants in Botswana and South Africa considered many new coal-fired power stations on both sides of the Botswana/South Africa border. They included about 3.6 gigawatt (GW) of coal plants in Botswana and 17.5 GW in South Africa for 2015-2035. A Regional Environmental and Social Assessment Study of Coal-fired Power Generation along the Botswana-South Africa Border found that the cumulative long term impacts of these investments would lead to increases in CO2, SOx and NOx and adverse impacts on surface and groundwater use and quality, and biodiversity. The study emphasized alternative energy options to avoid some of social and environmental damages by coal-based generation and recommended more reliable and better quality data to enable informed policy decisions.

The main safety concern during construction was operational safety at the construction site, especially work at height. Following the first safety accident on February 26, 2011, a number of measures were agreed to strengthen implementation of the Health, Safety, and Environmental (HSE) Plan, including stronger enforcement of the use of Personal Protection Equipment (PPE), strengthening the BPC health and safety team, communication between foreign and local workers, and preparation of an emergency preparedness and response plan. After the second accident on August 22, 2011 and further safety examination, the Bank mission in October 2011 confirmed a serious lack of safety enforcement by the EPC contractor. At the World Bank request, the BPC hired a specialized firm to audit safety practices at the construction site. Following the third accident in September 2012, the World Bank raised the safety enforcement to the highest level of the GoB. Police officers were deployed to enforce site security. At the Bank's recommendation, the BPC hired an HSE consulting firm to help supervise the project. By early 2013, the security and safety at the site improved due mainly to the strengthened enforcement by the BPC. Nevertheless, more fatal accidents happened in December 2013 and March 2015. As all four units were constructed in 2013, BPC did not extend the contract for SHE supervision when it expired at the end of 2013. Since the operations and management contractor arrived in January 2014, the health and safety at the plant improved but further improvements were still needed.

Social

The project was applicable to OP 4.12, Involuntary Resettlement, due to the presence of a family of four at the power site and the possible need for resettlement along the transmission line corridors. The other social issues were the potential for conflict and an increase in the incidence of HIV/AIDS, given the strategic location of the power plant and the expected influx of workers during construction of the plant. The resettlement of the family had been completed satisfactorily, as reported. For the transmission line corridors, compensation was paid to informal settlers while one house had to be demolished, with the owner being relocated to a nearby town. These construction activities impacted about 130 households. Two complaints were received from landowners, disputing the compensation terms and the proposed relocation of a borehole, which were resolved. Priority was also given to local community liaison and to the preparation of action plans to help prevent HIV/AIDS through educations. Local communities consultations continued throughout project implementation. The social aspects were addressed satisfactorily during supervision and were in compliance with OP 4.12. The project team confirmed a resettlement action plan was prepared and successfully implemented.

Safety of Dams

The principal safety concern identified in the PAD during appraisal was the design of a new ash dam. As agreed with the World Bank during project preparation in relation to the requirements of OP 4.37 (Safety of Dams), in 2010 the BPC hired an independent expert to review the ash dam design for Morupule B power plant, proposed by the EPC contractor. The consultant's design review report recommended a number of improvements, which was implemented in the dam design.

With regard to safeguard policy on **Pest Management** (OP 4.09), which required a satisfactory pest management plan for the sites of the Isang and other substations, since the BPC did not use any chemicals for site clearance, this became a non-issue. The policy on **Projects on International Waterways** (OP 7.50) was triggered because the primary source of water for the power plant is the North-South Carrier, which transfers surface water from the northeastern part of Botswana to the south. The GoB met the requirement under the policy for notification of riparian states prior to the World Bank Board approval.



b. Fiduciary Compliance

Financial Management

The project complied with fiduciary covenants during implementation. Internal control arrangements were in place, and an adequate financial management system was maintained. Project and entity audit reports were received on time, and no major issues were identified in the auditor reports in relation to the project financial management up to the project closing by the end of FY2014. However, the PCG remains callable during 2025-2030 and audits reports still need to be submitted. Financial statements for FY15 and FY16 were submitted to the Bank but the corresponding management letters were submitted in delay in December 2016. All audits were unqualified up to FY2016. Financial covenants of the PCG PA between IBRD and BPC were partially complied with (PA 8.1(c)(ii)(C) BPC to submit audited financial statements). IBRD loan accounted for 48 percent of the approved loan at the appraisal and CCS TF accounted for less than one percent of the approved TF grant. This IBRD loan closed with substantial, undisbursed savings was mostly attributable to the savings realized through the contracts for transmission infrastructure, which were competitively bid and awarded at significantly lower prices than estimated at appraisal. Part of the undisbursed balance is also attributable to a few components either not being implemented or being financed through separate grants. The ICR did not report misuse of funds.

Procurement

Procurement of all works, goods, and technical services financed by the IBRD loan followed the Procurement Guidelines "procurement under IBRD Loans and IDA Credits." There were no major procurement issues under the World Bank loan during implementation.

The process followed to select the EPC contractor was compromised by the switch in the preferred technology between the prequalification stage and the bidding stage. This resulted in qualifying the EPC contractor on the basis of the experience with CFB plants of their subcontractor, which did not have a lead responsibility in delivering the plant even the technologically-critical component of the plant (boilers); rather, its role was limited to providing the basic design of the CFB boilers. The PAD contained a summary of the EPC contractor's experience in select thermal plants with construction of six out of nine listed plants described as 'in progress', or to be completed, and only one completed plant (Zhangjiang) being similar in size (but not necessarily in technology) to Morupule B. There was no indication whether any of the reference plants used CFB technology and whether the EPC contractor had prior experience in building plants with the proposed design, or whether the boiler manufacturer had a proven track record of manufacturing CFB boilers of the design proposed for Morupule B. The selection of a non-experienced contractor led to poor performance and low quality in the construction of the power plant, in the end affecting the project outcomes.

Disbursement

The ICR did not report IBRD loan and CCS TF were found to be disbursed for ineligible expenditures (complied with the PCG PA 3.1).

c. Unintended impacts (Positive or Negative)

Not applicable.

d. Other

Not applicable.

12. Ratings

Ratings	ICR	IEG	Reason for Disagreements/Comment
Outcome	Unsatisfactory	Unsatisfactory	---
Risk to Development Outcome	High	High	---
Bank Performance	Unsatisfactory	Unsatisfactory	---
Borrower Performance	Unsatisfactory	Unsatisfactory	---



Quality of ICR

Substantial

Note

When insufficient information is provided by the Bank for IEG to arrive at a clear rating, IEG will downgrade the relevant ratings as warranted beginning July 1, 2006.

The "Reason for Disagreement/Comments" column could cross-reference other sections of the ICR Review, as appropriate.

13. Lessons

The following lessons were selected from the ICR:

- **Right balance of expertise in the Bank team is essential.** The Bank team for Morupule B lacked the right expertise in some important areas, advising on the EPC contract, the technical and engineering details and early detection, mitigation and remedies of any defects, the project management, project implementation arrangements, safeguards and the level of resources. The Bank's added-value in providing such expertise is important for its client countries, where technical and managerial skills and experience with complex projects may be limited.
- **In-depth expert scrutiny and monitoring from the very early stage of the project is essential to avoid or remedy deficiencies.** While the M&E and Result Framework are focused on the outcomes and results, scrutiny and monitoring of the quality during design, inputs, and the process of delivering outputs can identify potential risks and deficiencies and increase the project resilience, preparedness and remedy them before it is too late. This project's defects were found after commissioning of the plants, which had become extremely difficult and costly to resolve.
- **Ensuring the capacity of the implementing agency and contractors in terms of technical, management and safeguards with the right expertise, and the adequate number of personnel and resources are essential.** If not sufficient, the additional resources and support need to be provided.

14. Assessment Recommended?

No

15. Comments on Quality of ICR

This ICR is candid, evidence-based and analytical, especially on the main issues that affected the project performance. It could have been more concise, albeit the implementation issues deserve the level of detail covered in the ICR. The ICR offers a rich set of lessons that are based on evidence and analysis.

- a. Quality of ICR Rating
Substantial