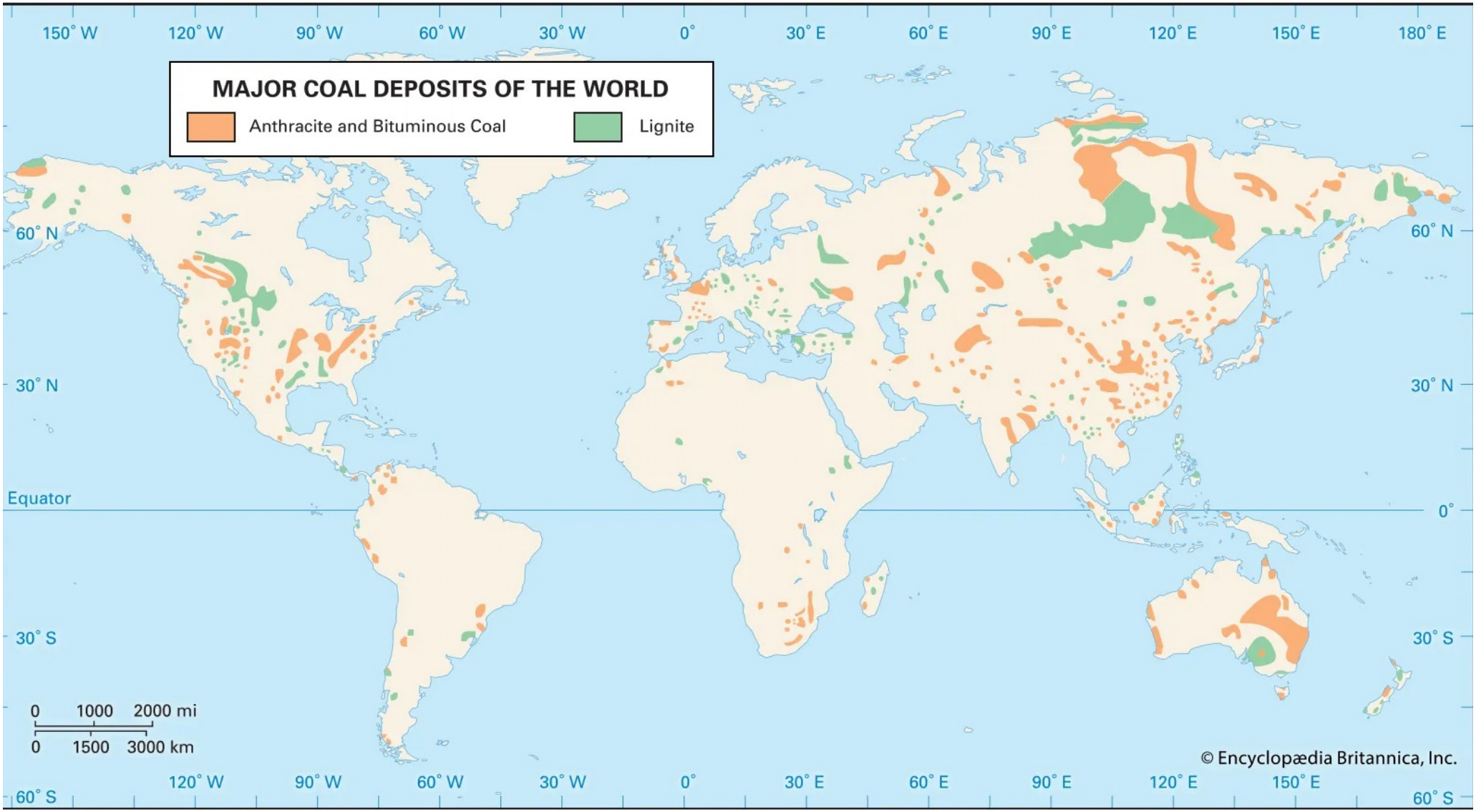
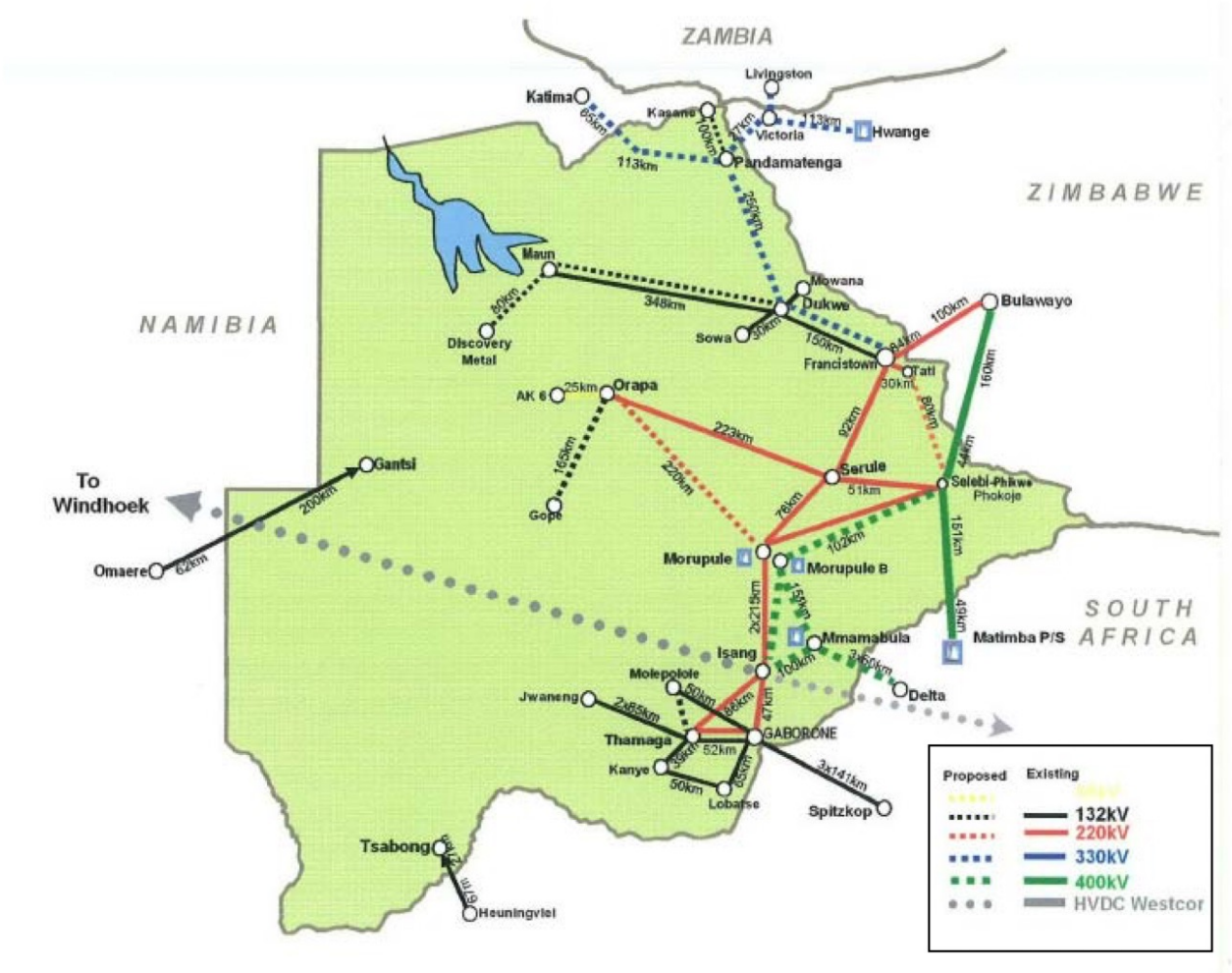

MAJOR COAL DEPOSITS OF THE WORLD
Anthracite and Bituminous Coal
Lignite
150° W
120° W
90° W
60° W
30° W
0°
30° E
60° E
90° E
120° E
150° E
180° E
60° N
30° N
Equator
30° S
60° S
0 1000 2000 mi
0 1500 3000 km
© Encyclopædia Britannica, Inc.

Morupule B Project

Map of Botswana showing key generation and transmission assets (proposed and existing)




Katima Mulilo
Binga
Harare
Ruwa
Mashare
Rundu
Caprivi Game Park
Kasane
Victoria Falls
Chegutu
Chitungwiza
Marondera
Divundu
Gokwe
Hwange
Kadoma
Shakawe
Ncamasere
Sepupa
Chobe National Park
Khaudum National Park
Zimbabwe
Chivhu
Mutare
Chimoio
Hwange National Park
Buhera
Gumare
Moremi Game Reserve
CT/1 Concessionaire (hunting)
Gweru
Shurugwi
Gutu
Maun
Masvingo
Bulawayo
Tsau
Gweta
Nata
Chipinge
Toteng
Makalamabedi
Zvishavane
Makgadikgadi Pans National Park
Sowa
Plumtree
Savé Valley Conservancy
NG/5 Cgae Cgae Tlhabologo Trust
Sehithwa
Gwanda
Rakops
Chiredzi
Francistown
Orapa
Groote Laagte
Tonotha
Dekar
Letlhakane
Ghanzi
Gonarezhou National Park
Selebi Phikwe
New Xade
Botswana
Charles Hill
Beitbridge
Serowe
Makunda
Musina
Thohoyandou
Banhine National Park
Ncojane
Louis Trichardt
Hunhukwe
Lephalale
Kang
Parque Nacional de Limpopo
Polokwane
Tzaneen
Hukuntsi
Tshane
Motokwe
Phalaborwa
Kruger National Park
Aranos
Lokgwabe
Mokopane
Hoedspruit
Gaborone
Bela-Bela
Lydenburg
Hazyview
Mbombela
Praia Do Bilene
Pretoria
Middelburg
Mahikeng
Maputo
Tshabong
Lichtenburg
Johannesburg
Mier
Google
Mbabane
Layers


Morupule Colliery
Morupule
Morupule-B power station
Morupule Golf Course
Temporarily closed
A14
Khuru Camp
Nando's Palapye
PALAPYE JUNCTION SHOPPING MALL
A1

https://www.gem.wiki/Morupule_B_power_station

Controversies

During the bidding process for construction of the power station, there were allegations that the Chinese contractor chosen (CNEEC) was awarded the tender through questionable means, as it was said to be pre-qualified without the necessary expertise. The Chinese Ambassador to Botswana, Ding Xiaowen, had advised Ministers Ponatshego Kedikilwe and Mompati Merafhe that the Chinese state owned company was not certified to undertake a project of that magnitude.[22]

During construction, the Ministry of Minerals, Energy and Water Resources (MMWER) temporarily shut the power station down due to environmental issues. The contractors are alleged to have been pumping raw sewage to water their gardens, with the residual water contaminated with sulphuric acid flowing into the village's river networks. There are also reports that at least two Chinese workers died during construction, and some Botswana workers were injured at the power plant as a result of lax observation of safety principles. In June 2015 media reports revealed that one of the boilers at the Morupule B Power Station had melted down when it was being tested.[22]

After a 2015 investigation into problems at the plant, CNEEC contracting manager Jianio Caiyi and two other company project supervisors allegedly fled the country, leaving the Station Project Manager, Glenn Black, who later handed in his resignation.[22]

China-built power plant transforms Botswana into electricity exporter

Source: Xinhua Editor: huaxia 2022-08-27 23:55:00

GABORONE, Aug. 27 (Xinhua) -- Botswana has been a net importer of electricity over the years. However, the coal-fired power station Morupule B -- built by the China National Electric Engineering Corporation (CNEEC) -- is slowly but surely changing Botswana's status quo, Professor Edward Dintwe, dean of the faculty of Engineering and Technology at the University of Botswana (UB), said in an interview with Xinhua.

For the past three months, both Morupule A and B power stations have been fully operational and dispatching over 800 megawatts of power per hour to the national grid, which is well above local electricity consumption, according to the Botswana Power Corporation (BPC).

"Sales have been made possible by improved plant availability at the flagship 600 megawatts Morupule B plant. So the surplus electricity should be sold to neighboring countries," Lefoko Moagi, Botswana's Minister of Minerals and Energy, told Xinhua.

As A landlocked country, Botswana is dominated by coal-fired power generation and had only one power station Morupule A before 2010.

To ensure energy security and increase electricity self-sufficiency, Botswana started the 600 MW Morupule B power Station project in 2010 with the CNEEC as the general contractor.

According to Zhang Xiangrong, CNEEC project manager, with the joint efforts of the Botswana government and the company, the plant operation is stable currently. The company started the renovation project of the power station in 2019. At present, the first unit has been renovated and the trial operation will be finished in September.

"Morupule B power plant is fully functioning with all the four units producing 150 megawatts of electricity each," said Moagi, adding that Morupule A power plant is generating at least 232 megawatts thereby bringing Botswana's power generation to 832 megawatts per hour.

According to Moagi, Botswana utilizes 580 megawatts during peak hours while only 360 megawatts are needed at off-peak hours. Botswana's peak and off-peak hours are during the evenings as well as mornings and in the afternoon and during weekends when industries are not open.

Moagi said South Africa, whose public electricity utility in Eskom is facing generation problems, is willing to buy power from Botswana. The BPC has therefore started engaging Eskom to purchase the excess electricity supply generated during off-peak periods to protect plants against load management fluctuations and also ensure that surplus electricity has a secured market.

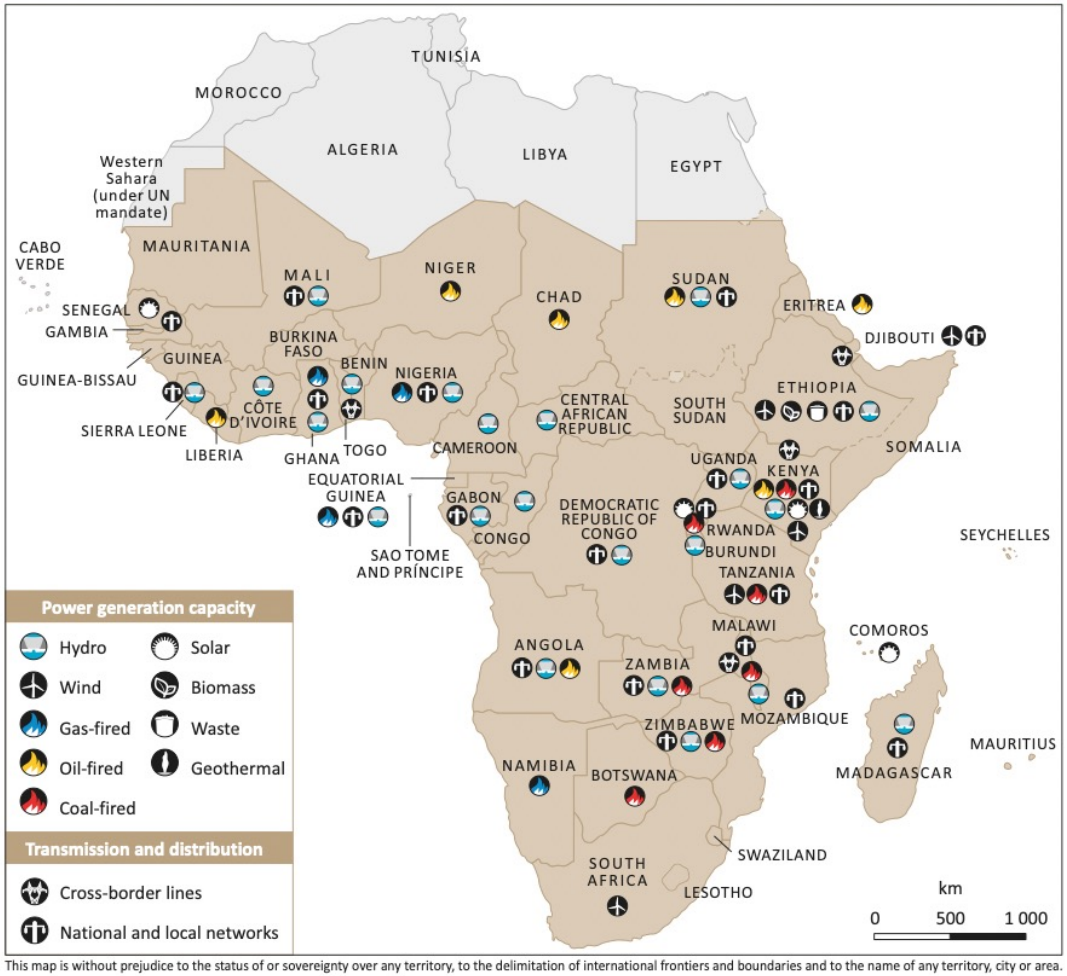
Speaking during a media briefing after the Botswana-South Africa Business Roundtable in Gaborone, capital of Botswana on Aug. 4, 2022, President Cyril Ramaphosa of South Africa said the willingness shown by Botswana to sell South Africa excess electricity will strengthen economic and trade ties.

By selling power to South Africa, Botswana hopes to realize its goal of becoming "a regional

https://english.news.cn/20220827/c792d5c1ce664235b9a526b71f62330a/c.html

http://large.stanford.edu/courses/2017/ph240/li1/docs/iea-2016.pdf

Map 1 • Greenfield power projects contracted to Chinese companies, 2010-20



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Note: Multiple projects in the same technology are represented by a single symbol in each country.

Key message • Chinese companies contracted greenfield power projects in more than three-quarters of sub-Saharan African countries.

2.2.4 A coal-fired power plant requires prudence in selecting boiler technology. The main factors considered are the type of coal, power system reliability and the electricity grid. Two options were considered for the Morupule B Power Plant, namely (i) Circulating Fluidized-Bed Combustion (CFBC) and (ii) Pulverised Coal (PC) boilers. The CFBC boiler technology was preferred over PC because it is better suited to the type of coal found in Botswana. CFBC boilers process solid fuel where the fuel is suspended in a mixture of superheated air and sand, collectively called "fluidized bed". Reagents like limestone are added and temperatures are controlled to directly capture the sulphur and reduce the formation of Nitrogen Oxides.

2.2.5 For CFBC, two technologies were considered, namely (i) sub-critical steam conditions and (ii) super-critical steam conditions. The latter was considered in order to achieve higher efficiency level but it was found that there is limited experience with this technology. Indeed, the first supercritical CFBC boiler of 460 MW rating is under construction at Lagisza in Poland. Besides, the single unit size is more than the BPC grid can sustain if there is an unplanned outage of the unit. For the above reasons, the application of CFBC super-critical boiler technology was rejected.

2.2.6 Furthermore, the Pulverised Coal super-critical technology was considered. Traditionally, the plants which adopted the super-critical technology were of large capacity, more than 500 MW (e.g. Matimba and Medupi of Eskom). Given the nature of the BPC's power system and the electricity grid limitation, the application of the PC super-critical boiler technology was also rejected.

2.2.7 The Morupule B power plant will deploy CFBC boiler technology. The plant will be supplied coal from the existing mine currently supplying coal to the Morupule A power plant. The coal supply agreement is expected to be signed before October 2009. The coal will be transported by overland conveyors that are covered to a coal processing plant where the coal will be separated, the coarse coal washed, and transported to the power plant B via another set of conveyors. This method of transporting coal is more cost effective than transportation by trucks. However, the conveyors belts when they break down will cause the spilling of coal and disruption of supply to boilers. The maintenance of the conveyor belts is part of the emergency preparedness plan to minimise the accidental spillage and the disruption of supply to boilers.

Table 2.2: project alternatives considered and reasons for rejection

Alternative	Brief description	Reasons for rejection
Generation		
a) No new generation capacity built / Reliance on power imports	a) Botswana currently needs to import >80% of power consumed nationally	a) Due to the regional power crisis, neighbouring countries will considerably reduce exports to Botswana over coming years and totally discontinue firm exports by 2013. Imports will therefore no longer be available over coming years and the economic cost of not meeting the demand for electricity would be enormous
b) Other power sources	b) (i) Coal Bed Methane; (ii) Solar (iii) Oil	b) (i) Reserves not proven yet; (ii) Not possible to develop in scaleable and timely manner to meet supply deficits over medium-term; (iii) Considerably more expensive and volatile (fuel would need to be imported). Would not provide the same level of energy self-reliance
c) Plant size	c) Plant size of 600 MW with 4x 150 MW units was selected	c) While a smaller plant size (400 MW) was originally considered, it was rejected to ensure that Botswana becomes self-sufficient. Implementing 4x150 MW units was identified as the least-cost configuration by taking into account the condition of the electricity grid
d) Boiler technology	d) Super-critical versus sub-critical boiler	d) Sub-critical CFBC boiler technology chosen over PC and CFBC supercritical due to the fact that CFBC is more suited to the type of coal and grid limitations in Botswana.
Transmission		
e) Voltage of transmission line	e) 220 kV or 765 kV instead of 400 kV lines	e) the 400 kV option was deemed to be optimal for Botswana's transmission system based on the 10 Year Transmission Development study conducted in 2006/7

Power Plant :Air Quality

3.2.4 As indicated in 2.2.5, the use of CFBC boilers would produce lower emission of SO_2 and NOx compared to typical coal fired power plant. Notwithstanding, the baseline ambient air quality of the local air shed was simulated through dispersion modelling because there is insufficient on-site data available for the criteria pollutants of concern. The main sources contributing to the ambient air quality within the vicinity of the proposed Morupule B Power Station are the current Morupule Power Station and the Morupule Coal Mine. The other main sources, i.e. Matimba and Medupi Power Stations across the border in South Africa are considered to be too far away to have a significant influence on the background concentrations at the Morupule Power Plant. The predicted baseline SO_2, NO_2 and PM10 baseline concentrations due to the existing Morupule Power Plant are summarized in Table 8.1/ B.8/ Annex 8.

4.4.3 BPC is going to operate and maintain the CFBC technology for the first time. The EPC contractor will be engaged to provide O&M services in the first two years to avoid risk of failure. The proposal is focussed on the safe operation of the station in the initial period, coupled with the training of local staff. CNEEC-SBW will provide approximately 240 staff who will train approximately 300 new BPC staff. It is intended that after that time, the plant would be fully operated by BPC staff, thereby greatly contributing to national capacity building. Besides, necessary spare parts for operation and maintenance have been planned and will be procured.

World Bank 2009

22. **Botswana must act quickly 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),[17] the only operating coal mine in Botswana. MCL has over 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.[18] 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. The contract price at about US$1,615 per kilowatt (kW) is competitive (see "Annex 8—Procurement Arrangements" for details) and is thus the least-cost replacement for imports from Eskom.