

# POWER PROJECTS IN AFRICA



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Each year during the annual conference, the Export-Import Bank of the United States highlights emerging trends and opportunities within Africa. This year, our focus features the energy needs throughout the continent and the opportunities for U.S. exporters and financial institutions in the growing power sector. In order to effectively present these initiatives, the following document has been compiled which provides an overview of several key African markets and their energy requirements. Additionally, a selection of current or proposed power projects in the various countries have been detailed and key contact information listed.

The Ex-Im Bank wishes to acknowledge with special appreciation the respective U.S. Missions in Botswana, Egypt, Ghana, Kenya, Morocco, Mozambique, Malawi, Nigeria, Senegal, South Africa, Tanzania, and Uganda as well as the Federal Ministry of Energy of the Government of Nigeria for their contributions in preparing the reports.

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# Botswana

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## Overview

Botswana is a politically stable country that scores well in various independent governance, corruption, and transparency rankings. It has held free and fair elections every five years since its independence in 1966, with the next general elections expected in October 2009.

Market challenges for any investor include: high transportation costs; landlocked country with a small domestic market; skilled labor shortage; poor productivity and customer service; difficulties in obtaining work and residence permits; and government bureaucracy.

Despite its recent difficulties, the future looks much brighter for the Botswana power sector. Large reserves of coal, three power generation projects in progress, and the potential for the development of coal-bed methane gas all add to the excitement over the possibilities in the energy sector. The Government of Botswana would welcome interest from foreign investors in the industry.

Ex-Im Bank is available to support financing in Botswana for the short, medium, and long term in both the public and private sectors.

## Key Players

Botswana Power Corporation (BPC)

BPC is part of the Government of Botswana's master privatization plan and might present a future FDI opportunity. The original master privatization plan listed BPC as desirable for privatization between 2010 and 2014. However, the Botswana government is currently behind schedule in its privatization efforts.

## Investment Opportunities

### *Coal Deposits*

Estimates of Botswana's coal reserves are slightly more than 200 billion tons. At an investor conference in Gaborone held in July 2007 (titled "The Awakening of the Coal Giant") the permanent secretary of the Ministry of Minerals, Energy, and Water Resources (MMEWR) stated that current projects should increase coal production by more than tenfold by 2012 and the government is optimistic that other coal-based projects will come on stream and further boost coal production. The government has granted 30 coal concessions to those exploring for coal over Botswana's 12 coal fields. Countries such as China and India as well as ones closer to Botswana such as Zambia and Zimbabwe are reported to be looking into importing coal from Botswana.

Much of Botswana's coal is low grade with high sulphur content, but recently some high grade export quality deposits have been discovered. A coal washing plant was commissioned in February and will come on line in mid-March 2008, with the capacity to yield one million tons of washed coal per year. According to Department of Mine

estimates, the amount of ash will be reduced from 20.4% to 12.6%, while the amount of sulphur will drop from 1.6% to 0.50% once the plant is operational.

#### *Power Generation Projects*

Botswana has three power generation projects at various stages of development. The first phase of the Morupule B expansion project is expected to come on line in 2010 to 2011, and a second phase in 2012/2013. The planned increase in power production by 1200 MW is expected to make Botswana self-sufficient in power. The Mmamabula Energy Project (MEP), expected to be completed in 2013/14, will be used primarily for export to South Africa. A third project for an independent power producer to build a power plant with a capacity of 250 MW and fill the expected supply gap in the next two to three years is at the tender stage.

#### Morupule Thermal Power Station

Government-owned Botswana Power Corporation (BPC) is in the process of expanding its Morupule Thermal Power Station, which is supplied by the Morupule coal mine. Once the expansion is completed, the Morupule power station should make Botswana self-sufficient in power.

BPC plans to increase the station's capacity by 1200 MW from the current installed capacity of 132 MW. The expansion will be completed in two phases, with the first expected to be completed by 2010/2011 and the second to be completed by 2012/2013. Each phase will consist of four 150 MW units. In February, the Minister of MMEWR announced that two Chinese companies were short-listed to submit Engineering, Procurement, and Construction tenders to undertake the expansion project.

The total cost of the project is estimated at \$1.2 billion. BPC or the Botswana Government expects to invest 20% of the total and has requested proposals from international financial institutions for project financing of the remaining 80%.

#### Mmamabula Energy Project (MEP)

The MEP will be the first independent power producer in Botswana. Canadian-listed CIC Energy Corp., which controls the majority of mineral rights to the coal fields, has completed its feasibility study and environmental impact assessment, which the Botswana government approved. CIC sold an interest in the project to International Power, which will develop the power station. Next steps to get to financial close by late 2008 or early 2009 include: CIC finalizing a power purchase agreements with South African utility Eskom and the BPC; CIC concluding a definitive Engineering, Procurement, and Construction contract; the Botswana Parliament approving new or amending Botswana laws such as the Mines and Minerals Act and the Electricity Supply Act; and all parties negotiating many other necessary agreements.

Once completed, the MEP is expected to generate up to 4,200 MW of power, with 75% to be exported directly to Eskom and 25% to be sold to BPC. There is sufficient coal at Mmamabula to support the MEP for 40 years.

CIC is expected to build the power plant in two equal phases. The first phase will consist of three 700-820 MW capacity units for a total net capacity of 2,100 to 2,460 MW. Although estimates vary, the first unit of phase one is expected to come on-line in

2013 with the second and third units coming on-line at six-month intervals after the first unit.

For the first phase, the MEP is expected to cost \$6 billion, with 80% coming from debt financing.

#### Independent Power Producers (IPP)

The Botswana government is encouraging private sector development in the power sector. The President of Botswana assented to amendments to the Electricity Supply Act, whose bill was passed by Parliament in December 2007. The amendment creates an enabling environment for the establishment, operation, and licensing of independent power producers and suppliers of electricity, and provide for the possibility of establishing an independent regulator.

In addition to the MEP, BPC recently accepted expressions of interest for an IPP to build a power plant with a total capacity of 250 MW with BPC as the off-taker. The field of applicants has been narrowed to four interested parties. BPC hopes to choose a winner by end of March 2008. One of the conditions of the tender was that it would take no more than two years to complete the project.

#### **Coal-Based Methane Gas**

Although still at a less-developed stage than coal, possibilities may exist for investors interested in coal-bed methane gas projects. A 2006 report mentioned the possibility of 60-trillion cubic feet of available gas. With the help of OPIC, Kalahari Energy Corporation is developing a 3.2 million acre gas field located in northeastern Botswana. Although Kalahari Energy recently sold some of its concessions to CIC, coal based methane development has been slow and opportunities remain in the sector.<sup>1</sup>

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<sup>1</sup> Report prepared by the US Mission in Kampala, Uganda.

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# Egypt

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## Overview

The U.S. is Egypt's second largest bilateral trading partner after the EU. Roughly two-thirds of total U.S. investment is in the oil and gas sector, but also includes investment in areas such as consumer goods, pharmaceuticals, automobile production, and financial services. Energy will continue to play an important role in Egypt's economy in coming years. Though Egypt's net exports of crude oil and petroleum products have declined in recent years, higher prices on world markets have pushed Egypt's oil revenues upward. The country also began exports of liquefied natural gas (LNG) in January 2005, adding to its hydrocarbon revenues. The country's real Gross Domestic Product (GDP) grew 7.1 percent in 2007. Real GDP growth is forecast at 7.2 percent for 2008. Power policy is formulated by the Ministry of Electricity and Energy.

Ex-Im Bank is available to support financing in Egypt in the short and medium-term for the public and private sectors, and available long-term for the public sector.

## Major Players

The state-owned Egyptian Electrical Holding Company (EEHC) is responsible for the generation, transmission, and distribution of electrical energy. It also owns and operates Egypt's electricity grid. The transport, distribution, and management of the grid remain a monopoly controlled by the EEHC, while electricity generation has been liberalized.

## Market Trends and Opportunities

Egypt's installed generating capacity stood at approximately 20 gigawatts (GW) as of 2005, with plans to add additional generating capacity of 8.38 GW by mid-2012. Around 84 percent of Egypt's electric generating capacity is powered by natural gas, with the remaining 16 percent hydroelectric, mostly from the Aswan High Dam. All oil-fired plants have been converted to run on natural gas as their primary fuel, and thermal power plants now account for roughly 65 percent of Egypt's total gas consumption. Overall, natural gas fuels 85 percent of Egypt's electricity production.

With electricity demand growing, Egypt is building several power plants and is considering limited privatization of the electric power sector. Egypt's power sector is currently comprised of seven regional state-owned power production and distribution companies, which were held by the Egyptian Electricity Authority (EEA). In July 2000, the EEA was converted into a holding company, though still owned by the state. Previous privatization plans have stalled, and the future direction of government policy in the electric utilities sector is unclear. Egypt has several privately-owned power plants currently under construction which were financed under Build, Own, Operate, and Transfer (BOOT) financing schemes. The first BOOT project was a gas-fired steam power plant with two 325-megawatt (MW) generating units, located at Sidi Kerir on the Gulf of Suez. The plant cost \$450 million, and began commercial operation in late 2001. U.S.-based InterGen (a joint venture of Bechtel Enterprises and Shell Generating Ltd.), along with local partners Kato Investment and First Arabian Development and Investment, have the 20-year BOOT contract for Sidi Kerir. The second BOOT power project award went to Electricite de France (EDF), for two natural gas-fired plants

located near the cities of Suez and Port Said. The two plants, which came online in 2003, have a total capacity of 1,366-MW. However, these assets now belong to Tanjong's Powertek, who in early 2006 formalized a sales agreement with EDF. Additionally, in February 2006, the World Bank agreed to fund a 700-MW plant expected to cost roughly \$260 million which will contain two 350-MW steam turbines.

Electricity supply in Egypt had witnessed a remarkable improvement since 1981. In 2005/2006 the generated capacity came to a 2.4 fold increase compared to 91/92. The length of networks progressed from 11.4 to 37.9 thousand km in 81/82 and 2005/2006 respectively, which is about 3.3 fold increase. Number of subscribers similarly leaped to 21.6 million in 2005/2006 compared to 5.6 million in 81/82, which is a 3.9 fold increase.

Hydroelectric sources, mainly at the Aswan dam, already contributes a significant 10.9% of Egypt's electrical demand as of 2006, meanwhile, Wind farms on the Red Sea coast contributed 0.7% of the electricity generation in 2006, up from 0.2% in 2001. Capacity from wind farms is to reach 1,050 megawatt by 2012, and 5,000 megawatt by 2022. On the other hand Egypt's huge potential for solar energy is only beginning to be tapped into. The first solar thermal power plant of 150 megawatt is expected to be operative by 2009. \*.

The electricity grid is connected to Jordan, Libya, and Syria (via Jordan). There are plans for a transmission line between Egypt and the Congo, through which Egypt would have access to the excess capacity generated by Congo's Inga Dam. Electricity supply enters Egypt duty free. Egypt is a net exporter of electricity, with 2002/03 net exports amounting to 780 GWh.

Law 100/1996 authorizes the private sector to build, own, operate, and transfer (BOOT) electrical power generation plants. Thus, private companies have been selling electricity to EEHC for twenty years and at the end of the operating period, they will transfer assets to EEHC. Since adoption of this law, private investment in the electricity sector has increased considerably, from \$22 million to \$915 million. The share of private generating companies in total installed capacity was just under 8 percent in 2003.

Electricity sector is the first sector in Egypt to adopt the BOT system of investment, in constructing EL- Koraimat plant.

The total power [generating] capacity in Egypt has hit 20,000 MW May 2005. In addition there is a strategy had been drawn up for the power sector for 2007-2022. The 16-year plan will see the construction of new power generating stations (including wind and solar), increasing the country's capacity to 36,000 MW by 2022. At this stage most of the decisions, contracting and financing is already in place to include most of the planned activities until 2012.

### **Renewable Energy Sector**

The New and Renewable Energy strategy aims at a 3% contribution of the total energy demand by the year 2010, mainly from the wind energy. Egypt is endowed with large wind energy resources that could reach approximately 20,000 MW in the Red Sea region, in addition to other contribution from the application of solar energy and solar thermal energy.

Egypt also is planning to build a part-solar power plant at Kureimat as a BOOT project, which will have 30 MW of solar capacity out of a total planned capacity of 150 MW. The World Bank will provide a financing package from its Global Environmental Facility which will offset the cost difference between the solar capacity and thermal capacity. Implementation and operation of the project are scheduled during mid-year 2010 and the estimated generated energy will be 985 GWh/year.

A Netherlands-funded project is building 60 MW worth of wind power units in the Suez Canal area. Egypt also has a 22-MW nuclear research reactor at Inshas in the Nile Delta, built by INVAP S.A. of Argentina, which began operation in 1997.

As for the remaining period until 2022 the following opportunities are foreseen\*\*

#### Wind generation

Currently there is no funding allocated for wind generation projects, however the ministry is actively seeking sources of financing or grants to increase generation annually by 200 megawatt in el Zaafarana area (best wind power generation location in Egyptian according to Egypt's wind atlas) until 2022.

#### Solar / Thermal generation

Similarly, there is no funding allocated for Solar generation projects, however the ministry is actively seeking sources of financing or grants to add two new solar farm in Borg El Arab area to generate 300 mega watt in 2016 and 2018

#### Fuel Generation

Over the period covering 2013 – 2022 a number of different generation plants are expected to be in place. Over this ten-year period a total figure of 15,000 megawatt is expected to be operational. Part of these expansions will be implemented using the ministry's budget; however, investors are welcomed to take part of this ambitious plan.

#### Biofuel Generation

Egypt does not have a national plan to cover Biofuel generation initiatives.

#### **Most Recent Tenders**

- Open tender number 27/2008 to construct transmission lines 500 KV, 405 Km long between Aboukeer and Abou Zaabal stations, Deadline 2/25/2008
- Open tender number 28/2008 to construct transmission lines 500 KV, 97Km long between Basous and Abou Zaabal stations, Deadline 2/25/2008
- Open tender number 29/2008 to construct a feeder 500 KV, in Kafr El Zayat transform station, Deadline 2/25/2008<sup>2</sup>

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\*\* Egyptian Presidency Website, 2008

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<sup>2</sup> Report prepared by the US Mission in Cairo, Egypt.

# Gabon

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## Overview

With a population of approximately 1.5 million inhabitants and abundant natural resources, Gabon enjoys an estimated per capita income of USD 7,717, four times that of most of sub-Saharan African nations. Despite fluctuating prices for Gabon's key exports—petroleum, timber, and manganese—the economy continues to grow steadily, with real growth in GDP at 4.5% annually, industrial production growth at 5% per year, and gross fixed investment stable at 24% of GDP.

Gabon has a high rate of rainfall of between 50 and 100 inches annually, and hydroelectric dams are the nation's primary source of electricity. Additional power production comes from gas-fired thermal plants and a heavy-fuel power station. In 2005, Gabon produced 1.52 billion kilowatt hours (kWh) and its electricity consumption was 1.241 billion kWh. The urban electrification rate is 90 percent, while 35 percent of rural households have access to electricity.

## Privatization

The privatization process began in 1996 when the government sought bidders for a 20-year concession to run the state-owned electricity and water utility, the Société d'Electricité et d'Eaux du Gabon (SEEG). In March 1997, the government announced an agreement with the French company Vivendi. Vivendi's contract was a landmark agreement for privatization in Gabon in that it was the first instance of a company making a firm commitment to invest in infrastructure improvements.

## The Major Players and the Institutional Framework

Gabon retains long-term ownership of all power production facilities and related infrastructure, while Veolia (formerly Vivendi) manages production, distribution, and sales through its controlling share (51%) of SEEG. Employees of SEEG and the public own the remaining shares of the company, with 5% and 44% respectively. A small number of independent power producers sell electricity to SEEG for resale to the public. In addition, companies are authorized to produce electricity for their own use.

SEEG supplies electricity to approximately 520,000 people in Gabon, mainly in the urban areas in and around the three major cities of Libreville, Port Gentil and Franceville. A current investment venture proposes improving the quality of supply and extending electricity to other areas of the country. Electricity rates have fallen since privatization in 1997 due to Veolia's investments to boost capacity and improve the country's transmission and distribution infrastructure.

## Investment Plans and Opportunities

Hydroelectric power currently accounts for 76% of Gabon's electricity supply, with two major dams on the M'Bei River—the Tchimbele (69 MW) and the Kinguele (58 MW)—as well as the Poubara dam on the Ogooue River. Other electricity is produced by gas-fired thermal plants (210 MW) and a heavy-fuel power station (30 MW). Gabon has approximately 6,000 MW of undeveloped hydroelectric potential.

Power development plans include a steadily increasing reliance on hydroelectric power and a diminishing role for thermal power. The state also intends to improve the distribution network connecting the three main dams (Tchimbele, Kinguele, and Poubara).

China has agreed to provide a loan of USD 83 million for a hydroelectric dam on the Ivindo River to power the Belinga iron ore mine in northeastern Gabon. The dam is to be built by the Chinese company Sino Hydro.

Although SEEG holds a monopoly on electricity sales, the power production sector is open to market competition. Companies may produce electricity for sale to SEEG, this being the primary opportunity for investment in Gabon's power generation sector.

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# Ghana

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## Overview

Ghana is one of the economic bright spots in West Africa, with real GDP growth exceeding 6 percent per year in 2006 and 2007. Meeting Ghana's growing demand for power will be critical if Ghana is to sustain and accelerate growth to meet its development goals. The Energy Commission estimated in 2006 that total electricity supply would need to double by 2013 to keep up with demand. Demand growth is driven by economic and industrial growth of more than 6%, population increases and a goal of achieving universal electrification by 2020 (current household access is just over half)

Ghana is emerging from a serious energy crisis in 2006-2007 that was triggered by drought and exacerbated by past inability to implement tariff reform or investment strategies to address growing demand. Ghana historically has depended on the Akosombo hydro plant for 65% of its power generation and at the height of the crisis, it was operating at only one-third capacity. Beginning in late August 2006 and continuing until September 2007, Ghana was forced to implement load shedding that cut power for 12 hours every two to three days. The economic costs of the power shortages are difficult to quantify but a September 2006 World Bank Aide memoire estimated the cost of depriving Ghana of electricity could be about \$980 million from September 2006 to December 2007.

Once the crisis was evident, the government became seized with the issue and moved to obtain emergency, diesel-run generators to provide more than 200 MW of power, while moving forward on acquisition of new generating capability including the 400MW Bui dam, refurbishment of a never-used power barge and several new thermal plants. Some private sector firms also took matters into their own hands. The four largest gold mining firms banded together to acquire 80 MW of generating capacity. A large portion of the proceeds from Ghana's \$750 million sovereign bond issued in October 2007 is slated to be used for energy-related needs, including capital investment.

Ghana has identified power generation investments of between \$1.2 billion and \$1.7 billion for the 2009-2012 periods.

Ex-Im Bank is fully available to support financing in Ghana for the public and private sectors.

## Ghana's Sources of Power

Ghana's main sources of electrical power are hydro and thermal. Solar energy for electricity in Ghana is used in some remote and off-grid rural locations. It is estimated that the 5,000 photovoltaic electric (PV) systems installed in the country have installed capacity of about one megawatt, generating between 1.2 – 1.5 Gigawatt-hours every year. Nuclear power is an option over the longer term. Ghana currently has a small research reactor. However, the GoG's Strategic National Energy Plan (2006 – 2020) does not envisage the addition of nuclear power generation before 2018 because of the long lead time required for planning and construction. Wind power generation is being explored by a few firms but no firm plans are in place. The GoG plans to expand the

share of electricity provided by renewables to 10 percent by 2020. Biomass (wood fuel) is still used to meet more than 60% of Ghana's total energy needs.

As of April 2007, Ghana had a total installed capacity of 1,855 MW. In 2006, total electricity generated in Ghana was 8,429 GWh but an additional 629 GWh was imported from Cote D'Ivoire; of the total, 755 GWh was exported to Togo and Benin. Electricity production from hydro was about 67% and thermal source was 33%. In 2007, production figures are somewhat lower and the thermal portion higher due to the drought-induced cutbacks at the Akosombo Dam. Currently all thermal plants in Ghana run on oil or diesel but once the West Africa Gas Pipeline begins operation, all of the large thermal plants plan to switch to the lower-cost natural gas.

### **Major Players**

The major players, all state-owned, in the energy sector are the Volta River Authority (VRA), responsible for power production, GRIDCO, a new entity being created from VRA that will be responsible for transmission, and Electric Company of Ghana (ECG) and Northern Electricity Department (NED), both responsible for distribution in different parts of the country. The Public Utilities Regulatory Commission (PURC) and the Energy Commission (EC) are two government agencies that regulate the utilities. PURC is an independent body with primary responsibility for setting the tariffs. The EC is tasked with licensing and regulating the technical operations of the utilities.

VRA will continue to handle transmission until GRIDCO is fully operational. Transmission is expected to remain state-owned. Changes in distribution arrangements are also foreseen. There are plans to merge ECG and NED and restructure it into a holding company with five regional companies covering the country. Restructuring and reform of ECG has been pending for quite some time. Prior to this plan, ECG was to have been placed under a private management contract but the GoG has had mixed experiences with management contracts and has decided to pursue a different approach. No policy decision on whether distribution will be opened to the private sector has been made.

Power sector needs in Ghana have been primarily funded by the public sector. The major privately funded plant is a 220MW thermal plant in Takoradi (TICO), in which the GoG has a 10% stake and has indicated it wishes to exercise its right to purchase additional shares, and even buy the entire plant. 25MW of a planned 50MW plant, Trans-Tema has also recently come on line. In order to address rapidly growing demand, Ghana will have to rely more on private participation. Ghana's regulatory framework is open to private investment in the generation but not in the transmission and distribution sectors. However, private investment has been slow to materialize in light of the poor financial state and weak capacity of the major players, tariff rates below cost-recovery levels, and an improving but still difficult investment climate,

### **Existing Power Generation**

VRA operates Akosombo and Kpong hydro power stations which have installed capacity of 1,120 MW and 160 MW respectively. The VRA's subsidiary, Takoradi Power Company (TAPCO), operates a 330 MW combined cycle thermal oil/gas plant. A GoG-owned 30 MW diesel plant installed in Tema in the early 1960s was decommissioned in 2007.

The 220MW Takoradi International Company (TICO) plant, jointly owned by VRA's subsidiary TAPCO (10%) and Abu Dhabi National Energy Company (TAQA) (90%), has been slated for expansion to a combined cycle 330MW plant for several years but issues related financing arrangements and a change of ownership of the private partner ownership have delayed progress.

25 MW of a 50 MW IPP has been installed by Trans-Tema, a Ghanaian company owned by a consortium. They have a PPA with GoG. The remaining 25MW should be on-line in the near term.

### **New Power Generation**

To address the power crisis, various emergency diesel plants were acquired with a total installed capacity of 266 MW. The emergency power plants are mainly diesel generators acquired by the GOG and o private entities. The emergency power is still being used but some have been moved to other regions to provide back-up.

Other power generation plants that should be on-line within a year are as follows:

- 125 MW Efasu Barge. This barge was constructed in the late 1990s and is an open cycle plant but has never operated. In 2007, the GoG reached an agreement with Balkan Energy to refurbish the barge, commission it and, in the future, convert it to a combined cycle plant that will provide an additional 60MW of power. A test was carried out in February 2008 with diesel but will later run on gas and it should be operational in March. Balkan has a power purchase agreement with VRA. A 50 MW Siemens gas/diesel plant purchased by the GoG is expected to be installed in Tema and should be operational in April or May, 2008. It should run at full capacity October.
- A 126 MW GE gas thermal plant purchased by the VRA was recently installed in Tema and will be up and running in June. Another 126 MW is expected to be added through an IPP by GECAD, the local agent of GE.
- A 220 MW Alstom (Swiss) gas/diesel plant has been ordered by GoG and contract for installation in Tema and should be operational in December 2008 or January 2009.

In addition to these new generation plants coming on line in the near term, a new transmission line from Obuasi-Kumasi to will be completed later in 2008 and should ease transmission bottlenecks in the west. A new evacuation station is also being completed to handle expanded power production in Tema.

### **IPP Initiatives**

TICO was the first IPP in Ghana and was commissioned in 2000, producing 220 MW. It was a joint venture between CMS Energy of Michigan and the VRA which formed TICO. CMS Energy, however, sold its 90 percent interest in TICO to TAQA in 2007. The second is Trans- Tema which installed its 50MW IPP in 2007. Others expected to come online are Balkan Energy operating the Osagyefo 125 MW barge, the expansion of the VRA thermal gas plant at Tema by GECAD, and the construction of a 500 MW thermal gas plant by Sunon Asogli Power Ltd (a Chinese-Ghanaian venture). New IPPs are also exploring the possibility of using Ghana as a generation base for supply to neighboring

countries under the West Africa Power Pool. In total, at least five IPPs with about 1600MW of capacity are at various stages of discussion.

### **Power Sector Reforms**

Further generation capacity in Ghana is largely envisaged in the private sector. The GoG is therefore establishing an 'Access Code' that will guarantee open access to electricity transmission infrastructure. This would be done either as a public-private partnership project or a wholly private sector investment. As a first step, the GoG is unbundling the Volta River Authority (VRA) into four companies; a hydro generation company, a thermal generation company, a transmission company and a distribution company. The law to establish a transmission company out of VRA has been passed. The new company, GRIDCO, has an interim CEO, but has not started full operation. Transmission is expected to remain a government owned but will be independently regulated natural monopoly in the unbundled industry structure. Plans are underway to merge ECG and the NED into a single distribution company.

Tariff levels have been too low to cover cost of production, which resulted in chronic lack of investment and poor quality of service. The PURC is currently working to move tariffs to economic levels in order to attract private investment in generation. In the past, the GoG has absorbed tariff increases recommended by PURC rather than pass them along to consumers, thereby exacerbating the poor financial condition of the utility companies. The GoG implemented significant increases in late 2007 and is committed to moving to full cost recovery.

### **Regional Power Projects**

The 600 km West African Gas Pipeline (WAGP) Project is expected to deliver its first natural gas in the second quarter of 2008. The WAGP will deliver natural gas at a lower cost than light crude oil to VRA's thermal generating facilities and other future thermal plants. WAGP will initially supply 200 standard (million) cubic ft per day, which will increase to 407 million cubic ft. The availability of the Nigerian gas from the pipeline would further improve Ghana's generation position. A secondary gas market plan has been developed and the Bulk Oil Storage & Transport (BOST), a state-owned strategic oil storage company, is expected to have the additional responsibility to be the main utility company.

Ghana is also involved in the development of the West African Power Pool (WAPP), aimed at establishing a regional market for electricity trade. WAPP will facilitate the expansion of electricity supply capacity and improve reliability of power supply in the sub-region. Ghana is already interconnected with its western neighbor Cote D'Ivoire and its eastern neighbors Togo and Benin. Plans are underway to interconnect with its northern neighbor, Burkina Faso.

### **Investment Plans**

The following planned investments are all government-funded investments.

#### **Generation**

In addition to the IPPs noted above, the 400MW Bui hydroelectric Dam is slated for completion in 2012, at a cost of about \$600 million.

## Transmission

- Construct a 161kV line from Kumasi to Sunyani
- Construct of a 161kV line through Tumu-Han-Wa to close the northern loop
- Upgrade transmission system-wide reactive power compensation capability.
- Upgrade and expand transmission circuits, both local and international
- Establish interconnection linking Ghana to Burkina Faso and to facilitate efficient regional power market under the West Africa Power Pool protocol includes a construction of a 330 kV line link to the Nigerian transmission network.

## Distribution

- Install a third bulk supply point for Accra, in the short term to improve the quality of power supply (reliability and voltage stability) in the nation's capital.
- Install a second bulk supply point for Kumasi by 2008
- Expand bulk supply points at Takoradi and Tamale between 2015-2020.
- Expand bulk supply points to other regional capitals.

Except for the IPPs, the GoG will continue to provide most funds and guarantees for power projects. Funds will come through government and government guaranteed loans from international financial institutions and the capital market. However, because of the low tariffs and weak collection system, the utilities may not be able to self finance their expansion plans.

## Renewable Energy

The present share of solar based generation of electricity is only 0.3%. The GoG plans to make solar and other renewable energy 10% of electricity generation by 2020. The United Nations Environment Programme (UNEP) through the Global Environment Fund is assisting in the Solar and Wind Energy Resource Assessment (SWERA) project. The project has developed a Geo-spatial Information System database for solar and wind. There are import duty and value-added tax exemptions on the import of solar components.<sup>3</sup>

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<sup>3</sup> Report prepared by the U.S. Mission in Accra, Ghana.

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# Kenya

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## Overview

Kenya's major sources of electricity are hydroelectric, geothermal, thermal and import from Uganda. The total *installed capacity* is 1,236 megawatts (MW) made up of hydropower (677 MW) oil based thermal (407 MW) and imports from Uganda of 30 MW. Some of this is lost through load shedding. The *effective capacity* is 1176MW with *peak demand for electricity* of 1031 MW in October 2007. The annual energy demand is expected to continue rising at no less than 8% per annum and industry analysts expect peak demand to reach 1153MW against a supply of 1185MW in 2008. Confronted with a reserve margin of only 7%, Kenya is intent on exploiting its vast reserves in geothermal energy located in the Rift Valley to ensure energy security and lessen dependence on hydro and diesel. At present, only 16% of the population is connected to the national grid.

Ex-Im Bank is available to support financing in Kenya in the short and medium-term for the public and private sectors.

## Key Players

KENGEN is the leading power producer in Kenya and accounts for 82% of the installed capacity. KENGEN is a 70% state owned corporation and the rest is public owned through the Nairobi Stock Exchange. Independent Power Producers (IPPs) currently have a combined capacity of 186 MW including 12 MW of geothermal energy. There are only four active IPPs; *Iberafrika*, *Mumias Sugar Company*, *Tsavo Power* and *Orpower*. In line with the GOK's expansion plan, KENGEN announced last year its 10year expansion plan where it seeks to raise US\$1 billion towards addition of another 559MW (mostly hydro and geothermal) to the national grid by July 2011.

Key government reforms undertaken in the past restructured the industry into three tiers: 1) Electricity Regulation Commission (ERC) as the regulator; 2) Kenya Electricity Generating Co. Ltd. (KENGEN) as the generator; and 3) Kenya Power & Lighting Co. Ltd. (KPLC) to carry out transmission and distribution.

## Investment Opportunities

Projects as contained in the Kenya Power Development Plan are:

1. Hydropower Generation: It contributes about 70% of the electricity supply in Kenya. The few remaining sites to be exploited are costly to develop thus KENGEN is looking to expand the capacity of existing stations.
  - a) Redevelopment of Tana Power Station: This involves construction of a new powerhouse and installation of new machines as well as refurbishment of existing structures. The feasibility and Environmental study are complete. The installed capacity will increase from 14.4 to 20MW and the estimated cost of the project is US\$41 million.
  - b) Raising Masinga Reservoir: Project looks to increase the reservoir capacity so as to improve regulation of the cascade and increase energy production. The feasibility study was completed in 2007 and currently site

- investigations and the EIA are ongoing. Construction should begin in 2009. Estimated cost is US\$12 million.
- c) Kindaruma 3<sup>rd</sup> Unit Project: To increase the installed capacity by an additional unit of 20MW and refurbishment of the existing two. Tenders for the construction expected in June 2008 with commissioning of the 3<sup>rd</sup> unit in 2011. The estimated cost is US\$20 million.
2. Geothermal Generation: Kenya's geothermal potential is estimated to be about 2,000 MW located in the Rift Valley. However, the exploited potential is only 130MW. The GOK has taken responsibility of resource development so that investors in the sector do not have to bear the risk of prospecting.
    - a) Olkaria II 3<sup>rd</sup> Unit Project: Located in the Hell's Gate National Park, this project involves construction of a new 35MW generation unit to increase the existing capacity of Olkaria II to 105MW. The EIA is complete and construction is expected to commence in March 2008. The cost estimate is US\$96 million and World Bank, EIB and KENGEN have committed to finance to the tune of US\$76 million. A financing gap of \$20 million exists.
    - b) Eburru Geothermal Plant: KENGEN will construct a 2.5MW generation plant to utilize the idle steam wells. The tender process is already underway and the estimated total cost is US\$6.25 million.
    - c) Olkaria Domes Appraisal Drilling: KENGEN contracted the Great Wall Drilling Co. of China to drill six directional wells for appraisal of the Olkaria Domes site geothermal resource capacity. This is part of KENGEN's effort to add 559MW to the national grid by July 2011. The drilling of 2 wells is already complete. This is being co-financed by KENGEN together with KfW, World Bank's IDA and the GOK Ministry of Energy.
    - d) Olkaria IV Geothermal Plant – Aims to develop a 70MW geothermal plant in the Domes area once the geothermal capacity is established. The plant commissioning is expected in 2010. The estimated cost is US\$147 million and KENGEN is seeking funds for this.
    - e) Olkaria Make-up Wells Drilling – Drilling of 4 make-up wells to compensate for the estimated annual reduction in steam production is already underway. These will feed into Olkaria I and II and the cost is estimated to be US\$11.5 million. Funding is not secured.
    - f) Olkaria I Life Extension – Olkaria I is a 45MW plant was installed in 1981 and this project will extend its life by 15years. The cost is US\$44 million and KENGEN is seeking assistance from development partners.
  3. Thermal Power Plants: There is currently an installed capacity of 147MW of thermal power generation in Kenya mostly along the Indian Ocean coastline. The GOK intends to facilitate the establishment of a Liquefied Natural Gas (LNG) terminal in Mombasa so that the thermal plants can use LNG to run the plants, as it is a cheaper fuel.
    - a) Mombasa Gas Turbine Power Plant (Kipevu GT 3 & 4) – The plant will comprise 2 units with total capacity of 80MW and running on LNG as the primary and kerosene as the secondary fuel. Commissioning was to be done in January 2008 but there has been delay. Financing of US\$50 million has not yet been secured.
    - b) Coal Power Plants – The Ministry of Energy has been undertaking coal exploration in Kitui and initial test results indicate the coal content and

quality is comparable to international standards. The GOK plans to use both local and imported coal in power generation. Consultancy services for a World Bank financed feasibility study for a 300MW plant has commenced and the first coal plant of 150MW is planned for 2011. Two others are planned later and the entire project would cost US\$650 million. Financing is not yet secured.

4. Wind Projects: KENGEN has an installed capacity of only 0.5MW of wind energy. However, wind measurement is ongoing at various sites so establish the viability of investing in it. The Marsabit area has the greatest wind potential in the country with an estimated potential of 4000MW. Discussions are ongoing for a joint venture with a local firm and wind measurements is ongoing.
5. Other Projects:
  - a) Ethiopia – KENGEN has signed a memorandum of understanding with the Ethiopian Power Corp for joint development of hydropower at two sites in Ethiopia, which would be cheaper than developing new sites locally.
  - b) Uganda – The Karuma Hydro project in Uganda is a JV between GOK and GOU and the project was identified under the East African Power Plan. It is proposed to have an installed capacity of 200MW and KENGEN is set to be a joint owner. The total cost of this project is estimated at US\$428.9 million.
  - c) Bagasse – KENGEN plans to partner with local sugar companies to increase co-generation and reduce reliance on oil-fired electricity. The surplus from these factories will be supplied to the national grid. The first such project is planned with Chemilil Sugar Company at an estimate cost of US\$35 million with financing from the partners equity and debt.
  - d) Additional Hydropower Projects – Several other hydropower projects have been in the pipeline for a long time now but have never taken off due to the high cost of implementation. These include Karura at 60MW for US\$136 million; Nandi Forest at 50MW for US\$125 million; Mutonga at 60MW for US\$196.7 million and Low Grand Falls at 140MW for US\$378.3 million. All these are old estimates from 2000 and before and would need to be updated and thus will cost a lot more now.<sup>4</sup>

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<sup>4</sup> Report prepared by the U.S. Mission in Nairobi, Kenya

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# Malawi

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## Overview

Malawi, a country of over 12 million people, generates 100 percent of its electrical power through a series of hydro-electric stations on the Shire River. The country has a total installed power generation capacity of 304 megawatts. At present, one 40 MW generator is off-line undergoing rehabilitation, leaving 264 MW of available power. Currently this is sufficient to satisfy the country's 255 MW demand. Only about 7% of the population is currently connected to the electrical grid, however, so rapid growth in demand is likely in the coming years. The narrow cushion of surplus, however, combined with the periodic necessity for servicing the country's generating plants, has often resulted in blackouts and other power shortages. Malawi's transmission infrastructure, still largely supported by wooden poles, is also vulnerable to interruptions. Private sector contacts report that the lack of reliable power is already a significant constraint to investment. Investors seeking to develop projects requiring substantial power are forced to consider self-generation. The Kayelekera uranium mine under construction in the far north is one such example. In addition to the needs of additional industrial/commercial demand, national development plans for rural electrification will require Malawi to develop significant increased capacity.

Ex-Im Bank is fully available to support financing in Malawi in the short-, medium-term, for the public and private sectors and in the long-term for the public sector.

## Key Players

In January 2008, the new Malawi Energy Regulatory Authority was established, enhancing the country's structural capacity for development of the energy sector. The new authority's major mandate is to solicit independent power projects (IPPs) to meet Malawi's energy needs. The authority is now working to put together packages for such an IPP offer; current estimates are that this initial preparatory work will be completed by the end of 2008. The legal framework has also been revised to support new projects, with a new energy law passed on December 28, 2007 and old laws repealed.

According to the Ministry of Energy and Mines, the Government of Malawi is open to the full range of options for financing the proposed new developments. These could include public funding, strategic partnerships, soft loans, or IPPs. Malawi is heavily dependent on international donors for support of the government's operating and especially capital expenses. It is unlikely that any significant investment in the power sector would take place without donor support.

The key institutional players in Malawi's energy sector are the Ministry of Energy and Mines, the new Malawi Energy Regulatory Authority (MERA), and the Electricity Supply Corporation of Malawi (ESCOM), the state-owned monopoly energy supplier. Once fully established, MERA will be the principal decision making body for the issuance of licenses or the awards of any IPP agreements. Information on projected power development projects can be obtained from the Department of Energy at the Ministry of Energy and Mines.

## Recent Developments

According to the Ministry of Energy and Mines, plans currently being considered by the government would triple the country's current capacity. Capacity increases would be obtained in three ways.

Plans currently underway for Malawi to participate in the Southern African electrical grid through interconnection with Mozambique would provide the most immediate access to new capacity. Negotiations for the interconnection have been completed. The only outstanding requirement is the passage by Malawi's Parliament of legislation to authorize a World Bank loan to finance the connection. Once operational, the interconnection will provide a fully-reciprocal import-export line, allowing Malawi to balance its power supply and demand by selling into or buying from the regional grid. Significantly, the agreement provides for access, but no guaranteed supply. Given the recent power shortages in South Africa, the largest regional power consumer, the interconnection provides an uncertain solution, at best, to Malawi's future power needs.

A second element of Malawi's power development plan involves the partially completed hydro-electric station at Kapichira, on the Shire River. When completed, the Kapichira station will have four generating turbines with a capacity of 32 MW each. All of the civil works for this station have been completed, and two of the turbines have been already installed and are operational (providing 64 MW of the country's current 304 MW capacity). Full operation of the Kapichira station would therefore represent an additional 64 MW of capacity. Financing totaling ~\$50 million is still needed to purchase the remaining two turbines.

The third element of Malawi's power development plan is to add capacity through the construction of additional hydro-electric plant(s). The Ministry has completed a survey of the country's water resources, identifying 13 perennial rivers with a total of 110 potential sites suitable for hydro-electric installations. Most of these would be in the medium capacity range (5-100 MW), although some might offer capacity of 100 MW or over. According to the Ministry, hydrological assessments have been done at all identified sites, with the sites ranked by potential. Two sites on the Shire have received the most thorough work, including the generation of cost estimates. A third site on a major northern river has also been the subject of relatively more extensive work.<sup>5</sup>

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<sup>5</sup> Report prepared by the U.S. Mission in Lilongwe, Malawi.

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<sup>6</sup> [Note: MERA has not yet fully set up its secretariat and has not yet occupied permanent office space.]



# Morocco

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## Overview

Since 2002, growth in demand for electricity in Morocco has grown at an annual rate of 8%, attaining 24,000 GWh in 2007. This trend is likely to continue due to rapid infrastructure development, rural electrification programs, and strong economic growth, including record levels of foreign investment in each of the past three years. The Government of Morocco (GOM) foresees spending \$1.1 billion per year for the next four years on new electricity generating plants, and will need to increase capacity by 400 MW per year just to keep up with demand. The Ministry of Energy, Mines, Water and the Environment (MOE) is developing an energy strategy to meet these challenges that should be completed as early as March 2008.

The GOM has been moving towards restructuring the country's electricity sector over the past few years. The most concrete step towards liberalization is occurring now as the final language of the electricity sector reform act is being reviewed by the Ministry of Energy for submission to the Parliament. The electricity sector reform act's liberalization legislation will significantly impact the Moroccan Office National de l'Electricite (ONE) through major revisions to the company's mandate and the creation of an open and regulated electricity market. To successfully adapt to these changes, ONE has requested USTDA support to assist the company in reorganizing its corporate structure with the perspective of liberalizing Morocco's electricity sector.

Morocco has no significant energy resources to produce electricity other than wind, and therefore must import about 96% of the fuel for its energy sector. Currently coal fired generation plants provide nearly 60% of Morocco's electricity, and the GOM seeks to diversify its fuel sources by using more natural gas and increasing wind generated electricity significantly. Morocco imports about 10% of its electricity from Spain because it is less expensive than producing electricity from imported fuels. According to ONE, the transmission line between Morocco and Spain is already operating at maximum capacity and importing a larger amount of electricity would require the construction of a new line, which would take 2-3 years to complete.

Ex-Im Bank is fully available to support financing in Morocco in the short-, medium-term, and long-term for the public and private sectors.

## Recent Developments and Investment Opportunities

Currently, Morocco has electric production capacity of about 4,500MW, but several fuel oil and diesel powered turbines are not used due to the high expense of fuel, and hydroelectric plants are unreliable due to persistent droughts. On a daily basis, approximately 50% of Morocco's electricity is produced by a 1,320 MW coal-powered plant in Jorf Lasfar that was built, and until last year, owned and operated by CMS Energy (U.S.). The GOM plans to increase its electricity generation capacity by 4,500 MW by 2012. The original plan included building a 1,200 MW plant (compatible for coal or natural gas) near the major tourist destination of Agadir, but local environmental concerns prevented its construction. An alternative site has been identified in Safi, but

the decision to start construction has not yet been finalized, as environmental protection groups are protesting against this site as well. According to ONE, Minister Benkhadra will decide where the plant will be located and a public tender for the project should be issued within three months.

The MOE is currently conducting a study to extend the aforementioned Jorf Lasfar plant with a 1,200 MW plant similar to the one planned for Safi. In addition, the MOE plans to install a new 300 MW gas/fuel oil turbine in Mohammedia in 2009 and a 300 MW gas powered plant in Kenitra in 2010. The Ministry is also planning to complete the upgrade of the existing 230 MW gas powered plant in Ain Beni Mathar to 450 MW that same year.

### Other Projects

In order to diversify away from coal, the GOM is studying the idea of spending \$1 billion to build a Liquefied Natural Gas terminal to supply a proposed 800 MW gas powered generation plant somewhere between Tangier and El Jadida. A pipeline would run between those two cities to supply the country's main industrial centers that are located along the Atlantic coast. According to ONE, the timing of this project would occur between the two 1,200 MW plants previously discussed.

Though national authorities are exploring the potential of solar and biomass energy, most of the remaining new capacity will come from wind energy. The GOM seeks to increase wind electricity from around 4% to 20% by 2012. Morocco has some of the best wind resources in Africa and has significant plans to exploit them in the next five years. In speaking with the MOE, ONE, the Moroccan Association of Solar and Wind Industries, and private companies, there are discrepancies in the number of wind energy projects currently being planned. Part of this can be explained by the GOM's new EnergyPro program to encourage large corporate consumers of electricity to build private wind farms to produce their own electricity and sell the excess power to ONE. It appears existing plans for GOM projects are being parceled off to these large companies. Regardless, the GOM's stated goal is for Morocco to produce 1,000 MW of wind-generated electricity by 2012. Its current installed wind-generated capacity is approximately 150 MW.

The GOM has identified at least eight potential wind farm projects with a cumulative capacity in excess of 1,150 MW that are in varying stages of planning and development. The EnergyPro program has attracted interest from six companies (Ciment de Maroc, Endesa, Nareva, Ynna Holdings, the National Phosphates Office [OCP] and Iberdrola) to finance some of these projects and could produce a total of 820 MW. Wind farm projects are as follows:

Tetouan (in operation)	54 MW
Essaouira (in operation)	60 MW
Tangier (2009)	140 MW
Taza (2009)	100 MW
Sandouk/Tangier (2009)	60 MW
Tarafaya (2010)	300 MW
Layoune (2010) *	240 MW
Others (near Layoune) *	200 MW
Total	1,154 MW

\* situated in disputed Western Sahara

ONE plans to upgrade portions of Morocco's transmissions network in the near future. A new 400 KV line will be built between Agadir and Layoune in the Western Sahara. In addition, a 225 KV line will be built between Layoune and Dhakla in the Western Sahara.

Morocco has been investigating a civilian nuclear energy sector since the 1980s and has 2 MW nuclear research reactors that it hopes can act as a training tool for staff members at a future nuclear power plant. While ONE has expressed interest in pursuing construction of a nuclear plant in the medium to long term, no political decision to pursue nuclear energy has yet been undertaken by the government.<sup>7</sup>

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<sup>7</sup> Report prepared by the U.S. Mission in Rabbat, Morocco.

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# Mozambique

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## Overview

Mozambique's economy is recovering from a civil war that ended in 1992. Macroeconomic reforms and large foreign investment projects have resulted in Mozambique's economy growing an average of eight percent per year during 1994-2007. This is the best growth record for any country in sub-Saharan Africa. The estimated real GDP growth rate for 2007 is 7.9%. The Mozambican government (GRM) expects an average real GDP growth rate of seven to ten percent over the next five years.

To date Mozambique's privatization program has been relatively transparent, with open and competitive tendering procedures in which both foreign and domestic investors have participated. Most remaining parastatals are in public utilities, making their privatization more politically sensitive. While the government has indicated an intention to take on partners in most of these utility industries, progress on privatization has been slow.

Investment and export opportunities exist in construction, energy (natural gas, hydropower, and bio-diesel), mining (tantalum, graphite, and coal), fishing (prawns, lobster, pelagic fishes), aquaculture, tourism, agriculture/horticulture (cashews, sesame, tea, essential oils, vegetables, flowers, paprika, tobacco, and fruits), telecommunications, and transportation.

Ex-Im Bank is fully available to support financing in Mozambique in the short-, medium-term, and long-term for the public and private sectors.

## Energy Sector

Mozambique has considerable hydropower potential. The Mozambican government is actively seeking investors to build a northern powerhouse at the Cahora Bassa dam (the southern bank powerhouse is in operation) and to construct a second dam lower down the Zambezi at Mepanda N'cua.

There is increasing regional demand for power, especially in South Africa. The Cahora Bassa Hydroelectric Company (HCB), which manages dam operations, was 82% Portuguese-owned and 18% Mozambican-owned since the dam went into operation in 1976 until very recently. In late 2005 the Mozambican and Portuguese governments reached an agreement whereby Mozambique acquired an 85% ownership in HCB. This agreement was finalized in late 2006, and the Mozambican government took control in November 2007.

Mozambique is a major supplier of energy in Sub-Saharan Africa. HCB generates approximately 2000MW, but has the potential to produce 14000MW. As a result, HCB has the capacity to light a third of Africa. Most of the output is exported to South Africa and Zimbabwe under low-cost, long-term contracts. Mozambique exports 1500MW to South Africa (although approximately 950MW are sent back to Mozambique to supply

power to the Mozal Aluminum Smelter). Mozambique also supplies about 200MW to Zimbabwe.

Plans are underway to boost the generating capacity of Cahora Bassa, as well as to construct a new hydroelectric facility on the Zambeze River to add an additional 1300MW generating capacity. In addition, there are hydroelectric dams located in Chicamba, Mavuzi, and Corumana that have a capacity respectively to produce 38MW, 50MW, and 17MW.

Currently, there is an energy consortium, the South Africa Power Pool (SAPP). There are 12 members. Out of these twelve countries, five countries import energy: Botswana (70%), Zimbabwe (40%), Swaziland (70%), Namibia (40%), and Lesotho (30%). HCB is a key energy supplier to Zimbabwe, Swaziland, and South Africa. It is important to note that the demand for energy rose in Sub-Saharan Africa between 1994 and 2007 by 50%, potentially explaining the energy crisis suffered by much of the region. There is hope in the region that HCB can increase its power capacity in order to make up for the power deficit in the region. Mozambique has the capacity to contribute in 2016 40% to 60% of the additional capacity required in the region. Finally, the Mozambican government is in the process of implementing a national plan to upgrade and modernize the country's electricity grid.

## **Mining**

Mozambique has commercially important deposits of coal (high quality coking coal and thermogenic quality coal), iron ore, titanium ore, apatite, graphite, marble, bentonite, bauxite, kaolin, copper, gold, and tantalum. Two of the largest investment projects in development are mining and processing ventures of "heavy sands" deposits, essentially mineral deposits brought down by rivers and built up into sandy bluffs. The Moma Heavy Sands (Kenmare Resources, Ireland) and Corridor Sands (BHP Billiton, Australia) projects together will require more than \$1 billion in investment in the next few years.

Companhia Vale do Rio Doce (CVRD), a large Brazilian coal company, won rights to the world-class Moatize coal field in Tete province in late 2004. Construction of a thermogenic power station, approximately 1,750 megawatts in size, is planned in conjunction with the mining operation. The Government and CVRD have solicited proposals for a partner in the power station venture, and a preferred bidder has been identified. The building of this station would offer additional opportunities in Mozambique's construction sector.

## **Hydrocarbon Exploration in Mozambique**

Exploration for hydrocarbons in Mozambique goes back to 1904, when the early explorers discovered thick sedimentary basins in Mozambique. From 1948 onwards, international oil companies moved into Mozambique and carried out extensive exploration, mainly onshore with limited activity offshore. As a result the Pande Gas Field was discovered in 1961 by Gulf Oil, followed by the gas discoveries of Buzi (1962) and Temane (1967). Exploration activity declined in the early 1970's due to political unrest. U.S.-based Anadarko has recently begun exploring for petroleum in the Rovuma Basin and has made a significant investment in Mozambique.

From 1970 to 1980 there have only 6 wildcat wells have been drilled in Mozambique – 3 of them offshore. An extensive drilling campaign conducted by Sasol in 2003, which included exploration and production wells in the Pende/Temane Block allowed the expansion of gas reserves and the discovery of Inhassoro Gas Field.

There are four proven gas fields in Mozambique: Pande, Temane, Buzi, and Inhassoro. There is significant potential for the discovery of more gas fields in Mozambique. However, the gas potential is not evaluated yet and gas extension area not outlined as well due to a lack of data.

## **Biofuels**

Mozambique has the potential to become a leading producer of biofuels, due to its significant tracts of undeveloped land and climate conducive to biofuel crops. Some experts estimate that Mozambique has the capacity to produce the biofuels equivalent of 3.1 million barrels of oil equivalent per day. This potential led a U.K. Company (CAMEC), to sign a USD 510 million deal with the Government of Mozambique in 2007. Chinese, Canadian, Italian, Portuguese, and Brazilian companies are already active in the biofuel sector in Mozambique. A South Africa company with a bio-diesel (jatropha) concession in Inhambane province is using U.S. technology and equipment exclusively in its production facility.<sup>8</sup>

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<sup>8</sup> Report prepared by the U.S. Mission in Maputo, Mozambique.

## Contact Information

U.S. Embassy Maputo welcomes all inquiries and looks forward to assisting U.S. investors in Mozambique. Robert Doughten is the Economic/Commercial Officer and Elizabeth Filipe is the Economic/Commercial Specialist. Their contact information is as follows:

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# Namibia

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## Overview

Namibia is highly dependent on electricity imports from South Africa and the government has recently stated that it aims to meet 100 percent of the peak demand with locally produced power by 2010. Generation from within the country has become increasingly difficult as coal import prices have increased and the flow in the Kunene has been variable, making hydro generation unpredictable. NamPower has embarked on a number of projects which will execute its plan to increase electricity generating capacity and supply in the country.<sup>9</sup>

In an effort to diversify the economy, the Namibian government has decided to focus on energy policies as the centerpiece of their economic development strategy. The discovery of the Kudu offshore gas field will provide plenty of feedstock for power generation. It is expected that the plant will triple domestic generating capacity and provide plenty of spare capacity for new industries to emerge in addition to contributing to export revenues.<sup>10</sup> Plans are underway to provide rural electrification of over 250,000 households in order to improve social conditions to be completed by 2010.

Ex-Im Bank is fully available to support financing in Namibia in the short-, medium-term, and long-term for the public and private sectors.

## Major Players

Power in Namibia is generated and supplied by Namibia Power Corporation (NamPower), previously the West Africa Water and Electricity Corporation (Pty) Ltd (SWAWEK). NamPower supplies electricity to the mining and industrial sectors as well as the rural parts of the country. Local authorities distribute electricity and Northern Electricity operates and manages electricity supply in the north. The establishment of an Electricity Act in conjunction with an Electricity Board will serve to regulate and improve the efficiency of the sector. Namibia has Africa's third highest electrification level at 20%.

NamPower, which has undergone a restructuring process, has set out to address the challenges of a restructured Namibian electricity supply industry, and is actively embarking on ways to raise electricity generation capacity in the country. With this in mind, Namibia's electricity regulatory authority, the Electricity Control Board, in conjunction with NamPower, aims to develop renewable energy, particularly wind power, and increase rural electrification, which presently stands at only 30 percent compared with 85 percent of urban households being electrified. Namibia is also a member of the Southern Africa Power Pool (SAPP), allowing for greater integration in interconnection infrastructure expanding generation capacity in the country.

The Ruacana Hydroelectric station on the Kunene River generates electricity in Namibia of which the excess is exported to South Africa.

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<sup>9</sup> NamPower (January 22, 2008). "Media Statement." (<http://www.nampower.com.na/nampower2004/news/index.asp?r=327>) Retrieved on February 26, 2008.

<sup>10</sup> Ford, Neil. "Namibia: Power is the Key." *African Business*. London: Feb 2007: (54-56)

The coal-fired, Van Eck, thermal station at Windhoek also supplies the country with electricity together with small diesel units around the country. In the north, wood is the main source of energy and biomass is the main fuel. Wind power and solar energy can also be harnessed as other energy sources. Two wind measurement stations have been installed at Walvis Bay and Luderitz and a solar measurement station at Noordoewer. Solar energy is vital in supplying power to distant places.

### **Major Developments**

NamPower has put in place measures to minimize the impacts of the reduced imports. These measures include the introduction of Demand Side Management and the optimization of own generation. The former includes Demand Market Participation (DMP), load shedding (voluntary and forced), introduction of time of use tariff and general load shifting. At this juncture it is worth pointing out that we are in constant communication with our large customers and distributors. We promise to inform our clients well in advance of load shedding schedules in the event of planned load shedding. In cases where system stability is under threat as a result of loss of supply we will have no other option than to implement forced load shedding.

The next three years will be critical as regional demand has outstripped the available supply. NamPower appeals to its customers and the public at large to reduce their electricity usage by about 20% to minimize load shedding. With this assistance from our big customers and the implementation of a Demand Market Participation, NamPower will ensure that power interruptions are kept to a minimum.

NamPower has embarked on a number of projects which will execute its plan to increase electricity generating capacity and supply in the country. As early as 1991, NamPower, in partnership with Namibia's Ministry of Mines and Energy, had begun working on implementing the Rural Electrification Programme. The aim of the project is to make electrical power accessible and available to the rural population of the country and to provide opportunities for economic development.

**Eskom** is indispensable in the regional power supply equation. It is responsible for over 80% of generation in the region and it is understandable that supply problems in RSA will spill over to trading partners. In 2006 NamPower has entered into a bilateral power supply agreement with Eskom. This agreement, like many other commercial agreements, guarantees availability of power when the supplier has sufficient capacity.

At the end of 2003, about 80 more villages and settlement areas had already received electrical power at the cost of N\$50 million. These included communities that are situated in the vicinities of Omasati, Okangwati, Koës, Koichab Pan, Tsinsabis, Kalkfeld, Omatako, Karas, Osjikoto, Stampriet Wes and the Maize triangle has now been included in NamPower's electricity grid.

### **Kudu Power Project.**

This project entails the development of the Kudu gas fields, which is situated 170km from Oranjemund in the Atlantic Ocean, and a power station powered by the Kudu gas fields also undergoing construction. The project includes transmission integration to Namibian and South African grids, whereby various transmission lines will be constructed in the process. The project is estimated to cost US\$ 1 billion.

### Popa Falls Project

NamPower has recently completed the first phase of a feasibility study for the project, which involves the construction of a hydropower station on the Okavango River situated in the vicinity of the Popa Falls. The feasibility study for the project is presently still underway.

### Epupa Hydro Project

The construction of a 360MW hydropower station downstream from Epupa Falls, situated along the Kunene River, is still in the process of being planned as the governments of Namibia and Angola are still to agree on the final site for the hydropower plant, since the Kunene River runs through both countries.

### Auas-Khomas Project

NamPower has recently completed this project involving the construction of a 220kV power line running from the Auas sub-station to the Khomas sub-station. The power utility is presently planning to construct a 132kV power line from the Auas Transmission Station east of Windhoek to the Rehoboth Substation just north of Rehoboth.

The purpose of the project is to rectify the problem of power supply constraints that have been experienced in the areas of Aris, Leutwein, Groot Aub, Oamites, Rehoboth, Oanob, Klein Aub and Blumfelde south of Windhoek. The areas are serviced by a fragile 66kV power supply system producing power of a poor quality. Rehoboth has also been seen as a potential central growth area in Namibia in need of an upgrade in the electrical power supply, while there is an increasing demand for electrical power in the area of Sossuvlei and the south-western areas of this region. It is for these reasons that NamPower sees the need to construct the 132kV power line as well as upgrading the remaining 66kV power supply system to meet growing power demand and to ensure a more consistent supply of electrical power in these areas.

## **Renewable Power Projects**

To complement these projects, the government plans to provide electricity in rural areas through a series of off-grid renewable energy ventures. The Namibia Renewable Energy Programme (Namrep) has been functional since 2003 but the Ministry of Mines and Energy intends to increase its funding to promote solar energy in particular to provide domestic heating, electricity and photovoltaic water pumps. Minister of Mines and Energy, Erkki Nghimina unveiled the new strategy to promote the use of solar power in heating water for all state owned organizations in the hopes that the state's electricity bill will be reduced by up to 50%.<sup>11</sup>

Biofuels, the other main area of renewable energy interest, has shown to be another economically and technically viable option. According to government research, the oil from the shrub *jatropha curcas* can be taken from the nuts and processed into motor fuel. The government has set a target of planting 63,000 hectares of *jatropha* by 2013.<sup>12,13</sup>

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<sup>11</sup> Ibid.

<sup>12</sup> Ibid.

<sup>13</sup> Report prepared by Ex-Im Bank staff.

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# Nigeria

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## OVERVIEW

Electric power supply in Nigeria dates back to 1886 when two (2) small generating sets were installed to serve the then Colony of Lagos. By an Act of Parliament in 1951, the Electricity Corporation of Nigeria (ECN) was established, and in 1962, the Niger Dams Authority (NDA) was also established for the development of Hydro Electric Power. However, a merger of the two (2) was made in 1972 to form the National Electric Power Authority (NEPA), which as a result of the Electric Power Sector Reform Act of 2005, was transformed to Power Holding Company of Nigeria (PHCN). The PHCN has been unbundled into a number of successor companies that are in the process of being commercialized and privatised.<sup>14</sup>

Ex-Im Bank is fully available to support financing in Nigeria in the short-, medium-, and long-term for the public and private sectors.

## Problems of the Sector

The Power Sector over the years has been in a deplorable state mainly due to inadequate maintenance of equipment, poor funding and inadequate infrastructural development. For over ten (10) years prior to 1999, the Sector did not witness substantial investments in infrastructure development and development of new generation plants.

The lack of maintenance and replacement of old and damaged equipment led to a wide gap between demand and supply. In 2001 generation went down from the installed capacity of about 5,600MW to an average of about 1,750MW, as compared to a load demand of 6,000MW. At the same time, only nineteen (19) out of the seventy nine (79) installed generating units were in operation. The net implications of the above on the Power Sector included massive load shedding, voltage and control problems, frequent system collapse, public outcry and bad image for the utility and above all, low economic activities due to high cost of self generation.

## KEY SECTOR INDICATORS

Nigeria currently has 14 generating plants, which supply electric energy to the National Grid. Of the 14 generating plants, 3 are hydro and 11 are thermal (gas/steam). The National Grid is made up of 4,889.2km of 330kV line, 6,319.33km of 132kV line, 6,098MVA transformer capacity at 330/132kV and 8,090MVA transformer capacity at 132/33kV.

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<sup>14</sup> Report prepared by the Ministry of Energy, Water Sector of the Government of Nigeria.

## **Generation**

The Total Installed Capacity of the currently generating plants is 7,876 MW (Table II), but the Installed Available Capacity is 4,361.5MW as at December 16, 2007. Seven of the fourteen generation stations are over 20 years old and the average daily power generation is below 2,700MW, which is far below the peak load forecast of 8,900MW for the currently existing infrastructure. As a result the Nation experiences massive load shedding.

The current status of power generation in Nigeria presents the following challenges:

- i. Inadequate generation availability;
- ii. Inadequate and delayed maintenance of facilities;
- iii. Insufficient funding of the power stations;
- iv. Obsolete equipment, tools, safety facilities and operational vehicles;
- v. Inadequate and obsolete communication equipment;
- vi. Lack of exploration to tap all sources of energy from the available resources; and
- vii. Low staff morale.

## **Transmission**

The transmission system in Nigeria does not cover every part of the country. It currently has the capacity to transmit a maximum of about 4,000 MW and it is technically weak thus very sensitive to minor disturbances. In summary the major problems identified are:

- i. It is funded solely by the Federal Government whose resource allocation cannot adequately meet all the requirements;
- ii. It is yet to cover many parts of the country;
- iii. It's current maximum electricity wheeling capacity is 4,000 MW which is awfully below the required national needs;
- iv. Some sections of the grid are outdated with equipment in a State of disrepair;
- v. The existing lines are in a radial configuration with inadequate redundancies as opposed to the required mesh arrangement;
- vi. The Federal Government lack the required funds to regularly expand, update, modernize and maintain the network;
- vii. There is regular vandalization of the lines, associated with low level of surveillance and security on all electrical infrastructure;
- viii. The technologies used generally deliver very poor voltage stability and profiles;
- ix. There is a high prevalence of inadequate working tools and vehicles for operating and maintaining the network;
- x. There is a serious lack of required modern technologies for communication and monitoring;
- xi. The transformers deployed are overloaded in most service areas;
- xii. Inadequate spare-parts for urgent maintenance; and
- xiii. Poor technical staff recruitment, capacity building and training program.

## ***Distribution & Marketing***

In most locations in Nigeria, the distribution network is poor, the voltage profile is poor and the billing is inaccurate. As the department which inter-faces with the public, the need to ensure adequate network coverage and provision of quality power supply in addition to efficient marketing and customer service delivery cannot be over emphasized. In summary some of the major problems identified are:

- i. Weak and Inadequate Network Coverage;
- ii. Overloaded Transformers and bad Feeder Pillars;
- iii. Substandard distribution lines;
- iv. Poor Billing System;
- v. Unwholesome practices by staff and very poor Customer Relations;
- vi. Inadequate logistic facilities such as equipment, tools and working vehicles;
- vii. Poor and obsolete Communication equipment;
- viii. Low staff morale and lack of regular Training; and
- ix. Insufficient funds for maintenance activities.

## **Reforms of the Power Sector**

In order to attract private sector investment and create a sustainable power sector, the Federal Government defined the objectives for power sector reforms as follows:

- Promote competition and facilitate more rapid provision of services throughout the country;
- Create a new and regulatory environment for the sector that establishes a level playing field, encourage private investment and expertise, and meets social goals;
- Restructure and private the National Electric Power Authority; and
- Encourage the successors to NEPA to undertake investment programs.

## **The Reform Act 2005**

The Electric Power Sector Reform (EPSR) Act came into being on the 11th of March, 2005. It provides the legal backing for the reform of the Sector and repealed the National Electric Power Authority (NEPA) Act and the Electricity Act. The EPSR Act provides for the restructuring of NEPA from its vertically integrated structure into 19 unbundled autonomous companies comprising the following:

- 1 Transmission Company;
- 7 Generation Companies and
- 11 Distribution Companies.

The Act further provided for the establishment of the Nigerian Electricity Regulatory Commission (NERC), the Rural Electrification Agency (REA) and the National Electricity Liability Management Company (NELMCO), which is a special purpose entity that shall take over and manage the residual assets and liabilities of the defunct NEPA after privatization of the unbundled companies.

Furthermore, the Act provided for the establishment of a Power Consumer Assistance Fund (POCAF), to subsidize under privileged electricity consumers.

To date the Nigerian Electricity Regulatory Commission (NERC), the Rural Electrification Agency (REA) and the National Electricity Liability Management Company (NELMCO) have all been established. Similarly, the Power Holding Company of Nigeria (PHCN), the successor to NEPA has been unbundled into the following 19 companies:

1. Egbin Generation Company
2. Delta Generation Company
3. Afam Generation Company
4. Sapele Generation Company
5. Kainji Generation Company
6. Jebba Generation Company
7. Shiroro Generation Company
8. Transmission Company of Nigeria
9. Kaduna Electricity Distribution Company
10. Kano Electricity Distribution Company
11. Yola Electricity Distribution Company
12. Ibadan Electricity Distribution Company
13. Eko Electricity Distribution Company
14. Jos Electricity Distribution Company
15. Enugu Electricity Distribution Company
16. Benin Electricity Distribution Company
17. Port Harcourt Electricity Distribution Company
18. Ikeja Electricity Distribution Company
19. Abuja Electricity Distribution Company

### **National Integrated Power Projects**

In addition, to restructuring NEPA Government through the NIPP and PHCN also made attempts to develop the infrastructure in generation, transmission and distribution on a fast track basis. The aim was to improve power supply to consumers. In order to achieve that, the Federal government in collaboration with State Governments embarked on the implementation of new generation, new gas pipelines, new transmission and new distribution networks in 2005, using the excess crude account. The projects were estimated to cost ₦1.23 Trillion (\$10.25 billion) out of which about ₦361 billion (\$3.01 billion) was released. Below are statistics of the expected impact of the NIPP project in the Power Sector:

#### **Generation;**

- Available new capacity resulting from NIPP; 2,744 MW
- Gereg, Omotosho, Papalanto, Alaoji and Delta IV will add 1,882 MW of new capacity

Expected improvement in generation capacity resulting from NIPP 68%

- Available generation capacity, February 2006; 4,006 MW

<b>Transmission;</b>	<b><u>Pre 2000</u></b>	<b><u>2006</u></b>	<b><u>Post NIPP</u></b>	<b><u>% increase</u></b>
• 330/132 kV Trx cap (MVA)	5,300	6,008	11,590	73
• 132/33 kV Trx cap (MVA)	5,700	7,805	11,118	42

• 132 kV line length (km)	5,430	6,227	7,036	13
• 330 kV line length (km)	4,495	4,738	6,932	46

Anticipated average increase in Transmission capacity from NIPP 48%

<b>Distribution;</b>	<b><u>2006</u></b>	<b><u>Post NIPP</u></b>	<b><u>% increase</u></b>
• 33 kV route length (km)	45,252	47,538	5
• 11 kV route length (km)	31,973	36,648	15
• 0.415 kV route length (km)	232,862	245,905	6
• 33/11 kV substation (MVA)	8,149	11,649	43
• 33 & 11/0.415 kV SS (MVA)	11,810	14,878	26
• 33 & 11/0.415 kV SS- Nos.	32,000	84,170	163
• 33 kV/11 kV SS Nos.	1,048	1,311	25

Planned average increase in Distribution capacity from NIPP 26%.

## **INVESTMENT OPPORTUNITIES**

### **Introduction**

Nigeria is a large country in both physical size and population. Endowed with huge natural resources, the country can boast of being the most recognized potential African economic giant *if well managed*. It is this attribute that has remained the driving force, which has given Nigeria's leaders since independence, the confidence to steer the country on the platform of high-level economic development. Notable programmes such as huge investments into Steel development for industrialization to reorient the economy from consumer to producer, large projects for agricultural development to provide food security and export of quality agricultural materials, large solid mineral development projects to diversify the economy, large investments into the development of infrastructure to open-up and modernize the country, programmes favouring foreign investments to attract foreign companies, etc, have been attempted, yet:

- the scale and level of viable economic improvement has remained a challenge;
- unemployment and poverty levels are increasing;
- foreign direct investment has remained selective and skeletal; and
- the high expectations by the citizenry along with their frustration on Government is alarmingly increasing.

Today, the same attribute of being a "potential economic power" has encouraged the present administration to pronounce the 20-2020 vision, through the effective and sincere implementation of the prioritized 7-Point Agenda. But, as always, the attainment of such a vision may remain a mirage if the energy sector, most particularly electricity power supply is not fully developed as required. The Federal Government has already pronounced the sector as a top priority. It therefore goes without saying that Government has extended the hands of partnership, and by implication exposing the ripe opportunities the sector presents to investors and the private sector.

In terms of investment and business, the power sector presents a viable option due to the enabling and conducive environments availed by Government through numerous

initiatives/incentives. Electricity as a product is most sought for by Nigerians, therefore, its demand well overweighs its supply, indicating that it could be the most rewarding business area for investors today. This publication attempts to unveil some of the immediate medium and long terms opportunities for investors into the power-sector in Nigeria.

### **Perspectives**

A number of studies by International Agencies indicated that for Nigeria to be among the top 20 economies in the world, its economy and indeed its infrastructure must grow at an estimated rate of at least 13% per annum. Thus, this growth rate has been adopted in the Vision 2020 document.

To attain the annual growth of 13%, electricity supply is critical. A close look at the top 100 economies of the World revealed that the USA is number 1, Belgium is number 20. South Africa is number 31, while Saudi Arabia is number 32. Nigeria is currently not among the first 80 economies. A close look at the power supply indices in some selected countries (Table I) shows a comparative per capita generation of power supply. The table clearly shows that Nigeria has a per capita generation of about 0.0508KW in 2007, compared to South Africa with 1.0882KW, South Korea with 1.6130KW, India with 0.1397KW and USA with 3.2894KW.

**Table I: Per Capita Generation of Selected Countries**

S/No.	Country	Population	Installed Generation [MW]	Per Capita Generation [KW] as at 2007
1	Kuwait	2,505,559	12,666	5.0552
2	UAE	4,444,011	20,428	4.5969
3	Canada	33,390,141	127,426	3.8163
4	USA	301,139,947	990,567	3.2894
5	Australia	20,434,176	52,645	2.5763
6	Japan	127,433,494	280,716	2.2028
7	France	63,718,187	117,653	1.8465
8	South Korea	49,044,790	79,109	1.613
9	Ukraine	46,299,862	54,225	1.1712
10	South Africa	43,997,828	47,878	1.0882
11	China PRC	1,321,851,888	711,512	0.5383
12	Bangladesh	20,434,176	6,418	0.3141
13	Peru	28,674,757	13,767	0.2818
14	India	1,129,866,154	157,786	0.1397
<b>15</b>	<b>Nigeria</b>	<b>135,031,164</b>	<b>6,862</b>	<b>0.0508</b>

To provide a guideline for energy development, the Energy Commission of Nigeria (ECN) developed the power demand projections for four economic growth scenarios, 7%, 10%, 11.5% and 13% under industrializing conditions. The projections are presented in the Table 2.

**Table 2: Peak Power Demand in MW for the Four Economic Growth Scenarios**

Scenario	2000	2005	2010	2015	2020	2025	2030
Reference Growth (7%)	4,230	5,746	15,730	28,360	50,820	77,450	119,200
High Growth (10%)	4,230	5,746	15,920	30,210	58,180	107,220	192,000
Optimistic Growth(11.5%)	4,230	5,746	16,000	31,240	70,760	137,370	250,000
Optimistic Growth (13%)	4,230	5,746	33,250	64,200	107,600	172,900	297,900

The study also suggested a power mix of Nuclear (2%); Hydro (7%); Renewable sources (10%); Coal (11%) and Natural Gas (70%) for the 10% GDP growth case by 2030. For

the 11.5% growth case, the study suggested a power mix of Nuclear (8%); Hydro (5%); Renewable (10%); Coal (11%) and Natural Gas (65%) by 2030.

**The recommended energy mix for a National Power demand of 30,000MW is natural gas 50%, hydro 20%, coal 25% and renewable sources 5%. This recommendation is in view of the various available energy resources in Nigeria and the need to exploit each of the major resources so as to diversify the energy mix and ensure enhanced energy security.**

Recognizing that the Power Sector is a highly capital intensive sector and Government alone cannot continue to fund its full development. This paper envisages that the Sector shall be substantially deregularized in the Medium Term, such that by the Long Term the private sector shall be fully involved in generation and distribution activities. Particularly under generation, the Federal Government shall avail attractive incentives and promote the:

- Build, Operate and Transfer (BOT) scheme;
- Contractor Finance Scheme; and
- Public Private Partnership Scheme.

The Federal Government shall also provide a number of guarantees and concessions to encourage the private sector to participate in power generation in Nigeria through a number of these Schemes. In addition to providing stable securitization, Power Purchase Agreement (PPA) and the Multi-Year Tariff Order (MYTO) arrangements in Nigeria by the end of March 2008, the Federal Government shall provide further encouragements including providing estimated power needs of the country, information on viable available energy resources, detailed surveys and feasibility studies on the available resources for power generation and guarantees and also provide a robust Transmission network with substantial redundancies. With all the above support from Government, the participation of the private sector in the Medium Term power strategies is therefore expected to generate more power in Nigeria for the general public.

It is important to note that Nigeria currently generates less than 3,000MW of its estimated 10,000MW demand. It is expected that with the meaningful participation of the private sector, Nigeria can generate 10,000MW by 2011 and an additional 100,000MW by 2020.

If in Nigeria, it is assumed that \$2.0 million will be required to generate, transmit and distribute 1MW, then to generate, transmit and distribute 10,000MW, a total sum of ~~N~~2.4 trillion (\$20.0 billion) will be required. For the 100,000MW, the sum of ~~N~~24.0 trillion (\$200.0 billion) will be needed. The financial requirement to achieve the above targets is phenomenal and may not be possible for the Government alone to fund. Hence, the need for inviting the private sector to meaningfully participate cannot be overemphasized.

In this paper, some viable projects that may suit the immediate participation of the Private sector are highlighted. These include:

- (i) The National Integrated Power Projects (NIPP) projects designed to contribute additional 5,212MW to the existing generating capacity in the country and other gas based power projects;

- (ii) Two Hydro projects that will provide up to 5,000MW of electricity and other viable hydro projects;
- (iii) Coal projects that may provide up to 30,000MW of electricity in Nigeria; and
- (iv) Some initiatives and projects aimed at tapping the renewable energy resources.

The paper also provides some briefs on the investment required to modify the Transmission Grid from its current radial state to a looped-grid and expanding the wheeling capacity of the grid to 15,000MW and 30,000MW respectively.

## **GAS BASED POWER PROJECTS**

### **Completion of the NIPP projects**

The NIPP is a programme aimed at developing the infrastructure in generation, transmission and distribution on a fast track basis. The aim was to improve power supply to consumers. In order to achieve that, the Federal Government in collaboration with State Governments embarked on the implementation of new generation, new gas pipelines, new transmission and new distribution networks in 2005, using the excess crude account. The projects were estimated to cost ₦1.23 Trillion out of which about ₦361 billion was released.

The NIPP generation projects consist of:

- (i) Omoku Thermal Power Station, Rivers State with 230 MW capacity;
- (ii) Gbarain/Ube Thermal Power Station, Bayelsa State with 225 MW capacity;
- (iii) Sapele Thermal Power Station, Delta State with 451 MW capacity;
- (iv) Ihovbor Thermal Power Station, Edo State with 451 MW capacity;
- (v) Egbema Thermal Power Station, Imo State with 338 MW capacity;
- (vi) Calabar Thermal Power Station, Cross River State with 561 MW capacity.
- (vii) Geregu Thermal Power Station, Kogi State phase II 434MW capacity;
- (viii) Omotosho Thermal Power Station, Ondo State phase II 754MW capacity;
- (ix) Papalanto Thermal Power Station, Ogun State phase II 754MW capacity; and
- (x) Alaoji Thermal Power Station, Abia State with phase I 318 MW capacity and phase II 696MW capacity.

***Sub-total capacity = 5,212MW.***

Below are statistics of the impact the NIPP project is expected to make on the Power Sector:

### **Generation:**

- Available new capacity resulting from NIPP is 2,744 MW
- Geregu, Omotosho, Papalanto, Alaoji and Delta IV generation plants will add 1,882 MW of new capacity
- Expected improvement in generation capacity resulting from NIPP is 68%
- Available generation capacity, February 2006 is 4,006 MW.

## Transmission:

<b>Transmission</b>	<b><u>Pre 2000</u></b>	<b><u>2006</u></b>	<b><u>Post NIPP</u></b>	<b><u>% increase</u></b>
330/132 kV Trx cap (MVA)	5,300	6,008	11,590	73
132/33 kV Trx cap (MVA)	5,700	7,805	11,118	42
132 kV line length (km)	5,430	6,227	7,036	13
330 kV line length (km)	4,495	4,738	6,932	46

- Anticipated average increase in Transmission capacity from NIPP is 48%

## Distribution:

<i>Distribution</i>	<b><u>2006</u></b>	<b><u>Post NIPP</u></b>	<b><u>% increase</u></b>
33 kV route length (km)	45,252	47,538	5
11 kV route length (km)	31,973	36,648	15
0.415 kV route length (km)	232,862	245,905	6
33/11 kV substation (MVA)	8,149	11,649	43
33 & 11/0.415 kV SS (MVA)	11,810	14,878	26
33 & 11/0.415 kV SS- Nos.	32,000	84,170	163
33 kV/11 kV SS Nos.	1,048	1,311	25

- Planned average increase in Distribution capacity from NIPP is 26%.

It is important to note that the NIPP were started in 2005. The source of funding was the Excess Crude Account, which has now stopped. The structures put in place for the execution of the NIPP include the NIPP Technical Committee and a Company that shall manage the entire NIPP investment called the **Niger Delta Power Holding Company, NDPHC**, which has already been registered with the corporate Affairs Commission. Furthermore, the feasibility studies of the projects were produced by Government and for full Government funding.

For meaningful involvement of the private sector, the key challenges may include the following:

- a. The urgent need to appoint independent consultants to audit the projects technically and financially (that is already being undertaken by an international firm); and
- b. The urgent need to comprehensively update the feasibility studies such that the time lost, investors involved and other important matters can be reflected in the feasibility reports.

The above reports will present clearer options for the private sector to invest in the NIPP programme. The Federal Government and willing private sector should therefore set in motion the necessary actions to develop these reports.

## Other Gas Based Projects

Nigeria is blessed with abundant gas reserves with proven estimated value of 181 trillion cubic feet. With that available gas reserve many other gas based power plants, apart from the NIPP projects, are also very viable. In view of the large reserve of gas in Nigeria, studies by the Energy Commission of Nigeria, concluded that, gas based power

generation shall, for along time, dominate the most efficient and viable energy mix in Nigeria. It is therefore very important to invite the private sector in to this viable sub sector.

## **Hydro Power**

Nigeria currently has three Hydro Power Plants all in Niger State. These are:

- The Kainji Hydro Plant;
- The Jebba Hydro Plant; and
- The Shiroro Hydro Plant.

The country has many other potential hydro plant sites, which are yet to be exploited. Two of such sites are briefly presented below:

### Mambilla Hydro Project

Diyam Consultants carried out the feasibility study for the Mambilla Hydroelectric Power Project in 1982/5, in association with Bennie & Partners of London. However, the detailed design specifications could not be concluded as geotechnical investigation could not be carried out due to lack of access road. The study provided for a 3,960MW scheme from a system of 3 dams and reservoirs at Gembu, Sumsum and Nghu. An underground power plant is to be situated at Abong.

Several initiatives were promoted by Government with a view to encouraging the private sector to implement the project on Build, Operate and Transfer (BOT) basis but were futile. Subsequently, Lahmeyer International GmGB, an international energy consulting firm was appointed in 2005 to produce a draft bankable feasibility study for a base load power plant of about 2,600MW. The 4-volume report covered Project Design, Construction Planning, Cost Analysis and Preliminary Environmental and Social Analysis. As a result of the aforementioned investor apathy, the implementation strategy was changed from Infrastructure Concession to Conventional Contract with the following partially overlapping phases:

- Lot I: Civil and Hydro-mechanical Works
- Lot II: Electromechanical Works
- Lot III: Transmission Lines and Sub-Stations
- Lot IV: Development of Irrigation and Tourism.

The following preliminary studies will be undertaken by the Federal Government:

- Geotechnical Investigation and Surveys
- Ortho Photo Mapping
- Environmental and Social Impact Studies, including Resettlement.

The Consultant's estimate of executing Lots I-III above was about US\$3.28 billion with a hydro plant capacity of 2,600MW.

In view of the national importance of this project, it is highly recommended that the private sector should take it over.

## Zungeru Hydro Project

The Zungeru Hydro Power project designed to provide additional 950MW of electric power to the national grid is to be located on the Kaduna River, about 77km downstream of Shiroro dam and 43km northwest of Minna.

The compelling reason for the project today is the urgent need to improve the generation capacity of the nation as well as diversify the technology-mix of the generation facilities thereby enhancing energy security. The project, with its entire catchment area within Nigeria, has the distinct advantage that it is not subject to the adverse effects of action upstream by other countries.

In August 1991, NEPA engaged the services of a consortium of Consultants led by Hidroservice Engenharia with the following scope:

- Review the feasibility study carried out earlier;
- Preparation of final design and specifications;
- Preparation of Tender Documents; and
- Evaluation of Tenders.

Tenders received and adjudicated in 1992 put the cost of the project at US\$1.5 billion and a plant capacity of 950MW but the project could not take off due to paucity of funds.

This is another viable project that should be taken over by the private sector.

### Other Viable Hydro Projects.

These include: Medium size hydro plants down stream of Jebba before Lokoja on River Niger; Medium size hydro plants down stream of Zungeru on River Kaduna; Lokoja (1950MW); Onitsha (750MW); Makurdi (600MW); Yola (350MW); and Gembu (130MW).

The private sector is expected to be provided with all necessary support by the Federal Government in order to ensure the implementation of all the above projects.

## Coal Power

Coal is a major source of energy, particularly power. Based on the data released by the World Coal Institute, in 2005, coal provided for 40% of the total World electricity generation. In Nigeria currently, none of the existing plants, uses coal as its source of energy. Also none of the 24 newly licensed companies by the Nigerian electricity Regulatory Commission, NERC, plans to use coal as its primary source of energy.

Nigeria is blessed with abundant reserves of coal deposits. The sub-bituminous coal is the major type of coal found in Nigeria. The coal reserves in Nigeria are estimated to be in excess of 2.75 billion tones.

The proven coal deposits in Nigeria estimated at about 6.4 million tones, are found in the following States: Adamawa, Anambra, Bauchi, Benue, Cross River, Edo, Enugu, Gombe, Imo, Kogi, Kwara, Nasarawa, Ondo and Plateau. The table below, indicates some potential coal mines sites with estimated reserves in Nigeria.

In order to ensure the use of coal for power generation in Nigeria, the key strategies to be adopted are as follows:

- a. Developing adequate infrastructure for handling and transporting coal within and outside the country;
- b. Intensifying the drive for coal exploration and production activities;
- c. Providing adequate incentives to indigenous and foreign investors in coal exploration and production;
- d. Production of a comprehensive feasibility studies on the establishment of at least 5 plants of 3,000MW each at different locations in Nigeria; and
- e. Promoting the realization of the projects in (iv) above.

### Existing Potential Coal Mines Sites with Reserves in Nigeria

S/No.	Mine Location	State	Type of Coal	Estimated Reserve (Mil. Ton)	Proven Reserve (Mil. Ton)
1.	Okpara Mine	Enugu	Sub-bituminous	100	24
2.	Onyeama Mine	Enugu	Sub-bituminous	150	40
3.	Ihioma	Imo	Lignite	40	NA
4.	Ogboyoga	Kogi	Sub-bituminous	427	107
5.	Ogwashi Azugba Obomkpa	Delta	Lignite	250	63
6.	Ezimo	Enugu	Sub-bituminous	156	56
7.	Inyi	Enugu	Sub-bituminous	50	20
8.	Lafia/Obi	Nasarawa	Bituminous (Cokable)	156	21.42
9.	Oba/Nnewi	Anambra	Lignite	30	NA
10.	Afikpo/Okigwe	Ebonyi	Sub-bituminous	50	NA
11.	Amasiodo	Enugu	Bituminous	1,000	NA
12.	Okaba	Kogi	Sub-bituminous	75	57
13.	Owukpa	Benue	Sub-bituminous	75	57
14.	Ogugu/Awgu	Enugu	Sub-bituminous	NA	NA
15.	Afuji	Edo	Sub-bituminous	NA	NA
16.	Ule	Ondo	Sub-bituminous	NA	NA

17.	Doho	Gombe	Sub-bituminous	NA	NA
18.	Kurumu	Gombe	Sub-bituminous	NA	NA
19.	Lamja	Adamawa	Sub-bituminous	NA	NA
20.	Garin Maigungu	Bauchi	Sub-bituminous	NA	NA
21.	Gindi Akwati	Plateau	Sub-bituminous	NA	NA
22.	Jamato Koji	Kwara	Sub-bituminous	NA	NA

**Source:** [www.methanetomarket.org](http://www.methanetomarket.org).

### ***Renewable Energy Sources***

The wide variety of other readily available renewable sources of energy in Nigeria include:

- Wind Energy;
- Solar Energy;
- Bio-fuels sources; and
- Tidal sources.

In the immediate term, and in view of the need to reach rural areas where the energy demand may not be in quantities that favour high investment, options on Wind, Solar, and Bio-fuels may be economically viable. Already, a comprehensive study with wind maps produced showing areas where wind energy may be economically tapped has been concluded. Also, numerous initiatives are being encouraged for the production of biofuels (bio-ethanol and bio-diesel) from biological materials nationwide. Results of studies and pilot projects are available for reference and further studies.

Wind as a source of power is viable in Nigeria. A study conducted by the Federal Ministry of Science and Technology in 2005 confirmed that some areas in Sokoto, Jos, Pakshin, Gembu, Maiduguri, Kano, Lagos and Enugu have relatively all season strong wind speeds suitable for energy generation using wind turbines and wind farms. Annex II presents the wind map of Nigeria as revealed by the study in 2005.

Studies by the Energy Commission of Nigeria, ECN, has shown that Nigeria has the potential of generating 15,000MW of power through hydro and has: biomass crop residue of 83 million tonnes/annum; biomass animal waste of 61 million tonnes/annum; biomass fuel wood of forest land of 13.071 million hectares of land; solar radiation of 3.5 to 7.0 kWh/sqm-day; and annual average wind speed of 2.0 to 4.0 m/s at 10.0m.

The private sector is equally invited to invest in all these viable areas.

### ***Transmission***

The transmission system in Nigeria does not cover every part of the country. It currently has the capacity to transmit a maximum of about 4,000 MW and it is technically weak thus very sensitive to major disturbances. In summary the major problems identified are:

- i. It is funded solely by the Federal Government whose resource allocation cannot adequately meet all the requirements;
- ii. It is yet to cover many parts of the country;

- iii. It's current maximum electricity wheeling capacity is 4,000 MW which is awfully below the required national needs;
- iv. Some sections of the grid are outdated with equipment in a State of disrepair;
- v. The existing lines are in a radial configuration with inadequate redundancies as opposed to the required mesh arrangement;
- vi. The Federal Government lack the required funds to regularly expand, update, modernize and maintain the network;
- vii. There is regular vandalization of the lines, associated with low level of surveillance and security on all electrical infrastructure;
- viii. The technologies used generally deliver very poor voltage stability and profiles;
- ix. There is a high prevalence of inadequate working tools and vehicles for operating and maintaining the network;
- x. There is a serious lack of required modern technologies for communication and monitoring;
- xi. The transformers deployed are overloaded in most service areas;
- xii. Inadequate spare-parts for urgent maintenance; and
- xiii. Poor technical staff recruitment, capacity building and training programme.

Government being the sole owner of the Transmission Grid, as provided in the Electric Power Sector Reform, (EPSR) Act of 2005, must be proactive to provide the infrastructure needed to wheel any power load generated by the private sector. Some studies by the Ministry of Energy (Power Sector) has shown that:

(i) To expand the current grid and ensure wheeling of at least 6,000MW by March 2009, the sum of ~~N~~50.913 billion is required. The sum of ~~N~~47.412 billion has been proposed in the 2008 budget. An additional investment balance of ~~N~~3.501 billion is still required;

(ii) To expand the above grid to wheel 15,000MW by end of 2011, an additional investment of ~~N~~408.813 billion is required. In order to successfully, achieve that, the projects must commence in 2008. Provision has not yet been made for that; and

(iii) To expand the above grid to wheel 30,000MW by 2015 an additional investment of ~~N~~345.800 billion is required.

In order to ensure that all the power generated through the participation of the private sector are effectively and efficiently wheeled, Government shall ensure that the above investments on Grid expansion are realized.

### **Conclusion**

Nigeria's current estimated power demand using a low growth rate of 7% is 10,000MW while based on an optimistic growth rate of 13% is about 22,500MW. The current generating capacity in the country is just 3,000MW. In order to meet the current demand a lot need to be done.

It is only through the participation of the private sector that such a target of meeting the national power national demand can be met. The power sector is currently quite untapped and very commercially viable. It is in view of that prospect that Government is willing to partner with the private sector so that more power can be generated, transmitted and distributed in Nigeria.

However, Government still has a lot to do. Government needs to fully deregulate the sector. That is the only way the private sector can be willing to participate in the development of the sector.

The Ministry of Energy, as an important part of Government is expected to drive the deregulation of the sector and also drive the mobilization of the private sector.

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# Senegal

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## Overview

Senegal does not have any indigenous energy sources – except for some natural gas production in Gadiaga, located south of Dakar -, and therefore has to rely on oil imports as a source of fuel for electricity generation to satisfy its strong electricity demand. The yearly growth in demand averages 9 percent in 2005-2009, compared to 8 percent in 1999-2004. Demand will continue to grow spurred by a growth in GDP and by the government's desire to expand electrical coverage throughout the country. The countrywide household electrification rate reached 33 percent in 2007 – 77 percent in urban areas and 16 percent in rural areas, and is expected to continue to rise. The rural electrification rate will reach 50 percent by 2012, which means that 3.8 million of Senegalese or 365 000 households in rural areas will have access to electricity compared to the current 102 000 households.

Ex-Im Bank is fully available to support financing in Senegal in the short-, medium-term, and for the public and private sectors and long-term for the public sector.

## Major players

Nearly, all the country's electricity supply is generated thermally. Senelec, the state-owned utility, is the major player with an installed capacity of 700 MW. Senelec accounts for 72.5 percent of electricity's production while private sector investors licensed as Independent Power Producers (IPPs) have currently a combined capacity of 113.5 MW. They were first allowed in the industry following the 1998 electricity reform, which called for a public/private partnership in the sector. In April 2003, the Government of Senegal published an information notice outlining further liberalization of the power sector using public/private partnerships. Production of electricity has become fully private and competitive with Senelec as the sole buyer, while transmission and distribution remain a Senelec's monopoly. Senelec will limit its generation ownership to currently owned plants. Under the new BOT act passed by Parliament in February 2004, the government of Senegal authorizes public-private partnership via Build-Own-Operate infrastructure projects. All future projects in Senelec's pipeline need to follow the BOT scheme.

The other major players in the sector include: The Electricity Regulatory Commission (CRSE) established in 1998. The Commission regulates the electricity and power sector, including the approval of electricity tariffs and the Senegalese Agency for Rural Electrification – ASER - created in 1999. ASER has the mission to increase the rural electrification rate from 8 percent in 2001 to 62 percent in 2022. In 2006, the rate reached 16 percent.

## Major Developments

The government will vie with market forces as the dominant influence in the sector for many years to come. General Electric was the first Build-Own-Operate IPP to be installed in Senegal in October 2000. The project is a 56 MW combined cycle oil-fired power station. GE is the majority shareholder – 60 percent and the operator of the facility. Edison SPA owns 30 percent and the IFC the remaining 10 percent. In January 2008, President Wade inaugurated the Kounoune power plant, financed by the

International Finance Corporation (IFC) with a partial guarantee of the World Bank. The inauguration of Kounoune is a harbinger of more power-generating investments designed to alleviate the power crisis experienced in Senegal, and in particular Dakar.

Senelec has outlined a vast investment program in the power sector for 2008-2015 at an estimated cost of USD 1.16 billion, for the construction of new power stations, transportation, a distribution network, and for civil engineering works

Senelec has mapped out an emergency program for 2007-2012, which dovetails into the bigger investment plan. This emergency plan, estimated at USD 389 million, addresses Senelec's current production gap and focuses on the construction and rehabilitation of 5 new BOO power plants with funding from the World Bank, West African Bank for Development, ECOWAs, and the Islamic Bank of Development.

Stymied in its electricity-generation development plans by the high cost of imported fuel, Senelec is turning to coal and hydropower to meet expected growth in demand. Coal and Hydroelectric sources are seen as the most attractive options in the effort to diversify away from diesel-powered plants.

## **Other Projects**

### Regional Hydropower Development

The Manantali dam and its 1,500-kilometer transmission grid supplies 60 MW to Senegal is the first source of hydropower. Manantali with an installed capacity of 200 MW is a joint development initiative between Mali, Mauritania and Senegal. They share respectively 53, 15 and 32 percent of the electricity generated by the dam. The greatest potential for expansion of hydropower production is on the Gambia, Kayanga-Geba and Koliba-Corubal river basins. The Gambia River Basin Development Organization – OMVG – has the overall responsibility for the implementation of the major power infrastructure project in OMVG's four member states, the Gambia, Guinea, Guinea-Bissau and Senegal.

The OMVG energy project consists in hydro-electricity production, transmission and interconnection of power grids in the four member countries. This pooling of hydropower from the region's largely unexploited energy potential is set to help end the persistent problems of power shortages and the heavy dependence on imported petroleum products for the production of electricity in the four countries. The project will also promote electrical power trade between the countries; the reliability of energy supply and the reduction in production costs and prices. African Development Bank studies have identified all socioeconomic and environmental impacts and cost of the project is estimated at USD 1.12 billion. The project will consist of construction of two hydroelectric power-generating stations and production represented 22.5% of forecasted demand. OMVG has favored a privately operated scheme managed by private entities. Huge opportunities in consulting work, technical assistance and engineering works remain for U.S. companies, notwithstanding the supply of electricity equipment such as the turbines.

### Coal-fired Plants

Senegal's growing reliance on high and volatile crude oil prices as a power source has prompted Senelec, the national utility, to turn to coal-burning power plants considered less costly. In January 2008, Senelec signed a 25-year power purchase agreement

with the Swedish operator Nykomb Synergetics for a 125 MW coal-fired plant to be installed in Sendou, located in the outskirts of Dakar, the capital city. The Sendou plant will produce 925 GWh starting in 2010 and will cost CFA 118 billion. The Sendou coal plant will require port infrastructure for the handling of coal imports, mainly from South Africa, but would also burn domestic peat deposits. The government of China has agreed to finance the construction of a 250 MW coal-burning power plant. The bid is yet to be published.

However, with opposition to coal plants rising everywhere in the world motivated mainly by broad fears about coal emissions linked to global warming, only time will tell if coal is a viable alternative to conventional sources of power. As a result, thorough feasibility studies need to be undertaken before Senegal embarks into this new power source. There might be an opportunity for the U.S. Trade Development Study to fund a feasibility study.

#### Biofuel and Ethanol Plants

President Abdoulaye Wade, a long-time advocate of cheaper power sources has been a strong supporter of biofuel and ethanol production. As a result, Senegal is exploring all possibilities to become a major biofuel supplier. There is serious interest from U.S. companies in developing biofuel capacity and integrated biofuel projects in Senegal. For instance, a U.S. company is considering a very large investment in ethanol production and would like assurances for long-term leases on agriculture land for expanding the country's sugarcane production. Another U.S. company is discussing with a range of Senegalese officials a possible investment in jatropha plantations for the production of biodiesel, with the possibility of building a biodiesel IPP power plant. Private ventures for the construction of biodiesel plants are welcomed. Senelec is interested in funding the feasibility of a 60 MW biodiesel plant

#### Renewable Energy

In addition to biofuels, the government is pursuing other renewable energy schemes, including small-scale, decentralized photovoltaic arrays at the village level. The government has announced plans for a 7.3 MW solar power plant in the Casamance region. Previously, President Wade proposed a long-term project to bring nuclear power to Senegal and the country recently joined the Vienna-based Global Nuclear Energy Partnership. There have also been recent news reports of companies interested in pursuing wind turbine installations in Senegal.

#### Distribution and Transmission

Investment in the transmission and distribution system has always been constrained by inadequate funding resulting in big system losses in the national grid. To redress the situation, Senelec has plans to invest CFA 175 billion for 2008-2015 to upgrade the transportation and distribution networks. Various bilateral lenders – Iran, China – are already involved in the construction of high voltage transmission lines for 24 billion CFA. A number of transmission lines will be built under the OMVG hydroelectric project whereby the electrical networks of the four member countries will be interconnected by 1677 kilometers of a 225 kilovolts power transmission line.

#### Rural Electrification

Following the 1998 institutional reforms in the energy sector, Senegal has created an autonomous agency responsible for rural electrification – ASER – with the aim of increasing the rural electrification rate to 62 percent in 2022. Senegal has an innovative rural electrification program favoring a Public Private Partnership whereby the government grants subsidies and private operators participate in the funding of the rural electrification project. Rural electrification is a priority for the World Bank energy portfolio in West Africa, in conjunction with KFW (the German Development Agency) and The African Development Bank. ASER has subdivided the territory in eighteen rural concessions, and the concessionaires will be responsible for providing power to rural communities as well as billing and revenue collection.

### **Privatization of Senelec**

Privatization continues to be the ultimate goal of the government of Senegal and the donor community, but a relaunch will be cautiously handled given two prior failed attempts in 1999 and 2001.<sup>15</sup>

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<sup>15</sup> Report prepared by the U.S. Mission in Dakar, Senegal.

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# South Africa

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## Overview

While the cost of electricity in South Africa is among the world's lowest, the country's strong economic growth, rapid industrialization and a mass electrification program led to demand for power outstripping supply in 2008. The Government of South Africa has declared that of the new capacity to be built, Eskom will target approximately 70% with the balance from independent power producers.

As a result, state energy company Eskom has embarked on a massive program to upgrade and expand the country's electricity infrastructure. These plans include spending a projected U.S. \$42 billion over five years to fund a new generation of power stations, with the first due to come on stream in 2013. Eskom has started work on two new coal-fired power stations, and is considering bids from two overseas companies to build a new conventional nuclear power station.

Eskom also plans to reopen three power stations that were mothballed in the 1990s, build two open-cycle gas turbines that will produce power by the end of 2009, and complete a hydro scheme in the Drakensberg in KwaZulu-Natal.<sup>16</sup>

Ex-Im Bank is fully available to support financing in South Africa in the short-, medium-term, and long-term for the public and private sectors.

## Major Players

Eskom Holdings is a vertically integrated South African utility that generates transports and distributes electricity to approximately 95% of the country's electricity and 60% of the total electricity consumed on the African continent. Compared with other international utilities, Eskom is eleventh in terms of generating capacity and ninth in terms of sales, and boasting the world's largest dry-cooling power station.

## PROJECTS

### Ankerlig Open Cycle Gas Turbine Station

**Location:** Atlantis Industrial area, north of Cape Town

This station has been in full commercial operation since 25 June 2007— four units rated at 148 MW each are now operated by Eskom's Generation Division. The formal opening of both Ankerlig and Gourikwa power stations took place on 1 October 2007, at Ankerlig power station. The total output for both OCGT stations is 1 036MW – 592 MW at Ankerlig and 444 MW at Gourikwa.

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<sup>16</sup> [http://www.southafrica.info/doing\\_business/economy/infrastructure/energy.htm](http://www.southafrica.info/doing_business/economy/infrastructure/energy.htm)

The building of five additional units at Ankerlig of 150 MW each started on 8 August 2007. Bush clearing has been completed.

The team has completed the compaction of the high-voltage yard terrace and stabilization. Construction of the HV yard bases has now commenced and the HV yard control room foundation is complete. Piling on the key foundations has also started.

#### Gourikwa Open Cycle Gas Turbine Station

**Location:** PetroSA area, west of Mossel Bay

The first sod was turned on 24 January 2006, and the station has been in full commercial operation since 8 June 2007 – three units rated at 148 MW each are now operated by Eskom's Generation Division.

The second phase involves building two more 150 MW Units. Earthworks started on 24 September 2007.

The ground and terrace work for the high-voltage yard, terrace level and drainage has started.

#### Medupi Power Station

**Location:** To the west of Lephalale, Limpopo Province

This is a coal fired power plant project comprising of 6 units rated in total at 4 788MW installed capacity. The first unit should be commissioned by the first quarter of 2011 and the last in 2015.

The terrace preparation work by Roshcon started in May 2007. The boiler contract is in the last stages of negotiation. The bush clearing is nearing completion.

The Medupi Project achieved 250 000 man hours without a time lost at the end of September 2007.

#### Ingula Pumped Storage Scheme

**Location:** 23km northeast of Van Reenen, within the Little Drakensberg mountain range on the border between the Free State and KwaZulu-Natal.

Ingula is a pumped storage scheme with a planned output of 4 x 338MW. The station will comprise two dams - one at the top and the other at the bottom of the escarpment - underground waterways, an underground powerhouse complex, access tunnels and access roads.

The station is planned to be fully operational by the end of 2012.

Excavation on the construction access tunnel has advanced to 26 metres. Bulk blasting of the open cut of the Main Access Tunnel is complete and tunnelling is to commence. The erection of the aggregate crushing plant should be completed by mid November. Access roads to the site offices and upper dam are also underway, and close to completion.

Tenders for the hydro mechanical generating plant and main underground civil works have been submitted and tender evaluation is in progress.

#### *RETURN TO SERVICE PROJECT*

##### Camden Power Station

**Location:** Near Ermelo, in Mpumalanga

Camden Power Station is the first of Eskom's three mothballed coal-fired power stations to be returned to service.

The station will add 1 552MW to the Eskom system. At Camden there are eight units rated in total 1 552 MW (2 x 200MW and 5 x 195MW). Unit 6 was the first unit to be commissioned in July 2005. The last unit (unit 1) is scheduled for commissioning by the first quarter of 2008.

Units 4, 5, 6, 7 and 8 are in commercial operation. Unit 3 was commissioned and connected to the grid on 25 September 2007. Completion of Camden is still targeted for the first quarter of 2008.

##### Grootvlei Power Station

**Location:** Near Balfour in Mpumalanga

Grootvlei Power Station is another of Eskom's three coal-fired, mothballed power stations to be returned to service. The station was built in the late 1960s and was shut down in 1990 and then mothballed. Grootvlei has six boiler-and-turbine sets rated at 200 MW each. At a total estimated refurbishment cost of \$0.71billion, that's just \$0.57million per megawatt – far cheaper than building new capacity.

The first Unit is to be commissioned by end November 2007. The last Unit is scheduled to be in commercial operation by the end of 2009.

From a technical perspective, this project is far from easy. The coal mines that fed the plant by conveyor are worked out and flooded. To use local coal would mean digging and developing new mines from scratch – a long and costly process. It's more effective to bring in coal by road from Witbank or Vereeniging, at least until a better option is found.

The boilers are old and environmentally inefficient – they produce comparatively more emissions than newer machines. So the fuel burners are being replaced with 'low-NOx' burners, specially designed to reduce the nitrous oxides in the smokestack plume.

##### Komati Power Station

**Location:** Between Middelburg and Bethal in Mpumalanga

The total station capacity is 955 MW (4 x 120MW and 5 x 95MW). The first unit (Unit 9) of this coal-fired station is planned to be commissioned by the last quarter of 2008. The last unit is scheduled to be in commercial operation by the last quarter of 2011.

## **TRANSMISSION PROJECTS**

### Cape Strengthening Western Grid Project:

The line stringing is complete. Outstanding work is the installation of anti-climbing devices. Commissioning was done from 30 September to 5 October 2007. Foundations are complete. All 59 steel lattice towers have been built, 127 monopole towers erected and 56 km of line strung and 51 km of line has been regulated.

### Platinum Basin:

Expansions in the platinum basin include the development of a new transmission line and three new substations, namely Dinaledi (Brits), Leseding (Steelpoort) and Marang (Rustenburg) in 2006.

The first phase of the scheme is complete but a portion of the Apollo/Dinaledi 400kV line is incomplete due to a servitude that needs to be obtained for the 7km section parallel to the Spoornet railway lines. The expected completion date is the first quarter of 2008.

The scheme is complete except for the Apollo/Dinaledi 400 kV line where the servitude for the 7km section parallel to the Spoornet railway lines and two railway crossings still has to be done.

### South Strengthening:

This involved the construction of a new 400 kV line (408 km) and substation upgrade. The line route spans from Beta substation in the Free State to Delphi substation in the Eastern Cape. The full 408 km lines have been strung and commissioned on 5 August 2007.

### 765kV Zeus to Omega:

This project involves the construction of a 765kV transmission power line from Zeus substation in Mpumalanga down to Omega substation, near Koeberg power station - approximately 1 450 km. The target date for completion is in 2010.

On the Mercury Perseus line, bush clearing and pegging is in progress, with first foundations cast. Tower erection has commenced. The foundations are ahead of schedule. Eight appeals have been received on the Mercury-Zeus record of decision. This will delay the awarding of the contract.

Civil work is progressing well on the Mercury and Perseus substations

## **OTHER PROJECTS**

### Majuba Rail Project

The Majuba Rail Project entails building a 68 km railway line between Ermelo and Volksrust to transport coal to the Majuba Power Station. The completion of this project

will result in a significant reduction in the number of trucks transporting coal by road to Majuba.

Project completion was targeted for August 2009, but several challenges, related to access, permits, servitude agreements and licenses, are likely to delay the project completion.

#### Upgrade Of Gariep Hydroelectric Scheme

**Location:** 300 metres downstream of the Gariep Dam wall on the banks of the Orange River, near Norvalspont in the Northern Cape.

In terms of the technical plan, the Gariep team planned to conduct generator refurbishments as part of their normal maintenance. They then embarked on a feasibility study to identify the requirements of a complete unit capacity upgrade. The result is that 80GWh additional capacity could be available through this initiative. This will be taken to the Eskom Board for approval in November 2007.

#### Arnot Capacity Increase

**Location:** Approximately 50km east of Middelburg in Mpumalanga.

Arnot, one of South Africa's oldest power stations, is undergoing extensive refurbishment in order to meet increasing demand for power in South Africa.

The aim is to increase the capacity of Arnot by 300MW. A capacity increase of 100 MW has been achieved since April 2006. The remaining 200 MW is to be commissioned between December 2007 and the end of 2010.

#### Project Bravo

This is a new coal fired power station project located to the West of the R545 between the N4 and N12 freeways near the existing Kendal Power Station. It comprises of six units rated at approximately 4800 MW installed capacity. The first unit is planned for commercial operation in 2012 with the last unit in operation by 2015/2016.

The Department of Environmental Affairs & Tourism issued a positive Record of Decision on 5 June 2007 and two appeals were received. These two appeals are now being addressed. It is anticipated that terracing work would begin by May 2008.

#### Wind Energy Facility

**Location:** On the West Coast north of the Olifants River mouth near the town of Koekenaap, east of Vredendal.

The wind energy facility is proposed to accommodate 50 turbines, each 2 MW, for a total output of 100 MW. The turbines would be positioned over an area of approximately 25km<sup>2</sup>. The environmental authorisation is anticipated for March 2008. Eskom is also currently busy with the land negotiations. Subject to the necessary approvals being obtained, the plant could be operational late 2009 / early 2010.

### *Capacity Expansion Funding*

According to Eskom, its \$21.4 billion capacity expansion programs will be funded largely from operational cash flows, commercial instruments and export credit agreements. Internally generated funds is expected to meet up to 50% of the CAPEX spend.

The primary sources of external financing will include:

#### **Local Market**

- Eskom Long Tenor Bonds;
- Eskom Commercial Paper for short term bridging; and
- Possibly Structured Financing.

#### International Market

- Export Credit Agency Financing;
- Soft Loan Agencies;
- Foreign Bonds; and
- Foreign Bank Credit.<sup>17</sup>

#### **Key Contacts:**

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<sup>17</sup> Report prepared by the U.S. Mission in Capetown, South Africa.

# Tanzania

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## Overview

Tanzania's energy sector remains underdeveloped, particularly the petroleum, gas and electricity sub-sectors. Although endowed with diverse energy sources including natural gas, hydropower, coal, wind power, solar power and renewable energies, Tanzania's energy sources are largely under explored and untapped. Tanzania has a per capita electricity consumption of between 85 and 90 KWh per annum. Only 10 percent of the population has access to electricity and the consumption is growing at the rate of 11 – 13 percent annually. Ninety percent of Tanzanians are still depending on biomass energy sources such as charcoal and firewood both of which are not environmentally friendly. The Government of Tanzania is continuing to promote renewable and alternative energy sources so as to make energy sources more accessible to the citizens. Also, the Government is seeking appropriate technologies to stimulate rapid economic growth.

The main sources of energy in Tanzania include:

- Imported petroleum (consumption estimated at between 1.8 and 2.0 million metric tons);
- Natural gas from the Songo Songo processing plant (450 megawatts);
- Hydropower from TANESCO plants in three main stations and hydro-based electricity from isolated stations (261 megawatts)
- Thermal electricity diesel turbines at Independent Power Tanzania Limited (IPTL) in Dar es Salaam (100 megawatts)
- Coal at Kiwira coal mines with installed capacity for energy generation (4 megawatts);
- Imported electricity from Uganda and Zambia (8 megawatts; 5 megawatts)

Oil exploration in Tanzania has been intermittent for the last 40 years. Recently, however, Tanzania has seen an increase in oil exploration in southern Tanzania and in several off-shore sites as a result of the Government of Tanzania signing key production and data sharing agreements which companies believe suggest hydrocarbon potential.

Extensive gas fields have already been identified off the coast at Songo Songo and Mnazi Bay which contain an estimated 44.02 billion cubic meters of natural gas. Songo Songo's natural gas resources are currently being exploited by Songas under a major gas-to-electricity project launched in 2004. Natural gas presently supplies about 30% of Tanzania's total electricity requirements. Natural gas resources at Mnazi Bay are still being developed.

The electricity sub-sector is largely dominated by a state-owned enterprise, Tanzania Electric Supply Company Limited (TANESCO), which has a vertically integrated monopoly in the generation and supply of electricity. In preparation for privatization, the Government of Tanzania began the process of unbundling TANESCO into separate generation, transmission and distribution businesses. The government has allowed Independent Power Producers (IPPs) to generate and sell power to TANESCO. In 2005, as a result of rising oil prices and severe drought affecting the supply hydropower, plans to completely privatize TANESCO stalled.

Hydroelectric energy continues to be the single most important indigenous source of commercial energy in the country. This source has a potential installed capacity of 4.7 GW of which only about 10% is developed. Coal reserves are estimated at about 1,200 million tons of which 304 million tons are proven.

Ex-Im Bank is fully available to support financing in Tanzania in the short-, medium-term, and for the public and private sectors and long-term for the public sector.

### **Best Prospects and Opportunities**

- High efficiency gas turbines, parts and service.
- Wind turbines, parts and service.
- Thermal power diesel turbines, parts and service.
- Petroleum products: oil and lubricants.
- Petroleum exploration services.
- Coal power generating plants.
- Electricity transmission equipment (transformers, cables, etc.).
- Electrical meters and installation equipment.
- Restructuring and privatization of TANESCO.
- Rural energy projects, including solar, wind, and geothermal generation.

### **Millennium Challenge Corporation Compact**

The United States signed a Millennium Challenge Corporation (MCC) compact with Tanzania on February 17, 2008. The five-year, \$698 million MCC Compact agreement with the United Republic of Tanzania seeks to reduce poverty, stimulate economic growth, and increase household incomes through targeted infrastructure investments in transport, energy, and water.

#### **MCC Energy Sector Project (\$206 million)**

Currently in Tanzania, industry, businesses, and households suffer from either a lack of energy services or unreliable service. Where electricity is available, the quality of supply is poor, with blackouts and other service interruptions common. The MCC Energy Sector project will improve electricity service and coverage in Tanzania through the addition of new power generation, transmission and distribution capacity, as well as through improvements to the existing network. The project is expected to result in increased reliability and quality of electric power, and the extension of service to communities and businesses not currently served. The components of the Energy Sector project include:

- The Zanzibar Interconnector activity includes laying an approximately 40 km long, 100MW capacity submarine electric transmission cable from Mainland Tanzania to the island of Unguja in Zanzibar along the path of the existing submarine cable. The present cable is reaching its limits in both capacity and lifespan. To support the additional transmission capacity, the activity includes the reinforcement of substations at either end of the cable, as well as the

corresponding installation of supplementary transmission capacity along existing lines. This activity is expected to provide a reliable and non-polluting power supply to Unguja, the largest island in the Zanzibar archipelago, which is entirely dependent on power supply from the Mainland. This will allow the island to continue to develop its potential as a high-value tourist destination, and improve productivity and quality of life for the island's population.

- The Malagarasi Hydropower and Kigoma Distribution activity includes the construction of a small run-of-river hydropower plant on the Malagarasi River at Igamba Falls, and the extension of a mini-grid system in the Kigoma region. Lack of access to reliable power has been one of the major constraints to investment in commercial and industrial operations in the far western region of Kigoma. This activity would replace inefficient and polluting diesel power generation with affordable, reliable, and clean renewable small-scale hydropower. The expanded distribution system will also facilitate the electrification of rural villages and towns.
- The Distribution Systems Rehabilitation and Extension activity will rehabilitate the existing distribution infrastructure and a number of small distribution line extensions to unserved areas in six regions - Mwanza, Tanga, Morogoro, Iringa, Dodoma, and Mbeya - that were identified by the Government of Tanzania as priority areas for investment. This activity will address the growing demand and the corresponding strain on the network to deliver reliable and quality power to industrial and commercial users, as well as to households, in these regions.

## **Recent Developments**

In 2006, facing a drought that reduced the capacity for hydroelectric power generation and led to the introduction of severe power rationing, the Government of Tanzania awarded the U.S.-based Richmond Development Company a contract to supply 100 megawatts of emergency power. However, the deal worth a reported USD 172 million, proved controversial, with concerns soon arising about apparent contraventions of official tendering procedures and the failure to insist on a performance bond. A special Parliamentary committee that was set up in November 2007 to investigate the contract criticized the arrangement. The head of the Parliamentary committee, Hon. Harrison Mwakyembe, reported that Richmond Company not only failed to deliver the 100 mw of power and subsequently sold the tender to United Arab Emirates-based Dowans Holdings, but "lacked experience, expertise and was financially incapacitated".

The special Parliamentary committee reported gross embezzlement of public funds through the Richmond Development Company LLC contract and proposed court action against all those implicated in the saga. On February 6, 2008, the report issued by the Parliamentary committee was read in a nationally-broadcast session. Prime Minister Edward Lowassa, who was implicated in the report, resigned on February 7, denying any wrongdoing and stated his belief that the committee on the Richmond Contract had misled the Tanzanian Parliament. Hours later, then-Minister of Energy and Minerals, Nazir Karamagi, and former Minister of Energy, Ibrahim Msabaha, also resigned. President Kikwete dissolved the entire cabinet on February 7, and named a new Prime Minister -- Honorable Mizengo Pinda -- on February 8, 2008.

On February 12, President Kikwete named a new cabinet. Hon. William Ngeleja was appointed the new Minister of Energy and Minerals. Negeleja was previously Deputy Minister of Energy and Minerals.<sup>18</sup>

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<sup>18</sup> Report prepared by the U.S. Mission in Dar es Salaam, Tanzania.

## **Key Contacts and Decision Makers**

Tanzania has a “Power System Master Plan (2004)” which is currently under review partly to update information and date, and to include new project proposals for power generation and supply facilities. According to Bashir Mrindoko, the Commissioner for Energy, the new version of the Master Plan should be completed by April 2008.

### Government Contacts:

- Minister for Energy and Minerals, Hon. William Ngeleja
- Deputy Minister for Energy and Minerals, Hon. Adam Kighoma Malima
- Permanent Secretary, Ministry of Energy and Minerals, Dr. Arthur Mwapugui
- Commissioner for Energy, Mr. Bashir Mrindoko

Ministry of Energy and Minerals  
Mkwepu Street / Sokoine Drive  
P.O. Box 2000, Dar es Salaam.  
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Website: <http://www.mem.go.tz/>

### Contacts at State-owned Enterprises:

- TANESCO Managing Director, Dr. Idris Rashid  
Email: [idris.rashidi@tanesco.co.tz](mailto:idris.rashidi@tanesco.co.tz)

TANESCO Limited  
Ubungu Head Office (Umeme Park Building)  
P.O. Box 9024  
Dar es Salaam  
Tanzania  
Tel: +255 22 2451130-9  
Website: <http://www.tanesco.com/>

### Private Sector (Independent Power Producers):

- CEO of Independent Power Tanzania Limited (IPTL): Mechmar Corp-Malaysia Bhd
- CEO of Songas Tanzania Ltd/ Globeleq: Mr. Christopher Ford
- CEO of Mchuchuma Coal Mines: Mr. Subash Patel

## **Web Resources**

- Ministry of Energy and Minerals under Government of Tanzania National Web site: [www.tanzania.go.tz](http://www.tanzania.go.tz)
- Presidential Parastatal Sector Reform Commission (PSRC): [www.psrctz.com](http://www.psrctz.com)
- Tanzania Electric Supply Company (TANESCO): [www.tanesco.com](http://www.tanesco.com)
- Tanzania Investment Center: [www.tic.go.tz](http://www.tic.go.tz)
- Government of Tanzania website on Mining: [www.tanzania.go.tz/miningf.html](http://www.tanzania.go.tz/miningf.html)



# Uganda

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## Overview

The energy sector in Uganda faces formidable challenges. Almost 95% of Uganda's nearly 30 million people do not have access to electricity. With a population growth rate of about 3.5 percent, and an estimated energy demand growth of at least 7-8 percent per annum -- and certainly higher in the future -- planned electricity projects will not meet Uganda's needs. Although Uganda's per capita energy consumption is about 0.3 TOE or 12.72 GJ, among the lowest in the world, Ugandans are eager to access electricity as it becomes available throughout the country. Overall energy consumption of about 5 million TOE/year is approximately 95 percent biomass (wood, charcoal, and agricultural residue), implying that true demand for power greatly outstretches available supply. All petroleum products are imported and provide about 5 percent of the country's energy consumption requirements. The consumption of petroleum products has increased by 38 percent in the last five years.

The shortage of power supply in Uganda is due in part to the growing demand for electricity and the lack of public and private investments in the power infrastructure. Uganda Electricity Transmission Company Ltd (UECTL) estimates the country's total generation capacity to be about 400 MW. Adding to the deficit was a prolonged drought from 2003-2006, during which the water level in Lake Victoria decreased by about six feet. Consequently, the major hydroelectric plant, the Nalubaale (Owen Falls) dam, on the Nile River, and its extension, the Kiira plant, produced significantly less power than the installed capacity until early 2007. This led to load shedding, lease of generators, and import of thermal energy. The price of energy currently stands at around USD 0.24 per kilowatt hour (kWh) for households and small scale industrial users, which is very expensive on a worldwide scale. Medium and large scale industrial consumers pay a slightly reduced fee.

According to the Uganda Investment Authority, the Government of Uganda (GOU) is studying ways to meet the increasing energy demand by tapping other indigenous energy sources. With the support of the African Development Bank, the GOU is examining a variety of energy sources such as geothermal, biomass, wind, peat, solar, and mini- and micro- hydro power generators. Energy Minister Daudi Migereko has stated the GOU aims to address the power crisis and become a significant exporter of power to the region. The GOU recently agreed to supply 50 MW to eastern Democratic Republic of Congo (DRC) by 2010. Prior to the current shortage, the sector was an important contributor to the national budget, providing export earnings through electricity sales to neighboring countries. Energy tariffs still contribute to the financing of public expenditures, and petroleum taxes provide a significant proportion to total fiscal revenues.

Uganda's Energy Ministry is in the process of planning for an additional 1045 megawatts of electricity generating capacity in the next five years. Hydropower plants account for approximately 850 MW of the planned plants, and Heavy Fuel Oil (HFO) plants will power an additional 195 MW. The planned power plants are a mix of GOU- and donor-funded projects and private sector initiatives. The GOU has also devised a strategy aimed at promoting an efficient energy sector, one that would offer an increased role to

the private sector, and increase the percentage of rural households with direct access to electricity. Specifically, the GOU aims to increase rural electrification by 10 percent by 2010 – an increase of 400,000 new households country-wide.

Oil and gas prospects are developing quickly in Uganda as tests in a resource rich area known as the Albertine Graben in western Uganda continue to yield successful results. To date, about ten wells have been drilled, nine of which have been successful, increasing the potential for locally produced energy development. Official -- and conservative -- figures put Uganda's initial oil capacity at 35,000 bpd, with an estimated 350 million barrels in total. The actual figure could be much higher based on oil industry estimates. Despite expectations by foreign energy experts that Uganda has a low quality crude, further tests are required to determine the oil's potential. Tests have so far turned up waxy crude, which could be cleaned with chemicals.

GOU plans include refining the crude in country for local consumption and/or exporting crude by reversing the flow of a 422-mile pipeline under construction from Mombasa to Kampala. Tullow Oil (one of the four exploration companies operating in western Uganda) has signed a Memorandum of Understanding (MOU) to invest in, build, own, and operate at 50 MW power plant and small refinery near its concession on Lake Albert.

Ex-Im Bank is fully available to support financing in Uganda in the short-, medium-term, and long-term for the public and private sectors.

### **Organization of the Energy Sector**

The country passed and implemented a new Electricity Act in 1999, a wide-ranging statute which established the Electricity Regulatory Authority (ERA); split the state-owned electricity company into generation, transmission, and distribution agencies; privatized generation and distribution; created a Rural Electrification Agency; and approved a credit facility to support energy investments in rural areas. Energy sector observers say the ERA is the most advanced and fully independent utilities regulator in the region. However, despite transparent procedures for proposing and negotiating private power projects, political pressures have interrupted selection procedures in the past.

#### Hydropower Development

Bujagali: The long delayed Bujagali hydropower project (HPP) will be a 250 MW facility on the Victoria Nile. The project consists of the development, construction, and maintenance of a run-of-the-river power plant on a Build-Own-Operate-Transfer basis, eight kilometers north of the existing Nalubaale and Kiira power plants. The project's operation will recycle water flows released from these upstream hydropower facilities to generate additional electricity. The project sponsor is Bujagali Energy Limited (BEL), a joint venture between the Kenyan-owned Industrial Promotion Services (IPS) Ltd. and the U.S.-based Sithe Global Power, LLC. IPS is the industrial development arm of the Aga Khan Fund for Economic Development Network. BEL will also manage the construction of approximately 100 kilometers of 132 kilovolt (kV) transmission line on behalf of UECTL, to strengthen the transmission of electricity purchased from the Bujagali plant.

It is anticipated the Bujagali HPP will be commissioned in 2011, although most observers believe 2013 is a more realistic online date. Bujagali will likely relieve residual power shortages and substantially reduce the need for more expensive emergency thermal power. The Bujagali project cost is expected to be about USD 750 million, although there are rumors of significantly higher costs, and will be financed by the GOU as well as a consortium of lenders, including the World Bank Group. The interconnection project will be financed entirely by the African Development Bank.

Karuma: The Karuma Falls Hydropower project has taken a back seat to Bujagali, but is the next big project for the GOU. The developer of the Karuma HPP is NORPAK and the scheme is run-of-the-river, using the natural head created by the Karuma falls and adjacent rapids, immediately upstream of the bridge across the Victoria Nile in central Uganda. NORPAK envisions Karuma HPP will have an installed capacity of 150 or 200 MW, but recent hydrology analysis suggests that the project could generate up to 300 MW.

Other Hydro Sites: The local press recently reported that two Chinese companies, Gezlouba Corporation and Catic Company Ltd, would develop large hydropower sites of Ayago north (300 MW) and Ayago south (200 MW), along the Nile with soft loan financing by the China Development Bank.

#### Heavy Fuel Oil Power Plants

Following the recent oil finds, the GOU has decided to begin petroleum extraction and production on a limited scale while exploration continues to determine the full extent of oil reserves. The GOU has entered into an MOU with Tullow Oil for an Early Production Scheme (EPS) to build, own and operate a small refinery located near Tullow's Lake Albert block to produce about 5,000 bpd of refined oil projects. Roughly 3,800 bpd will be refined as HFO, with the remaining amount refined to diesel, kerosene and other oil products. Tullow will also invest in, build, own and operate an HFO 50 MW power plant near the refinery. The other oil exploration companies operating in Uganda are Heritage, Neptune and Dominion. The GOU lifted a moratorium on licensing new oil companies in 2007, and will offer the remaining two blocks (each of which could be split in half) in a competitive bidding process this year.

#### Renewable Energy Potential

Uganda has considerable unexploited renewable energy resources. The contribution of biomass is significant, but remaining renewable sources contribute just 5 percent of the country's total energy consumption. This figure is likely to increase once hydro-power projects noted above are brought on-line. According to the recently adopted Renewable Energy Policy, the GOU estimates the following power potential: hydro – 2000 MW, mini-hydro – 200 MW, solar – 200 MW, biomass – 1650 MW, geothermal – 450 MW, and peat – 800 MW. To bridge the power deficit and diversify power generation, the GOU plans to accelerate the development of a grid connecting small, renewable energy generation projects. Such connections will be expedited by a standardized Power Purchase Agreement (PPA) and a standardized feed-in tariff.<sup>19</sup>

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<sup>19</sup> Report prepared by the U.S. Mission in Kampala, Uganda.

## **Key Players**

Key players in the development of the energy sector:

Energy Minister: Daudi Migereko

Minister of State for Energy: Simon D'Ujang

Minister of State Mineral Development: Kamanda Bataringaya

Commissioner for Energy: Paul Mubiru

Petroleum Exploration and Production Department Commissioner: Reuben Kashambuzi

Petroleum Exploration and Production Department Assistant Commissioner: Ernest Rubondo

Tullow Oil Country Director: Brian Glover

Tullow Oil Development Director: John Morley

Heritage Oil & Gas (U) Ltd. Country Director: Bryan Westwood

Neptune Petroleum (U) Ltd. Country Director: Marilyn Hill

Mantrac (Caterpillar Distributor) Country Director: Vincent Balogun

Sithe Global: Glenn Gaydar